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Some laboratory studies on reinforced soil using Coconut coir mat

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Abstract: Attempts have been made in this paper to determine feasibility of Brahmaputra River sand reinforced by Coconut coir mat in terms of CBR values under soaked and unsoaked conditions in the laboratory for road construction purposes. Coir mats were placed at different depths from top of the mould and CBR values were obtained. CBR values are also determined using different mould-plunger ratios to know the effect of lateral confinement. Further settlement pattern of the same is studied by loading and unloading tests for one cycle only.

Index Terms-reinforced, Coconut coir, CBR values, lateral confinement

Introduction:

Design and construction of pavement on weak subgrade soils pose lots of problems due to low load bearing capacity of soft subgrade, roads causing rut formation under high axle loads of vehicle. Several techniques have been developed to overcome the problem. Among them, soil reinforcement with natural fibre, e.g., and geotextiles is seen to be a promising scope in future. The use of geosynthetic/ geotextiles as reinforcement for soil improvements has been studied by many researchers. Use of coir mats in the form of geotextiles as soil reinforcing materials first gained popularity in India because of its long durability and abundance in India. A wide variety of geotextiles ranging from 400 to 1400 gm per sqm have been developed by Coir Board. However, there is limited literature available where coconut coir mats are used as reinforcing material. Under that circumstance it becomes necessary to improve the bearing resistance of subgrade or to reduce lateral displacement of subgrade by providing earth reinforcement using coconut coir mat.

Mehndiratta et al (1993), Cancelli et al (1996), Aziz & Ramswami (1994), Rao et al (1996, 1999), Army Corp of Engineers (2003) etc are some of the literature reporting the use of geosynthetics or geotextile materials for pavement design. Sheeha et al. (2000) observed that the behavior of a clay layer changes from undrained to drained nature with the use of coir felt. Smaller thickness of felt is required for sandy beds to increase resistance. Lyngdoh (2006) observed improvement in bearing capacity of sandy soils reinforced by coconut coir mat by model plate load tests in laboratory. Conducting an experimental study, Abhijit (2015) reported that increased strength of subgrade in terms of CBR values was observed using natural coir fibers as reinforcement. The optimum percentage of coir fibers was found to be five and the ideal position of placing the same was at top.

Since very little literature is available on the use of coconut coir mat as a reinforcing material, Dora (2007) studied the behaviour of this abundant product as a reinforcing element in subgrade soil to investigate the following,

- (1) to determine the effect of reinforcement and lateral confinement on CBR values of reinforced soil,
- (2) to predict the soaked CBR values of soil from the unsoaked values with the help of a correlation developed in the study and
- (3) to segregate the recoverable and non-recoverable components of total settlement of the reinforced soil and compare the values with unreinforced soil

Test Programme:

The test programme consisted of two series. In the first series, the tests conducted are –sieve analysis, Specific gravity, Proctor compaction and California Bearing Ratio tests. The second series of tests for reinforced soil were conducted using coconut coir mat at different depths and different diameters of moulds(D in cm)10,15,20,25,plunger diameter (d =5 cm)and height 175 mm with detachable extension collar 50 mm height and a detachable perforated base plate of 10 mm thick. Table 1 show various tests conducted in the second series of tests.

Table 1: List of Tests on Reinforced Soil Samples

Name of the test	D/d	No. of Test			
		Position of Reinforcement from top surface of samples			
		1 cm	2cm	3.2cm	4.2cm
CBR Test Unoaked & Soaked	2	1	1	1	1
	3	1	1	1	1
	4	1	1	1	1
	5	1	1	1	1
CBR Test with Unsoaked & Unloading	2	1	1	1	1
	3	1	1	1	1
	4	1	1	1	1
	5	1	1	1	1

Sample Preparation:

Optimum moisture content and maximum dry density (determined by Proctor Compaction Preparation of samples for CBR tests both for soaked and unsoaked conditions were done at test). Soils were compacted (statically) with the help of a hydraulic jack of capacity 5 t/cm². The reinforced samples were prepared by placing the circular coir mat of the same size of the internal diameter of the mould at the required position from the top surface of the sample. For this purpose, coir mats were cut into circular section to fit the required mould. The soil in the mould was compacted in three layers with proper measurement especially while incorporating the coconut coir geotextile.

Taking the surcharge weight of 5kg for the mould of diameter 15cm as standard, the surcharge weights for the other moulds of 10cm, 20cm and 25cm are calculated and approximately found to be 2.5kg, 10kg and 15kg respectively maintaining constant surcharge pressure (almost) for the different sizes of moulds .

The test procedures followed in experimental study were as per relevant Indian Standard codes.

Test results and interpretation:

The soil sample collected from of the river Brahmaputra bank was tested in the Soil Mechanics laboratory of Assam Engineering College. The obtained grain size distribution of soil is shown in Table 2 .The other properties are : Specific gravity : 2.602 , Optimum moisture content (O.M.C) and maximum dry density (γ_d) are 15 % and 1.63 gm/cc respectively. CBR value of the soil is 5.29% for unoaked condition and 2.46% for soaked condition at optimum moisture content and maximum dry density.

The soil according to Indian Standard Classification falls in the category of poorly graded sand and silt mixture (SP- SM).

Table 2: Grain size distribution of Brahmaputra river sand

Silt & Clay % Less than 0.075 mm	Sand			Gravel % (>4.75mm)
	Fine Sand % (0.075-0.425mm)	Medium Sand % (0.425-2.0mm)	Coarse sand % (2.0-4.75)mm	

5.948	93.928	0.1	0.024	0
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Results of the California Bearing Ratio (CBR) tests:

All CBR tests were conducted at optimum moisture content and maximum dry density. CBR values obtained from Penetration curves drawn from C.B.R. tests results (not shown due to space constrain) for both soaked and unsoaked conditions are listed in Tables 3 .The adopted C.B.R values considered to be the higher of the values corresponding to penetration 2.5mm and 5mm and are marked by * marks shown in the same table.

Table 3: CBR values for different conditions.

D/d ratio-	D/d=2		D/d=3		D/d=4		D/d=5	
Penetration Level	2.5mm	5.0mm	2.5mm	5.0mm	2.5mm	5.0mm	2.5mm	5.0mm
Position of Coir mat from top surface (cm)	Unsoakedspecimen (%)							
No coir mat	15.86%	*18.16%	*5.29%	4.87%	*6.00%	5.57%	3.42%	*3.47%
1	14.34%	*20.49%	7.55%	*9.61%	5.58%	*10.90%	5.48%	*6.36%
2	13.06%	*16.55%	6.64%	*6.99%	4.17%	*6.84%	6.94%	*9.45%
3.2	10.79%	*13.61%	5.80%	*7.18%	5.15%	*6.72%	5.07%	*5.79%
4.2	11.14%	*14.08%	5.26%	*5.83%	4.92%	*5.97%	2.47%	*3.15%
Position of Coir mat from top surface (cm)	Soaked (%)							
No coir mat	8.75%	*10.20%	2.26%	*2.46%	2.54%	*3.16%	2.47%	*2.51%
1	10. Specimen 20%	*14.27%	7.14%	*7.71%	4.63%	*6.90%	3.29%	*4.05%
2	8.69%	*10.82%	2.55%	*2.97%	3.75%	*4.88%	3.52%	*4.42%
3.2	4.96%	*6.18%	2.04%	*2.53%	2.92%	*3.27%	3.81%	*4.66%
4.2	2.27%	*3.86%	1.13%	*1.78%	2.58%	*2.64%	2.69%	*3.09%

The percentage change of CBR value due to coconut coir reinforcement is calculated and listed in Table 4.

Table 4: Percentage change of CBR value with respect to original

Unsoaked Specimen					
D/d	Unreinforced CBR (%)	Percentage change of CBR value w.r.t. unreinforced (%)			
		at1cm from top	at 2cm from top	at 3.2cm from top	at 4.2cm from top
2	18.16	12.83	-8.87	-25.06	-22.47
3	5.29	81.66	32.14	35.73	10.21
4	6	81.67	14.00	12.00	-0.50

5	3.47	83.29	172.33	66.86	-9.22
Soaked Specimen					
D/d	Unreinforced CBR (%)	Percentage change of CBR value w.r.t. unreinforced (%)			
		at 1cm from top	at 2cm from top	at 3.2cm from top	at 4.2cm from top
2	10.2	39.90	6.08	-39.41	-62.16
3	2.46	213.41	20.73	2.85	-27.64
4	3.16	118.35	54.43	3.48	-16.46
5	2.51	61.35	76.10	85.66	23.11

It is observed from Table 4 that CBR values of the soil have been improved up to 81.67% for unsoaked condition and 213.41% for soaked condition when the position of reinforcement was placed at 1cm from the top surface.

Variation of CBR values with respect to position of reinforcement (unsoaked and soaked conditions) and D/d ratios are shown in Figures. 1 a & b and 2 a & b respectively.

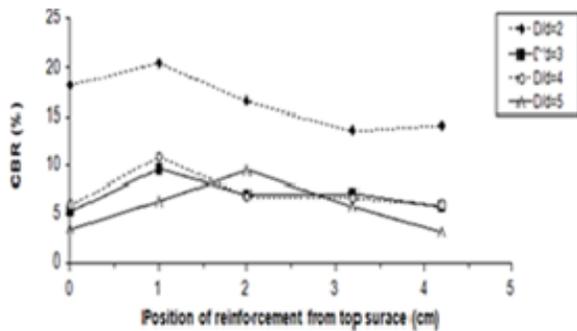


Figure 1a CBR Vs position Reinforcement from top surface of unsoaked specimen

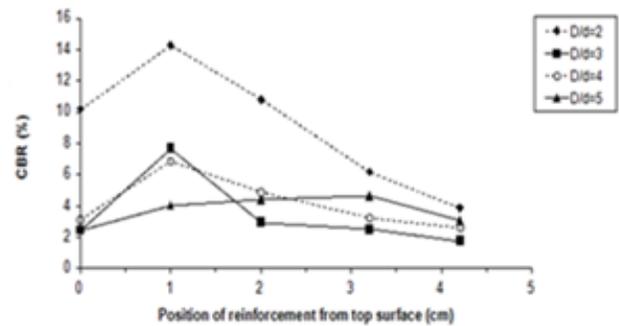


Figure 1b CBR Vs position of Reinforcement from top surface for soaked specimen

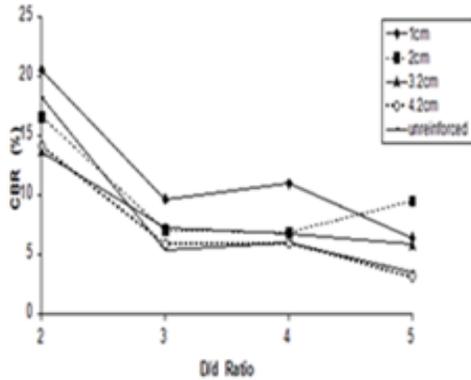


Figure 2 a CBR Vs D/d Ratio for Unsoaked Specimen

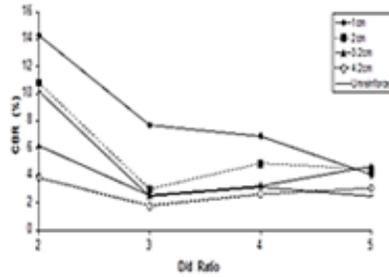


Figure 2 b Vs D/d Ratio for Soaked Specimen

The figures indicate that the best position of reinforcement is at 1 to 2 cm from top of soil surface. Increasing diameter of mould of CBR tests (indicating decreasing confining pressure) is observed to affect the CBR values which tend to decrease with increase in D/d ratios.

Relation between Soaked and Unsoaked CBR.

The relation between CBR values for Soaked and Unsoaked conditions are determined using Regression analysis according to the concept given by Mehndiratta, (1993) .The relation is shown in Table 5 for different values of D/d and for unreinforced soil .Similarly equations for reinforced soil can be developed.

Table 5: Relation between the soaked and unsoaked CBR values

D/d Ratio	2	3	4	5
R ² adopted	0.868	0.8338	0.8689	0.6043
Equation adopted	$\text{CBR(Soaked)} = 1.3292x \text{ CBR(unsoaked)} - 12.97$	$\text{CBR(Soaked)} = 1.3119x \text{ CBR(unsoaked)} - 5.6669$	$\text{CBR(Soaked)} = 0.7881x \text{ CBR(unsoaked)} - 1.5723$	$\text{CBR(Soaked)} = 0.2788x \text{ CBR(unsoaked)} - 2.1724$

Results of CBR test with unloading

The performance of coconut coir reinforced soil due to unloading is studied in terms of total settlement and plastic settlement by unloading CBR tests. In this case, CBR tests were carried out, by statically increasing load up to the maximum load with corresponding records of the total settlements (S). Next the load was reduced slowly at the same rate of loading and recording the plastic settlement values (Sp) from the dial gauge readings. It can be considered as cyclic CBR test with one cycle of loading and unloading.

Using results of unloading tests for different D/d ratios ,for unreinforced and reinforced soil at different positions of reinforcement from the top surface and for both soaked and unsoaked conditions ,total settlement(S), plastic settlement i.e. unrecoverable settlement (Sp),and elastic settlement i.e.(recoverable settlement (Se) , corresponding to load on plunger (P)are shown in Tables 6.

It is observed in Table 6 that the load corresponding to maximum total settlement decreases with increase in mould -plunger diameter (D/d) ratio and is of lesser values in cases of soaked conditions than unsoaked condition. For comparison purpose, ratios of total settlement of reinforced soil and unreinforced (TSR) and ratio of plastic settlement of reinforced and unreinforced soil (PSR) for different positions of reinforcement and D/d values are calculated as shown in Table 7.

Tables 6 and7 indicate that plastic settlements are of lesser value for reinforced soil than that of unreinforced soil in all cases except for D/d =2 ; but for soaked condition settlement ratios are greater than 1 both for D/d=2 and 3.

The variation of TSR and PSR with respect to D/d ratios are presented in Figs.3 a , b and 4 a , b for different conditions considered.

Table 6: Total(S), Plastic(Sp) and Elastic(Se) Settlements for a given load & D/d Ratio at Different Positions of reinforcement

Table: 7: Total Settlement ratio (TSR) Plastic Settlement Ratio (PSR)between reinforced and unreinforced soil for different positions of reinforcement and D/d ratios

D/d Ratio	Load on Plunger P (Kg)	Total (S), Plastic (Sp) and Elastic (Se) Settlements for a given load respective to the different moulds.														
		Unsoaked Specimen						Reinforced								
		Unreinforced			at 1cm from top			at 2cm from top			at 3.2cm from top			at 4.2cm from top		
		S	Sp	Se	S	Sp	Se	S	Sp	Se	S	Sp	Se	S	Sp	Se
2	257.4	4.52	3.25	1.27	5.13	3.58	1.55	6.44	4.48	1.96	7.83	5.59	2.24	5.81	4.7	1.11
3	158.4	9.05	7.7	1.35	7.25	5.34	1.91	6.05	4.44	1.61	6.86	5.36	1.5	8.97	7.5	1.47
4	158.4	12.04	10.55	1.49	8.54	6.6	1.94	8.91	7.07	1.84	10.25	8.11	2.14	11.94	9.2	2.74
5	118.8	12.41	10.83	1.58	5.26	3.73	1.53	5.32	3.67	1.65	9.42	7.47	1.95	8.81	6.76	2.05
Soaked Specimen																
D/d Ratio	Load on Plunger P (Kg)	Total (S), Plastic (Sp) and Elastic (Se) Settlements for a given load respective to the different moulds.														
		Unreinforced			Reinforced											
		Unreinforced			at 1cm from top			at 2cm from top			at 3.2cm from top			at 4.2cm from top		
		S	Sp	Se	S	Sp	Se	S	Sp	Se	S	Sp	Se	S	Sp	Se
2	178.2	4.22	3.22	1	5.3	3.23	2.07	7.08	5.53	1.55	8.54	6.67	1.87	8.08	6.73	1.35
3	99	6.24	4.51	1.73	8.08	6.62	1.46	6.61	5.02	1.59	8.17	6.53	1.64	11.7	10.21	1.49
4	79.2	12.29	10.3	1.99	5.17	2.83	2.34	8.01	6.84	1.17	9.47	7.12	2.35	11.83	9.77	2.06
5	59.4	13.56	11.93	1.63	5.65	3.79	1.86	9.8	7.29	2.51	12.29	9.89	2.4	10.37	8.25	2.12

Condition	D/d ratio	Values of TSR * and PSR *							
		Reinforced at 1 cm from top		Reinforced at 2 cm from top		Reinforced at 3. 2 cm from top		Reinforced at 4. 2 cm from top	
		TSR	PSR	TSR	PSR	TSR	PSR	TSR	PSR
Unsoaked	2	1.13	1.1	1.42	1.5	1.73	1.72	1.28	1.45
	3	0.8	0.69	0.67	0.58	0.76	0.69	0.99	0.97
	4	0.71	0.62	0.74	0.67	0.85	0.77	0.99	0.87
	5	0.42	0.34	0.43	0.33	0.76	0.69	0.71	0.62
Soaked	2	1.26	1	1.68	1.72	2.02	2.9	1.91	2.09
	3	1.29	1.47	1.06	1.11	1.3	2.07	1.87	2.26
	4	0.42	0.27	0.65	0.66	0.77	0.69	0.96	0.94
	5	0.42	0.31	0.72	0.61	0.91	0.83	0.76	0.69

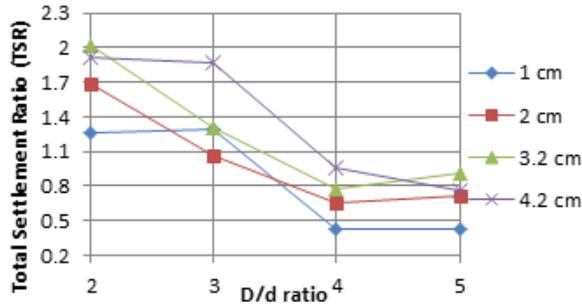


Figure 3 a TSR VS D/d Ratio for unsoaked condition

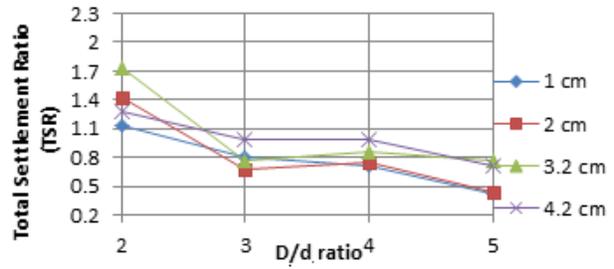


Figure 3 b TSR VS D/d Ratio for soaked condition

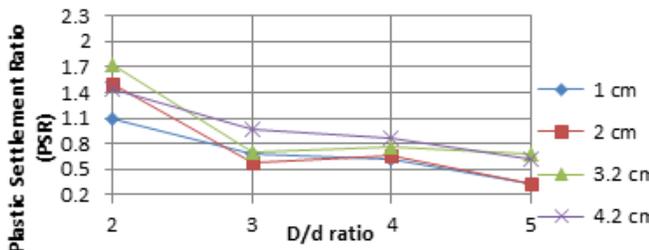


Figure 4 a - PSR VS D/d Ratio for unsoaked condition

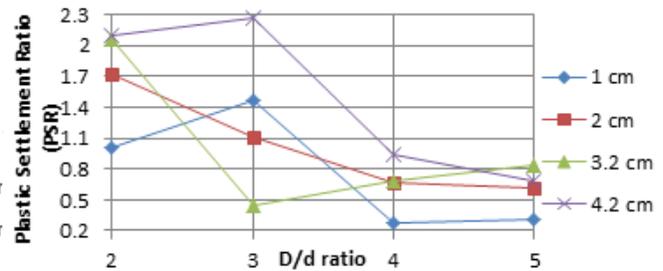


Figure 4 b - PSR VS D/d Ratio for soaked condition

Table 6 indicates that values of Plastic Settlement (SP) decrease with introduction of coconut coir mat reinforcement when D/d ratios are 3, 4 & 5 while SP increases for D/d = 2 for unsoaked condition. Therefore PSR is greater than 1 for D/d ratio is 2 and smaller than 1 for D/d ratio is 3, 4 or 5 (Table 7). It may be inferred that settlement ratio depends on D/d ratio as indicated by Table 7 and Figure 4a. But no conclusion can be made from soaked condition test result (Table 7 & Fig. 4b). It may be due to swelling of soil and coir mat in contact with water in soaked condition. Therefore further study is required in this direction.

Conclusion

The conclusions drawn from the study are:

1. The soil sample selected for the study is from the river Brahmaputra with a specific gravity of 2.602 and has optimum moisture content and maximum dry density 15% and 1.63 gm/cc respectively. CBR values of the soil are 5.29% for unsoaked condition and 2.46% for soaked condition at optimum moisture content and maximum dry density. The soil according to Indian Standard Classification is poorly graded sand & silt mixtures (SP-SM).
2. The CBR values of the soil have been observed to be increased with addition of coconut coir reinforcement both for soaked and unsoaked conditions showing improvement up to 81.66% for unsoaked condition and 213.41% for soaked condition when the position of reinforcement was placed at 1 cm from the top.
3. There exists a good relation between soaked and unsoaked CBR values and it is possible to predict the soaked values from the unsoaked values of both for unreinforced soil and reinforced soil without conducting the soaked tests for this type of soil using the method mentioned.
4. The best position of reinforcement has been found out to be near the loading surface i.e. at 1 cm and 2 cm for both soaked and unsoaked condition. Position of reinforcement at 3.2 cm from the top is also seen to be effective as compared to the unreinforced soil. Position of reinforcement at 4.2 cm has no positive effect.

5. CBR values decrease with increasing D/d ratio i.e. reduction in lateral confinement (approaching field conditions). Decrease is seen to be more for the soaked than that for unsoaked condition. The same trend is found for D/d = 2, 3, 4 for both conditions, whereas for D/d = 5 no conclusion can be made.
6. Total Settlement ratio and Plastic Settlement Ratio of the reinforced soil due to CBR loading and unloading tests is seen to be dependent on D/d ratio and position of reinforcement. It may be inferred that effect of reinforcement is dependent on confining condition of subgrade.

REFERENCES

- [1] Abhijith, R.P (2015) Effect of Natural Coir fibres on CBR Strength of Soil Subgrade, International Journal of Scientific and Research Publications, Volume 5, Issue 4, April 2015, ISSN 2250-3153, pp 1-4
- [2] Ayyar, T.S. Ramanatha, & Girish, M.S (1999). Performance of a model Retaining Wall Using Coir Fibres, Analysis and Practice in Geotechnical Engineering, Vol-I, Proc. Of Indian Geotechnical Conference 1999, Volume, Geotechnical Study Circle, Calcutta chapter, pp, 194- 197.
- [3] Aziz, M.A. and Ramaswamy, S.D (1994) – Some studies on Jute Geosynthetics and their Applications, Geosynthetics World, J.N. Mandal , 1994, New Age International Ltd, pp- 162 – 181 .
- [4] Cancelli, A Montanelli, F, Rimoldi, P and Zhao, A (1996), Full Scale Laboratory testing on geosynthetics reinforced paved roads, Earth reinforcement, Ochiai, Yasufuki & Omine (eds), 1996 Balkema, Rotterdam ISBN 90 5410 8339, pp, 573 – 578).
- [5] Lyngdoh, Markodor (2006) , Behaviour of Foundation Reinforced by Coconut Coir, M.E. Dissertation (2006) in Civil Engg , Gauhati University , Assam .
- [6] Mehndiratta, H.C, Chandra, Satish, & Singh, Virendra (1993). Correlations amongst strength Parameters of Soil Reinforced , pp- 227. 216, Highway Research Bulletin No. 49, pp - 13-14.
- [7] Rao, G. v, Tripathi, S. G & Gupta, K.K, Geosynthetics reinforced model pavements under Repetitive loading, Environmental Geotechnology with Geosynthetics, G.V. Road and P.K. Bannerjee (Eds), Asian Society for Environmental Geotechnology, New Delhi, India
- [8] Sheebha, K.P., Sobha, S, Poul, S.L and Devi, D.R (2000), Studies on the potential of coir Reinforced structures, Journal of Scientific & Industrial Research, Vol. 59, January, 2000, pp, 55-62.
- [9] Synem Dora Shailin, A Laboratory Study of Reinforced Subgrade using Coconut Coir Mat, A dissertation for Master of Engineering in Civil Engineering, Gauhati University, Assam, January, 2007.

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Youth Pornography Exposure: Addiction Screening Test and Treatment Recommendation

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Yayasan Kita dan Buah Hati

Abstract: This study aims to examine youth exposure toward pornography. 1765 Junior High School and Senior High School students age 12-18 were participated. Data were collected by Kita dan Buah Hati Foundation. The objective of the study is to asses' pornography addiction among youth. 25 Linker scale of Youth Pornography Addiction Screening test (YPAST) was used to determine whether they are in mild, at risk or fully addict category. Result found that, 58.1 % of respondent in the category of mild exposure to pornography, 34.7 % are at risk category and there are 7.2 % are in the category of fully addict. Result of cross tabulation shows that there are more male students in category of at risk and fully addict than female students. Result of t test also indicated that there is significant different between male and female students in term pornography addiction in which male students score higher than female students. Further analysis on bivariate correlation found that, there are positive correlations between age and pornography addiction score, the older the age the score of pornography addiction are higher. Furthermore, the present study also indicated that YPAST is a valid and reliable measure in Indonesian sample with good validity and reliability. The result of the present study provides empirical evidence on the description of youth exposure to pornography. Result of this study can be used as a framework to implement several preventions and treatments to pornography addiction among children and youth.

Index Terms: Pornography, Youth, Addiction

INTRODUCTION

Pornography nowadays is inevitable, due to the accessibility, availability, affordability and of course the anonymous nature of accessing it (Kastleman,2007). Lately, pornography creates various problems to our children and youth who have a big curiosity about it. Literature found that pornography can lead to behaviour addiction. Pornography addiction may lead to a serious mental health problem such as loliness, depression and compulsive behavior(Carnes,1983; Muhammad Iqbal & Gadies Nurdiani)). Not only that pornography addiction may result in brain damage and prolong psychological problem (Belnap, 2008).

Pornography Addiction

Fremuth (2008) state that an addiction toward substance or behavior, is characterized by repetitiveness, high frequency or excess. Pornography consider as one of the behaviour addiction if individual continue watching pornography and lost control toward it, increase tolerant toward pornography and experience negative consequences (Skinner,2005).

There are several continuum of addictive behaviour according to Fremuth (2008) including:

Recreational level

- Controlled by the situation
- Frequency and intensity of behavior is relatively stable
- Negative effects are rare, unexpected, private and a direct effect of the behavior

At-risk level

- Controlled by intrinsic reinforcement
- A once social behavior occurs alone or with "like-minded" others

–Negative effects are intermittent, a direct effect of the behavior, and not unexpected

Problematic level

- Doing the behavior is more important than the people it is done with
- Frequency and intensity of behavior is increasing
- Secondary negative consequences: physical, psychological, & social responses to direct negative effects

Fully Addicted level

- Behavior continues even after desired effect is achieved
- Behavior is in-discriminant
- Tertiary negative consequences (e.g., depression forms as a result of guilt and inability to control the behavior, risk of job loss as a result of lowered work performance).

Skinner (2010) in his book treating pornography addiction explains the continuum for pornography addiction into seven level. In each of the seven level of pornography addiction there are common behaviours that distinguish each level from the others. These difference identified based on the compulsivity, frequency and intensity and the belief that individual forms about self. According to this model, level one is consider as the mildest form of involvement with pornography. In which this person in this level have very limited exposure to pornography or accidentally watch pornography and do not have problem with pornography. In level two, viewing pornography not become compulsive, but the curiosity about pornography is increase and pornography slowly became a problem in that individual life. Level three is actually the border line between a growing problem and compulsive behaviour, in this level pornography somehow become impulsive, individual need to put extra effort into quitting because they have been exposed to stronger forms of pornography, this level also characterized by fantasizing and experience withdrawal symptom if they don't give in. In level four, involvement in pornography is likely impacting more and more aspect of person life, fantasizing also increase, withdrawal symptom is increasing, individu try to cut back but they can not do it and continue watching pornography again. In level five, pornography is impacting day to day living. At this level individu spending significant amount of time watching pornography, they might losing aspects of their life, individu in this level usually fighting for pornography addiction for many years, they really want to stop but they don't know how to stop, this lead to feeling of depression. Level six, individu life is dominated by pornography, they experience negative consequences because of pornography but still continue watching it. In level seven, individu already acting out after watching pornography, they feel loss of control, lying frequently about their involvement with pornography, his thought dominated with pornography.

Based on this continuum, Aspen Counseling Service developed Youth Pornography Addiction Screening Test (YPAST). This measure divides three levels of pornography addiction based on norm reference of adolescent at the age group 12-18 years in USA. The three level include: level one is the mild exposure to pornography, second level is at risk and problematic pornography addiction and the third level is fully addict. In this study YPAST is used to examine the pornography addiction among teenagers age 11 to 19 years old.

Development of Addiction in Human mind

Several studies examine how pornography can create addiction in human mind. One of the pioneer on the study of how pornography cause addiction is establish by Ronald Hilton the author of "the New Drug of Millenium" he explain the neurotransmitter involve when individu watching pornography. The neurotransmitter including, serotonin, oxytoxin, dophamine

Skinner (2005) also explain that at the first time people see pornography their mind does not understand the stimulus that triggers strong emotions and feeling, but they generally like it. However, the next time they view pornography, they enjoy the experience of viewing pornography, after several times a person can associate this feeling with findings comfort when they are under stress and lonely. Therefore the human mind with more exposure toward pornography are demanding for such strong feeling, these strong feeling are accompanied by the release of chemicals inside the brain such as Dophamine and seretonin that can create addiction.

Past study on the addiction toward pornography among youth

Chelsen, P.O. (2011) examine the correlation between the extent of access to Internet pornography among male undergraduates at select Evangelical Christian colleges in the Midwest and indicators of addiction patterns, guilt regarding online use and online sexual behavior that is social in nature?" This correlational study collected data through an online survey with 46 questions and was sent to 2,245 male undergraduate students at three different Evangelical Christian colleges in the Midwest. Result in present study found a statistically significant relationship exists between the extent of Internet pornography usage

among male undergraduates at three Evangelical colleges and indicators of addictive patterns related to Internet pornography, guilt regarding online pornography use, and online sexual behavior that is social in nature. Furthermore, the multiple regression results overall suggest that students who do not self-identify as Evangelical, spend higher amounts of time online, demonstrate higher indicators of Internet pornography addiction and demonstrate online social behavior that is sexual in nature are more likely to access Internet pornography a higher number of hours each week. The addictive scale emerged as the strongest predictor for the amount of time, on average, spent viewing Internet pornography each week.

Laier, C.; Pawlikowski, M.; Pekal, J.; Schulte, F.; Brand, M. (2013) conducted two experimental studies. The first study aimed at identifying predictors of cybersex addiction in a freely recruited sample of 171 heterosexual males. The aim of the second study was to verify the findings of the first study by comparing healthy ($n = 25$) and problematic ($n = 25$) cybersex users. *Results:* The results show that indicators of sexual arousal and craving to Internet pornographic cues predicted tendencies towards cybersex addiction in the first study. Moreover, it was shown that problematic cybersex users report greater sexual arousal and craving reactions resulting from pornographic cue presentation. In both studies, the number and subjective quality of real-life sexual contacts were not associated to cybersex addiction. The results support the gratification hypothesis, which assumes reinforcement, learning mechanisms, and craving to be relevant processes in the development and maintenance of cybersex addiction. Poor or unsatisfying sexual real-life contacts cannot sufficiently explain cybersex addiction. This study concludes that positive reinforcement in terms of gratification plays a major role in cybersex addiction.

Yang and Youn (2012) examined whether exposure to pornography leads to aggression, utilizing pornographic video excerpts and measuring participants' aggression by the number of human faces chosen as targets during a dart-throwing decision task. Male college students ($n = 120$) were randomly assigned into one of three experimental groups who viewed the sexually explicit material (nonviolent, sadomasochistic, or violent pornography) or to a control group who viewed nonsexual, nonviolent material. Each participant could then behave aggressively, or not, in a dart-throwing decision task offering pictures of human faces as possible targets. The facilitative effect of aggression was significant for all three groups exposed to pornography. The effect was especially conspicuous for those groups exposed to violent pornography.

RESEARCH METHOD

In the second study 1765 Junior High School and Senior High School students age 12-18 were participated. The objective of second study is to assess pornography addiction among youth. 25 Likert scale of Youth Pornography Addiction Screening test (YPAST) was used to determine whether they are in mild, at risk or fully addict category. This instrument is reliable with Cronbach alpha greater than .80 (0.893). Furthermore, this instrument also shows evidence of construct validity in which each item is correlated significantly with the total score of all items with corrected item total score greater than 0.3 for all items. Furthermore, results of factor analysis also confirm the addiction theory in which there are three factors of addiction criteria including loss of control, tolerance increase and continue doing the addictive behaviour with the presence of negative consequences. These three factors explain 50.21 % of variance that can explain addiction toward pornography.

Analysis used in the present study is descriptive analysis and cross tabulation to examine the profile of pornography addiction across gender, area and economic background. The present study also used t test and one-way Anova to analyse if there are any significant differences in terms of pornography addiction level across gender, age and economic background which is measured by the amount of money that students bring to school everyday.

First procedure in the present study is asking permission from school authority, to collect data. Participants were asked to fill out the questionnaire at their school for a duration of 5 to 7 minutes. All of the samples are school students who participated in a program organized by Yayasan Kita dan Buah Hati from the month of January until June 2015.

RESULT

Respondents of the second study consist of 1765 students from Subang and Jabodetabek, Bandung are participated in this study. However, after data cleaning and removing the data with missing values, total respondents are 1543. Consist of 587 female students and 619 male students. Results indicated that, 58.1 % of the respondents are in the category of mild exposure of pornography, 34.7 % are at risk and problematic category and 7.2 % are in the category of fully addict. Results of cross tabulation show that, there are more male students at the fully addict and at risk category in comparison to female students. With regard to location, students from Bandung area show the highest score for fully addict category. Cross tabulation for age group also indicated that the group age 11 to 15 years old show the highest score for fully addict category.

Results for correlation analysis show that, there is a positive and significant relationship between age group and pornography addiction level ($r=0.77$, $p>0.05$), this indicates that the older the students' age the higher the addiction level.

Other important findings from this research are:

1. 31.9% of the respondent always feel ashamed with themselves because of watching pornography
2. 46.9 % of the respondent promise themselves everyday that they don't want to watch pornography anymore
3. 42.2 % of the respondents never delete the history after browsing in internet however, 57.8 % of the respondent delete the history after browsing pornography material
4. 76.1% of the respondent worried that there is something wrong in their mind because of pornography
5. 58.4% of the respondent feels that their fantasies about pornography disturb their religious and moral values.
6. 73.5 % of the respondent feel that they are annoyed by their thinking about pornography
7. 45.2 % of the respondent admit that they have difficulties to stop watching pornography
8. 22.1% of the respondent always feel that pornography disturb their academic activities at school
9. 67.4 % of respondent did not masturbate when watching pornography however, 15.2 % do masturbation at least one time in a year, 9 % do masturbation one time in a month, 3.8 % do masturbation 3-6 times i a month and 1.7 % do masturbation everyday when watching pornography.
10. 54.1% of the respondent have lied to their family member about watching pornography
11. 4 % of the respondent always looking for a situation where she or he can be alone and enjoy pornography.

DISCUSSION

Result in the present study found that, children and youth exposure to pornography is quite high in Indonesia. This is because the accessibility of pornography itself. Furthermore, lack of parent control over the used of technology for pornography. Most of our youth are disturb by their thinking and fantasy about pornography, they feel ashamed, they lied about watching pornography and most of them delete the history after browsing pornography material, furthermore, half of the respondent reported that they have difficulties to stop watching pornography.

Finding in the present study, in line with previous study who stated that high exposure to pornography make people want more and difficult to control the behaviour. Although only 7.2 % of the respondent at fully addict categories, if this small portion did not get a proper treatment the addiction might getting worse. There are several recommendations that we can do to help fully addict categories based on the literature according to several scholars including Skinner, 2010; Harker, 2011; and Chelsen 2011:

- Fully addict people need to realized that, they have problem with the addiction, parents counsellor can help them by helping them to realized that they can not control the behaviour, the tolerance toward pornography is increase as well as they experience negative consequence.
- Parents and counsellor also can motivate them to change using the motivational interviewing method, by asking question if they are not addicted to pornography how their life will be better
- Several cognitive, behaviour, emotional and spiritual therapy can be used to treat the addicted behaviour

Furthermore 34.7 % are at risk categories. There are several recommendation that we can do to help the at risk category so that they are not moving to fully addict category:

- Parents and counsellor need to help them to realise how they are trap in pornography, what could be the situation, people and things that can trigger
- After knowing the trigger help them to design activities that can be done when the trigger happen this what Skinner (2010) called as a game plan)

- Encourage children to activate good behaviour including daily sport and daily spiritual intervention as well as daily communication with parents or family member and recorded the activities in daily journal

Lastly, there are 58.1 % of respondent at the mild exposure to pornography. Several things that we can do to help this mild exposure so that they are not moving into at risk category including:

- Educate them about the dangerous of pornography, including that addicted nature of pornography, because its release the dopamine hormone that can make people feel relax and happy when watching pornography, this can create addiction
- Prolong exposure to pornography can cause a brain damage, because the pre frontal cortex no longer active to prevent individu from doing what the animal brain want.
- Talk with your student/parent that pornography is not real, its create false relationship, its exploitation and its disturb our perception about good relationship and the scarcity of marriage and sexual activities between husband and wife.

Limitation and Recommendations

Several limitation for the present study are, first, the sampling method in the present study is not systematic random sampling, for future study it is suggested that the stratified random sampling based on the region in youth population in JABODETABEK can be done.

Second, single method use in data collection which is questioner. For the future study it is recommended to use more than one method in data collection for more comprehensive data explanation.

Third, the present study only describe youth pornography addiction in JABODETABEK, future study should elaborate more on the predictors of youth addiction and effectiveness of treatment on pornography addiction school age children.

CONCLUSION

In conclusion, this study found that, around 7 % of youth consider as fully addict toward pornography in which they loss control, tolerance increase and continue doing the behaviour with the present of negative consequences. The present study also validate the YPAST to be used in Indonesian sample, this measure are having good reliability as well as evidence for the validity. The present study also discuss several treatment recommendation based on literature for the mild, at risk and fully addict category.

REFERENCES

- [1] Chelsen, P.O. (2011). An Examination of Internet Pornography Usage Among Male Students at Evangelical Christian Colleges. Desertation submitted to Loyola University Chicago.
- [2] Davis horizon, 23 sep 2004 by JoAnn Hamilton "talking to kids about tough issues
- [3] Deanne Lambson article: its time to talk RPI interview with your children (lioness at the gate)
- [4] Freimuth, M. (2008b). Addicted? Recognizing Destructive Behaviors Before It's Too Late. New York: Rowman and Littlefield. Freimuth, M. (2009 Paperback). Hidden Addictions: Assessment Practices for Psychotherapists, Counselors, and Health Care Providers. NY: Jason Aronson.
- [5] Freimuth, M. Addiction screening in psychotherapy. American Psychological Association education directorate.
- [6] <http://www.internetsafety101.org/pornographyrulesofengagement.htm>
- [7] Hawker, M.W (2013). Like dragon did they fight.
- [8] Joan (2014). Saving the family. "Garbage in garbage out":www.strengthen the family.net
- [9] Muhammad, I, Gendies, N. (2016). Is smartphone addition related to loneliness? Specialty Journal of Psychology and Management, Vol, 2 (2), 1-6.
- [10] Kastlemen, M.B (2001). The Drug of the New Millennium: The Science of How Internet Pornography Radically Alters the Human Brain and Body.
- [11] Laier, C; Pawlikowski, M.; Pekal, J.; Schulte, F.; Brand, M. (2013). Cybersex addiction: Experienced sexual arousal when watching pornography and not real-life sexual contacts makes the difference. Journal of Behavioral Addictions 2(2), pp. 100-107 (2013).
- [12] Lisa, D. (2014). How to Talk to Your Teenager About Pornography
- [13] Nakken, c. The addictive personality understanding the addictive process and compulsive behaviour.<http://lightsalongtheshore.com/2013/06/04/dealing-with-sex-addictionpornography-relapse/protecting families from the harmful effects of pornography>
- [14] Skinner. B. K (2010). Treating Pornography Addiction: The Essential Tool for Recovery: GrowthClimate, Inc:Utah.
- [15] Yang, D.; Young, G. (2012). Effects of Exposure to Pornography on Male Aggressive Behavioral Tendencies. The Open Psychology Journal, 5, 1-10.

Analysis Occupational Change and Earning of Star Hotel's Workers in Palembang Indonesia

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Abstract- This research is based on theory and previous research on Occupational Change and Earning for hotel's workers in Palembang Indonesia.

Index Terms- Occupational Change, Earning, Multinomial Logit

I. INTRODUCTION

This article provides novel evidence on the relation between changes in occupational and earning of hotel's worker. We assess: (1) location and occupational with four category (2) analyze the factors that affect worker to occupational change. The category of the location and occupational influenced by sex, married, previous earning, experience, age, training and education. Work plays an important role in the labor market. Work is a tool used to construct different types of work into a group of work based on its classification so that it can be differentiated level and specialization of its expertise. Research conducted by Longhi (2009) in the UK and Germany, the results of the study show that first: there is more specific than the change of work compared with the case of change of job title in the same profession. Second: the working situation of people who change jobs is different from those who change job titles in the same profession, as well as the characteristics of the person making the change. Third: the effect of job change on income and job satisfaction. Job changes are often associated with changes in one's income (Shaw, 1998: 1).

Workers change jobs in order to increase their income, assuming that 1). Workers are interested in money and non money from the job 2). Workers expect a higher level of compensation for the same level of work (Ehrenberg, 1997: 248). Wage or income compensation theories suggest a suitability between workers in the labor market (Nurlina, 2012: 96).

Since South Sumatera was officially appointed to host Asean Games 2018, various preparations have been made by the South Sumatra provincial government in various sectors. One such preparation is to meet the needs of lodging for participants and guests ie with the construction of hotels.

Table 1.1 Classification of Hotels Based on Star Criteria in Palembang

No	Hotel Criteria	Hotel Amount (Unit)	the occupancy rate (%)
1	5 Star	3	65,46
2	4 Star	10	60,26
3	3 Star	15	68,56
4	2 Star	13	54,38
5	1 Star	12	61,02
	Total	52	100

Source: Department of Tourism, 2016

Each with a different hotel occupancy rate, 2017 data show that for a five-star hotel 65.46 percent, four-star hotels 60.26 percent, three-star hotels 68.56 percent and two-star hotels 54.38 percent and star hotels One 61.02 percent. The highest percentage of occupancy rate was in three star hotels which was 68.56 percent. There is a change in jobs due to better revenue expectations. The increase in hotel growth in Palembang city, is an opportunity of employment and demand for hotel workforce. Workers who originally worked on the field A certain will be moved to make changes to the work in the hope that the income will be increased compared to before the change of work.

II. Research Elaborations

The concept of job change is rooted in the concept of job mobility. There is no general definition of job change. The definition differs depending on the background and purpose of the research. Job changes can be made with or without geographic mobility. Job changes may occur within the same company or with the involvement of different entrepreneurs.

Job change characteristics include elements:

A. Changed profession

B. Changes based on job-related content before and after job change. The need for different competencies to fulfill work-related tasks.

C. Not limited to expansion of activities but also career development responsibilities.

D. Job change as labor mobility is the ease of switching work, both on the same level; To a higher or lower level as well as to a different kind of work (Borjas 2000: 314).

McConnell, Brue and Macpherson (2010: 264) suggests several types of work changes: 1). Change of work but no change of occupation and residence. 2). No occupational change but no change of residence 3). Change of residence but without changing occupation. 4). Occupational change and residence.

The type of job change can be seen on the following page image:

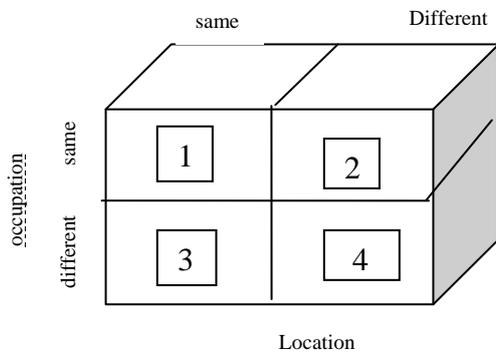


Figure 2.1 Type of job change
 (Source: McConnell, 1999: 276)

In Figure 2.1 consists of columns and rows. Columns section for residence and part row for occupation. It can be assumed that the residence as a location and occupation as a job. The work in question is the type of work. Job type is division and job title. Box 1 shows for locations that remain unchanged and jobs that remain unchanged. In box 2 it shows for the changed location and the work remains unchanged. In Box 3 it shows for a location that remains unchanged and the job is changing. In Box 4 shows for changed locations and changed jobs.

III. Result and Finding

This study assumes that the income of the hotel workers during a certain period of time depends on the seven main variables: job change itself, age, gender, marital status, education level, training and employment and income. Job changes as a dependent variable depend on Independent variable (AGE), sex (SEX), marital status (M_STA), education (EDU), training (TRAIN) and experience (EXPE) and Income Before Employment (INC). The nature of the dependent variable is the qualitative data of the nominal scale.

In this study consists of 4 (four) categories. Location Changed Permanent Work (LBPT) Changed Employment Changes (LTPB) and Changed Employment Changed Locations (LBPB) with Basic Category Fixed Location Fixed Work (LTPT)

The model that can be used is multinomial logistic regression model. Models with 4 (four) categories produce 3 (three) logit functions. Based on the Kenneth (2012) multinomial logit model, the logit model form in this research is:

$$OC_LBPT = \ln \left(\frac{LBPT}{1-LTPT_i} \right) = \alpha_0 + \alpha_1 AGE + \alpha_2 M_STA + \alpha_3 SEX + \alpha_4 EDU + \alpha_5 EXPE + \alpha_6 TRAIN + \alpha_7 INC + \epsilon_1 \quad (3.1)$$

$$OC_LTPB = \ln \left(\frac{LTPB}{1-LTPT_i} \right) = \beta_0 + \beta_1 AGE + \beta_2 M_STA + \beta_3 SEX + \beta_4 EDU + \beta_5 EXPE + \beta_6 TRAIN + \beta_7 INC + \epsilon_2 \quad (3.2)$$

$$OC_LBPB = \ln \left(\frac{LBPB}{1-LTPT_i} \right) = \gamma_0 + \gamma_1 AGE + \gamma_2 M_STA + \gamma_3 SEX + \gamma_4 EDU + \gamma_5 EXPE + \gamma_6 TRAIN + \gamma_7 INC + \epsilon_3 \quad (3.3)$$

$$INC = \delta_0 + \delta_1 OC_LBPT + \delta_2 OC_LTPB + \delta_3 OC_LBPB + \epsilon_3 \dots \dots \dots \quad (3.4)$$

Where :

- OC = Job Changes
- LTPT = Job Change Fixed Location Fixed Job
- OC_LBPT = Job Changes Location Changed Fixed Jobs
- OC_LTPB = Job Changes Fixed Location Job Changed
- OC_LBPB = Change Jobs Location Changed Jobs Changed
- AGE = Age
- M_STA = Marital status
- SEX = Gender
- EDU = Duration of education
- EXPE = Experience
- TRAIN = Training Frequency
- INC = Income Change
- A = constant
- $\alpha\beta\gamma$ = variable coefficients
- ϵ = error (another independent variable outside the model)

Based on the results of research estimation by comparing wald statistic and chi square (sig) values, independent variable's probability of job change in the Changed Work Changes (LTPB) and Changed Employment Changes (LBPB) category with Basic Category of Permanent Location Permanent Work (LTPT) are summarized in tabular form as shows at Table 3.1.

Based on Table 3.1. Then the employment opportunity to change the job with the location of change of permanent employment (LBPT) based on each variable is as follows: For age variable with category 1 (20-29 years) job change opportunity is 0,734214 or equal to 73 percent. While for age with category 2 (30-39 years) job change opportunity is 0,537924 or equal to 54 percent. For unmarried workers the opportunity to make a job change is 0.000625 or equal to 0.06 percent. For the variable of worker with female gender the opportunity to make job change is 0,627746 or equal to 63 percent. For high school education variables job change opportunity is 0.568828 or 57 percent. While for the education variables diploma job change opportunity is 0.000687 or equal to 0.07 percent. For experience variables with category 1 (0-5 years) the job change opportunity is 0.000685 or equal to 0.07percent. For experience variables with category 2 (6-15 years) the job change opportunity is 0.000996 or 0.10 percent. For training variables with category 1 (without training) the job change opportunity is 0.000424 or 0.04 percent. For the training variable with category 2 (1x training) the job change opportunity is 0.00091 or 0,09 percent. For training variables with category 3 (2x training) the job change opportunity is 0.000912 or equal to 0.09 percent.

Based on Table 3.1, the employee's opportunity to place a Changed Work Location (LTPB) based on each variable is as follows: For the age variable with category 1 (20-29 years) the job change opportunity is 0.755858 or equal to 76 percent. While for age with category 2 (30-39 years) job change opportunity is 0,632111 or equal to 63 percent. For unmarried workers the opportunity to make a job change is 0.000949 or 0.09 percent. For the female worker variables the opportunity to make a job change is 0.617284 or 62 percent. For high school education variables job change opportunity is 0,590667 or by 59 percent. While for the education variables diploma job change opportunity is 0.520291 or 52 percent. For experience variables with category 1 (0-5 years) the job change opportunity is 0.000478 or 0.05 percent. For experience variables with category 2 (6-15 years) the job change opportunity is 0.000534 or 0.05 percent. For training variables with category 1 (without training) the job change opportunity is 0.00026 or 0.03 percent. For the training variable with category 2 (1 training) the job change opportunity is 0.000684 or equal to 0.07 percent. For the training variable with category 1 (without training) the job change opportunity is 0.000708 or equal to 0.07 percent.

Table 3.1.
 Probability of Independent Variables on Job Changes

Independent Variable		LBPT	LTPB	LBPB
		Exp(B)		
Female	SEX	.986	1.009	1.684
Single	M_STA 0	1.194	.831	.732

Income 1	INC 1	47.677	103.556	108.498
Income 2	INC 2	3.971	6.292	7.841
Income 3	INC 3	1.671	1.530	1.785
Experience 1	EXPE 1	.673	.711	.119
Experience 2	EXPE 2	.187	.283	.094
Experience 3	EXPE 3	.209	.400	.141
Experience 4	EXPE 4	.377	.548	.188
Experience 5	EXPE 5	.484	.377	.221
Age 1	AGE 1	2.471	2.103	6.981
Age 2	AGE 2	3.830	2.702	4.742
Training 0	TRAIN 0	.641	.768	.645
Education 1	EDU 1	.974	.923	1.208
Education 2	EDU 2	1.839	1.221	1.230

Source: Research Data Processed, 2017

Based on Table 3.1, the employment opportunity of Changing Employment with Changed Employment Changes (LBPB) based on each variable is as follows: For the age variable with category 1 (20-29 years) the job change opportunity is 0.831255 or 83 percent. While for age with category 2 (30-39 years) job change opportunity is 0,784929 or equal to 78 percent For unmarried worker variable the opportunity to make job change is 0.000815 or equal to 0,0815 percent. For the female worker variables the opportunity to make a job change is 0.637755 or 64 percent. For high school education variables the opportunity of job change is 0,554324 or equal to 55 percent. While for the education variables diploma job change opportunity is 0.534188 or by 54 percent. For experience variables with category 1 (0-5 years) job change opportunity is 0.000365 or 0.03 percent For experience variables with category 2 (6-15 years) job change opportunity is 0.000539 or 0.05 percent . For the training variable with category 2 (1 training) the job change opportunity is 0.000513 or 0.05 percent. Thus it can be concluded that the employment opportunity of the Employment Changes with Changed Job Location Changes (LBPB) based on each of these variables, the greatest probability is based on the age of the worker.

The reference variables for the model based on table 3.1 above are:

$$OC_LBPT = \ln \left(\frac{\rho_{LBPT}}{\rho_{LTPT_1}} \right) =$$

$$-0,731 - 0,014 SEX_0 + 0,177 M_STA_0 + 3,864 INC_1 + 1379 INC_2 + 0,514 INC_3 - 0,395 EXPE_1 - 1,674 EXPE_2 - 1565 EXPE_3 - 0,974 EXPE_4 - 0,725 EXPE_5 + 0,904 AGE_1 + 1343 AGE_2 - 0,445 TRAIN_1 - 0,026 EDU_1 + 0,609 EDU_2 \dots \dots \dots (3.1.1)$$

Based on the equation table 3.1 it can be explained that: the value of the female gender lower variables affect the worker to choose Location Changed Permanent Work (LBPT) with coefficient of 0.014 or Sex significantly affect the probability of workers doing LBPT job change lower than LTPT, with coefficient value 0.014 And odds ratio 0.986. For the marriage variable value the unmarried category is higher affecting the worker to choose Location Changed Permanent Work (LBPT) with coefficient 0,177. For the value of income variable before category 1 (low income) and category 2 (middle income low) and category 3 (high income) higher influence workers to choose Location Changed Permanent Work (LBPT) with coefficient 3,864 and 1379 and 0,514. In the category 1 (0-1 years) and category 2 (2-5 years) experience variables, 3 (6-10 years old) and 4 (11-15 years) experience category and 5 (16-20 years) experience experience variables) Lower the worker's influence to choose a Changed Permanent Work Location (LBPT) with a coefficient of 0.395; 1,674; 1565; 0.974 and 0.725. The variable value of age 30 category 1 (less than 30 years), category 2 (between 31 to 40 years old) is higher for workers to choose a permanent job change location (LBPT) with each coefficient of 0.904 and 1343. Variable value Training of training category 1 (Did not get training) lower influence workers to choose with coefficient 0,445 to choose Location Changed Permanent Work (LBPT). The variable value of lower secondary education influenced the worker to choose a permanent job change location (LBPT) with a coefficient of 0.026 but for higher Diploma education affecting the workers to choose Location Changed Permanent Work (LBPT) obtained coefficient 0.609.

$$OC_LTPB = \ln \left(\frac{\rho_{LTPB}}{\rho_{LTPT_1}} \right) =$$

$$-0,321 + 0,009 SEX_0 - 0,186 M_STA_0 + 4640 INC_1 + 1839 INC_2 + 0,425 INC_3 - 0,342 EXPE_1 - 1,263 EXPE_2 - 0,916 EXPE_3 - 0,601 EXPE_4 - 0,975 EXPE_5 + 0,744 AGE_1 + 0,994 AGE_2 - 0,264 TRAIN_1 - 0,080 EDU_1 + 0,200 EDU_2 \dots \dots \dots (3.1.2)$$

Based on the equation table 3.1 it can be explained that: the variable value Female gender is higher affecting the worker to choose Fixed Work Change Location (LTPB) with coefficient 0,009 or Gender affects the probability of the worker to change the LTPB work is lower compared to LTPT and significant, with coefficient value 0.009 and odds ratio 1.009. For the Marital Status variable value the unmarried category is lower affecting the worker to choose a Changed Work Changes Location (LTPB) with a

coefficient of 0.186. For the value of income variables before category 1 (low income) and category 2 (middle income low) and category 3 (high income) higher influence workers to choose Fixed Work Changes (LTPB) with coefficients 4640 and 1839 and 0.425. In the category 1 (0-1 years) and category 2 (2-5 years) experience variables, 3 (6-10 years old) and 4 (11-15 years) and 3 (16-20 years)) Lower the employee's influence to choose a Changed Work Changes Location (LTPB) with a coefficient of 0.342; 1,263; 0.916; 0.601 and 0.975. The variable value of age 30 category 1 (less than 30 years), category 2 (between 31 to 40 years old) was higher for workers to choose a permanent job change location (LTPB) with each coefficient of 0.744 and 0.994 variable value Training category 1 Get training) lower influence workers to choose with coefficient of 0.445 to choose Fixed Work Changes Location (LTPB). The variable value of the lower secondary education affects the worker to choose a permanent job change location (LTPB) with a coefficient of 0.080 but for higher Diploma education affecting the workers to choose the Permanent Fixed Work Location (LBPT) obtained coefficient of 0.200.

$$OC_LBPB = \ln \left(\frac{\rho_{LBPB}}{\rho_{LTPT}} \right) =$$

$$-1265 + 0,521 SEX_0 - 0,312 M_STA_0 + 4687 INC_1 + 2059 INC_2 + 0,579 INC_3 - 2,131 EXPE_1 - 2,361 EXPE_2 - 1957 EXPE_3 - 1669 EXPE_4 - 1511 EXPE_5 + 1943 AGE_1 + 1556 AGE_2 - 0,438 TRAIN_1 + 0,189 EDU_1 + 0,207 EDU_2 \dots \dots \dots (3.1.3)$$

Based on the equation table 3.1 it can be explained that: the variable value Female gender is higher to influence the worker to choose the Changed Work Changed (LBPB) with the coefficient of 0.521 or Gender affects the probability of the worker to change LBPB work is higher than the LTPT and significant, with coefficient value 0,521 and odds ratio 1684. For the marriage variable value the unmarried category is lower affecting the worker to choose the Changed Work Changed Location (LBPB) with the coefficient of 0.312. For the value of income variable before category 1 (low income) and category 2 (middle income low) and category 3 (high income) higher influence workers to choose Changed Employment Changes (LBPB) with coefficients 4687 and 2059 and 0.579. In the category 1 (0-1 years) and category 2 (2-5 years) experience variables, 3 (6-10 years old) and 4 (11-15 years) and 3 (16-20 years)) Lower the worker's influence to choose a Changed Work Changed Location (LBPB) with coefficient 2131; 2361; 1957, 1669 and 1511. The variable values of age 30 category 1 (less than 30 years), category 2 (between 31 to 40 years) were higher for workers to choose Changed Employment Changes (LBPB) with each coefficient of 1943 and 1556 Training category 1 (did not get training) lower training influenced workers to choose with coefficient of 0.438 to select Changed Work Changed Locations (LBPB). The variable value of the SMA Higher Education influences the worker to choose the Changed Work Changed Location (LBPB) with coefficients of 0.189 and 0.207.

Table 3.2 Coefficient and Model Significance
 Change of Employment to Income Changes

Model	Beta	Sig
(Constant)		.000
LTPT	0,034	.474
LBPT	0,159	.001
LBPB	0,149	.001

Source: Field Research, 2016

Based on Table 3.2 above coefficients, it can be arranged regression line equation as follows:

$$\text{Revenue LTPT Now} = 0.034 + 0.159 + 0.149 \text{ LBPB LBPT} \dots \dots \dots (3.1..4)$$

The explanation regression line as follows: Constant value of 8,094,211.823 shows that without a Fixed Location Works Equipment (LTPT), Location Changed Permanent Employment (LBPT) and Location Changed Permanent Employment (LBPB) the revenue to be received Rp 8,094 workers .211,823. While the regression coefficient Still Works Permanent Location LTPT at 118,794.506 show that if a variable location Fixed Fixed Works LTPT rose 1 times the income received by workers will increase by Rp 118,794.506 assuming variable Fixed Location Changed Jobs LBPT and LBPB considered constant . For variable regression coefficient values Transformed Works Permanent Location LBPT at 631,742.723 show that if variabelLokasi Changing Fixed Work LBPT rose 1 times the income received by workers will increase by Rp 631,742.723 assuming variable Fixed Location and Area Job LTPT Permanent Jobs Changed Changed LBPB is considered constant. LBPB variable regression coefficient values Transformed Job Location Berubahsebesar 664,385.738 show that if a variable LBPB Location Changed Jobs Berubahmeningkat 1 times the earned income of employees will increase by Rp 664,385.738 assuming variable Fixed Location Jobs Permanent Jobs Changed TetapLTPT danLokasi LBPT considered constant.

IV. Conclusion

The model with just entering intercept will result in a Log-Likelihood value of 1234.284 and the Log-Likelihood value will decrease to 1089,642 when the variable is entered in the model. From the value of pearson and deviance obtained value significance of Chi Square greater than 0.05 so it can be concluded that the model is fit or fit with empirical data.

$$-0.731 - 0.014 + 0.177 M_STA0 SEX0 INC1 + 1379 + 3.864 + 0.514 INC3 INC2 - EXPE1 0.395 - 1.674 EXPE2 - EXPE3 1565 - 0, 974 EXPE4 - EXPE5 0.725 + 0.904 + 1343 AGE1 AGE1 - TRAIN1 0.445 - 0.026 + 0.609 EDU2 EDU1 \dots\dots\dots (4.1)$$

Table 4.1
 Significance of Location Changed Permanent Work (LBPT)
 Location Changed Work Changes (LTPB) and Location Changed Jobs
 Changed (LBPB) with Basic Category Fixed Location Fixed Work (LTPT)

Independent Variable	LBPT	LTPB	LBPB
SEX 0	.961	.970	.084
M_STA 0	.567	.503	.360
INC 1	.000	.000	.000
INC 2	.001	.000	.000
INC 3	.148	.179	.193
EXPE 1	.698	.719	.072
EXPE 2	.060	.120	.016
EXPE 3	.059	.229	.033
EXPE 4	.234	.429	.070
EXPE 5	.394	.231	.123
AGE 1	.072	.072	.001
AGE 2	.001	.003	.001
TRAIN 0	.108	.280	.152
EDU 1	.942	.793	.623
EDU 2	.055	.483	.578

Source: Results of the 2016 data
 Significance at $\alpha = 5\%$

It can be concluded that partially independent variables on job change have positive effect. For gender variables (SEX), marital status (M_STA), experience (EXPE), training (TRAIN) and education (EDU) have positive but insignificant impact on job change in LBPT, LTPB and LBPT. While the income variable (INC) and age (AGE), have a positive and significant effect on job change in the three categories of LBPT, LTPB and LBPT. While simultaneously variable of job change category LBPT, LTPB and LBPT to earnings change have positive and significant influence.

REFERENCES

Bartel, Ann and Borjas, George.(2000). **Wage Growth and Job Turnover : An Empirical Analysis**. *Studies in Labor Market*.Rosen, University of Chicago Press
 Ehrenberg, Ronald.(2012).**Modern Labor Economics** : theory and Public Policy.
 Karlton, Kenneth, 2012, The determinants of interregional migration within the framework of a multinomial logit model economics, p 3847 A, Institute manpower training for national development.
 Longhi, Simonetta and Brynin, Malcolm.(2009). *Occupational Change in Britain and Germany*, ISER University of Essex Colechester CO4 3SQ, UK.
 McConnell, Campbell and Brue, Stanley. (2010). **Contemporary Labor Economics**, McGraw Hill.International Editions.
 Nurlina, Tarmizi. (2012). **Ekonomi Ketenagakerjaan**.ISBN : 979-587-352-0, Universitas Sriwijaya. Palembang. Sumatera Selatan.
 Shaw, Kathryn.(1987).*Occupational Change, Employer Change, and Transferability of Skills*. Southern Economic Journal, Pennsylvania.

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On Sextic Equation With Five Unknowns

$$2(x^3 + y^3)(x - y) = 84(z^2 - w^2)P^4$$

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ABSTRACT

The non-homogeneous sextic equation with five unknowns represented by the Diophantine equation is

$2(x^3 + y^3)(x - y) = 84(z^2 - w^2)P^4$ analyzed for its patterns of non-zero distinct integral solutions are illustrated. Various interesting relations between the solutions and special numbers namely, polygonal numbers, pyramidal numbers are exhibited.

KEYWORDS

Integral solutions, Non-homogenous equation, Sextic equation.

1. INTRODUCTION

The theory of Diophantine equations offers a rich variety of fascinating problems (Dickson, 1952; Carmichael, 1959; Mordell, 1969; Telang, 1996). Particularly, in (Gopalan et al., 2007; Gopalan and Sangeetha, 2010; Gopalan et al., 2010), sextic equations with three unknowns are studied for their integral solutions. (Gopalan and VijayaShankar, 2010; Gopalan et al., 2012; Gopalan et al., 2012; Gopalan et al., 2013; Gopalan et al., 2013; Gopalan et al., 2013; Gopalan et al., 2013) analyze sextic equations with four unknowns for their non-zero integer solutions (Gopalan et al., 2012; Gopalan et al., 2013; Gopalan et al., 2014; Gopalan et al., 2015) analyze sextic equations with five unknowns for their non-zero integer solutions.

This communication concerns with yet another interesting non-homogeneous sextic equation with five unknowns

$2(x^3 + y^3)(x - y) = 84(z^2 - w^2)P^4$ given by tuple is analysed for its infinitely many non-zero distinct integer solutions (x, y, z, w, P) satisfying the above equations are obtained. Various interesting properties among the values of x, y, z, w, P are presented.

NOTATIONS

$t_{m,n}$: Polygonal number of rank n with size m .

P_m^n : Pyramidal number of rank n with size m .

2. METHOD OF ANALYSIS

The non-homogeneous sextic equation with five unknowns to be solved for its distinct non-zero integral solutions is

$$2(x^3 + y^3)(x - y) = 84(z^2 - w^2)P^4 \tag{1}$$

Introduction of the linear transformations

$$x = u + v, \quad y = u - v, \quad z = 2u + v, \quad w = 2u - v, \quad u \neq v \neq 0 \tag{2}$$

in (1) leads to

$$u^2 + 3v^2 = 84P^4 \tag{3}$$

Different methods of obtaining the patterns of integer solutions to (1) are illustrated below:

2.1 PATTERN: 1

Let

$$P = a^2 + 3b^2 \tag{4}$$

where a and b are non-zero integers.

Write 84 as

$$84 = (9 + i\sqrt{3})(9 - i\sqrt{3}) \tag{5}$$

Using (4), (5) in (3) and applying the method of factorization, define

$$(u + i\sqrt{3}v) = (9 + i\sqrt{3})(a + i\sqrt{3}b)^4 \tag{6}$$

From which, we have

$$\left. \begin{aligned} u &= 9a^4 + 81b^4 - 162a^2b^2 - 12a^3b + 36ab^3 \\ v &= a^4 + 9b^4 - 18a^2b^2 + 36a^3b - 108ab^3 \end{aligned} \right\} \tag{7}$$

Using (7) in (2), the values of x, y, z and w are given by

$$\left. \begin{aligned} x(a,b) &= 10a^4 + 90b^4 - 180a^2b^2 + 24a^3b - 72ab^3 \\ y(a,b) &= 8a^4 + 72b^4 - 144a^2b^2 - 48a^3b + 144ab^3 \\ z(a,b) &= 19a^4 + 171b^4 - 342a^2b^2 + 12a^3b - 36ab^3 \\ w(a,b) &= 17a^4 + 153b^4 - 306a^2b^2 - 60a^3b + 180ab^3 \end{aligned} \right\} \tag{8}$$

Thus (4) and (8) represent the non-zero integer solutions to (1).

PROPERTIES

$$\diamond x(1,b) + y(1,b) - 18P^2(1,b) + 24[t_{8,b} + t_{10,b} + t_{12,b} + t_{16,b} + t_{18,b} - 18P_b^3] = -696b$$

- ❖ $y(a,1)+z(a,1)-w(a,1)-10P(a^2,1)+12[t_{8,a} + t_{12,a} + t_{14,a} + t_{16,a} - 12P_a^3] \equiv 0 \pmod{6}$
- ❖ $z(a,1)-w(a,1)-x(a,1)+8[P(a^2,1)-36P_a^3] \equiv 0 \pmod{48}$
- ❖ $z(1,b)-w(1,b)+6[216P_b^3 - P(1,b^2)] - 6[t_{10,b} + t_{12,b} + t_{18,b}] \equiv 0 \pmod{4}$
- ❖ $w(a,1)+y(a,1)-x(a,1)-15P(a^2,1)+6[132P_a^3 - t_{14,a} - t_{16,a} - t_{18,a}] \equiv 0 \pmod{3}$

2.2 PATTERN: 2

Consider (6) as

$$u^2 - 81P^4 = 3(P^4 - v^2) \tag{9}$$

Write (9) in the form of ratio as

$$\frac{u + 9P^2}{P^2 + v} = \frac{3(P^2 - v)}{u - 9P^2} = \frac{\alpha}{\beta}, \quad (\beta \neq 0)$$

which is equivalent to the following two equations

$$\begin{aligned} \beta u - \alpha v + (9\beta - \alpha)P^2 &= 0 \\ 3\beta v + \alpha u - (9\alpha + 3\beta)P^2 &= 0 \end{aligned}$$

On employing the method of cross multiplication, we get

$$\left. \begin{aligned} u &= 9\alpha^2 + 6\alpha\beta - 27\beta^2 \\ v &= 3\beta^2 - \alpha^2 + 18\alpha\beta \end{aligned} \right\} \tag{10}$$

$$P^2 = 3\beta^2 + \alpha^2 \tag{11}$$

which is satisfied by

$$\begin{aligned} \alpha &= 3r^2 - s^2 \\ \beta &= 2rs \end{aligned}$$

Substituting the values of α and β in (10) and (11), we get

$$\begin{aligned} u &= 81r^4 + 9s^4 - 162r^2s^2 + 36r^3s - 12rs^3 \\ v &= -9r^4 - s^4 + 18r^2s^2 + 108r^3s - 36rs^3 \end{aligned}$$

Substituting the values of u and v in (2), the non-zero distinct integral values of x and y are given by

$$\left. \begin{aligned} x(r,s) &= 72r^4 + 8s^4 - 144r^2s^2 + 144r^3s - 48rs^3 \\ y(r,s) &= 90r^4 + 10s^4 - 180r^2s^2 - 72r^3s + 24rs^3 \\ z(r,s) &= 153r^4 + 17s^4 - 306r^2s^2 + 180r^3s - 60rs^3 \\ w(r,s) &= 171r^4 + 19s^4 - 342r^2s^2 - 36r^3s + 12rs^3 \\ P(r,s) &= 3r^2 + s^2 \end{aligned} \right\} \quad (12)$$

Thus (12) represent the non-zero integer solutions to (1).

PROPERTIES

- ❖ $w(1,s) - x(1,s) - y(1,s) - P(1,s^2) + 36[t_{3,s} - 6P_s^3 + 6t_{3,s-1}] \equiv 0 \pmod{6}$
- ❖ $x(r,1) + y(r,1) - z(r,1) - 3P(r^2,1) + 18[36P_r^3 - (t_{10,r} + t_{14,r} + t_{16,r})] \equiv 0 \pmod{2}$
- ❖ $z(1,s) - y(1,s) - 7P(1,s^2) + 6[84P_s^3 - (t_{14,s} + t_{16,s} + t_{18,s})] \equiv 18 \pmod{42}$
- ❖ $z(r,1) - x(r,1) - 27P(r^2,1) + 6[t_{12,r} + t_{14,r} + t_{16,r} + t_{18,r} + t_{20,r} + 20t_{3,r} - 36P_r^3] \equiv 12 \pmod{18}$
- ❖ $w(1,s) - z(1,s) - 2P(1,s^2) + 36[t_{16,s} - 12P_s^3] \equiv 0 \pmod{12}$

2.3 PATTERN: 3

Write (9) in the form of ratio as

$$\frac{u + 9P^2}{3(P^2 + v)} = \frac{(P^2 - v)}{u - 9P^2} = \frac{\alpha}{\beta}, (\beta \neq 0)$$

which is equivalent to the following two equations

$$\begin{aligned} \beta u - 3\alpha v + (9\beta - 3\alpha)P^2 &= 0 \\ \beta v + \alpha u - (9\alpha + \beta)P^2 &= 0 \end{aligned}$$

On employing the method of cross multiplication, we get

$$\left. \begin{aligned} u &= 27\alpha^2 + 6\alpha\beta - 9\beta^2 \\ v &= -3\alpha^2 + \beta^2 + 18\alpha\beta \end{aligned} \right\} \quad (13)$$

$$P^2 = 3\alpha^2 + \beta^2 \quad (14)$$

which is satisfied by

$$\begin{aligned} \alpha &= 2rs \\ \beta &= 3r^2 - s^2 \end{aligned}$$

Substituting the values of α and β in (13) and (14), we get

$$u = -81r^4 - 9s^4 + 162r^2s^2 + 36r^3s - 12rs^3$$

$$v = 9r^4 + s^4 - 18r^2s^2 + 108r^3s - 36rs^3$$

Substituting the values of u and v in (2), the non-zero distinct integral values of x and y are given by

$$\left. \begin{aligned} x(r,s) &= -72r^4 - 8s^4 + 144r^2s^2 + 144r^3s - 48rs^3 \\ y(r,s) &= -90r^4 - 10s^4 + 180r^2s^2 - 72r^3s + 24rs^3 \\ z(r,s) &= -153r^4 - 17s^4 + 306r^2s^2 + 180r^3s - 60rs^3 \\ w(r,s) &= -171r^4 - 19s^4 + 342r^2s^2 - 36r^3s + 12rs^3 \\ P(r,s) &= 3r^2 + s^2 \end{aligned} \right\} \quad (15)$$

Thus (15) represent the non-zero integer solutions to (1).

PROPERTIES

- ❖ $y(1,s) + 10P^2(1,s) = 24[6P_s^3 + t_{8,s} + t_{10,s}]$
- ❖ $x(r,1) + 8[P^2(r,1) - 108P_r^3 + 6t_{12,r}] = -528r$
- ❖ $z(1,s) - y(1,s) + 7[P(1,s^2) + 72P_s^3 - 6(t_{10,s} + t_{12,s})] \equiv 0 \pmod{42}$
- ❖ $x(r,1) - z(r,1) - 27P(r^2,1) + 6[36P_r^3 + t_{10,r} + t_{12,r}] \equiv -6 \pmod{18}$
- ❖ $x(1,s) + y(1,s) - w(1,s) - P^2(1,s) + 12[18P_s^3 - t_{8,s} - t_{10,s}] = 240s$

PATTERN: 4

Write (9) in the form of ratio as

$$\frac{u + 9P^2}{3(P^2 - v)} = \frac{(P^2 + v)}{u - 9P^2} = \frac{\alpha}{\beta}, (\beta \neq 0)$$

which is equivalent to the following two equations

$$\beta u + 3\alpha v + (9\beta - 3\alpha)P^2 = 0$$

$$-\beta v + \alpha u - (9\alpha + \beta)P^2 = 0$$

On employing the method of cross multiplication, we get

$$\left. \begin{aligned} u &= 27\alpha^2 + 6\alpha\beta - 9\beta^2 \\ v &= 3\alpha^2 - \beta^2 - 18\alpha\beta \end{aligned} \right\} \quad (16)$$

$$P^2 = 3\alpha^2 + \beta^2 \quad (17)$$

which is satisfied by

$$\alpha = 2rs$$

$$\beta = 3r^2 - s^2$$

Substituting the values of α and β in (16) and (17), we get

$$u = -81r^4 - 9s^4 + 162r^2s^2 + 36r^3s - 12rs^3$$

$$v = -9r^4 - s^4 + 18r^2s^2 - 108r^3s + 36rs^3$$

Substituting the values of u and v in (2), the non-zero distinct integral values of x and y are given by

$$\left. \begin{aligned} x(r, s) &= -90r^4 - 10s^4 + 180r^2s^2 - 72r^3s + 24rs^3 \\ y(r, s) &= -72r^4 - 8s^4 + 144r^2s^2 + 144r^3s - 48rs^3 \\ z(r, s) &= -171r^4 - 19s^4 + 342r^2s^2 - 36r^3s + 12rs^3 \\ w(r, s) &= -153r^4 - 17s^4 + 306r^2s^2 + 180r^3s - 60rs^3 \\ P(r, s) &= 3r^2 + s^2 \end{aligned} \right\} \quad (18)$$

Thus (18) represent the non-zero integer solutions to (1).

PROPERTIES

- ❖ $z(1, s) - x(1, s) - y(1, s) + P(1, s^2) - 18[12P_s^3 - 6t_{3,s} - t_{6,s}] \equiv 0 \pmod{6}$
- ❖ $z(r, 1) - w(r, 1) - 6[P(r^2, 1) - 36[-6P_r^3 + (t_{8,r} + t_{10,r} + t_{12,r} + t_{16,r})]] \equiv 0 \pmod{4}$
- ❖ $y(1, s) + 8P(1, s) + 4[72P_s^3 - 49t_{3,s} - 12t_{10,s}] \equiv 0 \pmod{48}$
- ❖ $y(r, 1) + w(r, 1) - x(r, 1) + 45P(r^2, 1) + 6[300t_{3,r} - 396P_r^3 + t_{8,r}] \equiv -6 \pmod{30}$
- ❖ $z(1, s) - w(1, s) - x(1, s) - y(1, s) + 16[108P_s^3 - P(1, s^2) - 6(t_{8,s} + t_{6,s} + 2t_{3,s-1})] \equiv 0 \pmod{96}$

2.5 PATTERN: 5

Write (9) in the form of ratio as

$$\frac{u + 9P^2}{(P^2 - v)} = \frac{3(P^2 + v)}{u - 9P^2} = \frac{\alpha}{\beta}, \quad (\beta \neq 0)$$

which is equivalent to the following two equations

$$\beta u + \alpha v + (9\beta - \alpha)P^2 = 0$$

$$-3\beta v + \alpha u - (9\alpha + 3\beta)P^2 = 0$$

On employing the method of cross multiplication, we get

$$\left. \begin{aligned} u &= 9\alpha^2 + 6\alpha\beta - 27\beta^2 \\ v &= \alpha^2 - 3\beta^2 - 18\alpha\beta \end{aligned} \right\} \quad (19)$$

$$P^2 = 3\beta^2 + \alpha^2 \quad (20)$$

which is satisfied by

$$\begin{aligned} \alpha &= 3r^2 - s^2 \\ \beta &= 2rs \end{aligned}$$

Substituting the values of α and β in (19) and (20), we get

$$\begin{aligned} u &= 81r^4 + 9s^4 - 162r^2s^2 + 36r^3s - 12rs^3 \\ v &= 9r^4 + s^4 - 18r^2s^2 - 108r^3s + 36rs^3 \end{aligned}$$

Substituting the values of u and v in (2), the non-zero distinct integral values of x and y are given by

$$\left. \begin{aligned} x(r,s) &= 90r^4 + 10s^4 - 180r^2s^2 - 72r^3s + 24rs^3 \\ y(r,s) &= 72r^4 + 8s^4 - 144r^2s^2 + 144r^3s - 48rs^3 \\ z(r,s) &= 171r^4 + 19s^4 - 342r^2s^2 - 36r^3s + 12rs^3 \\ w(r,s) &= 153r^4 + 17s^4 - 306r^2s^2 + 180r^3s - 60rs^3 \\ P(r,s) &= 3r^2 + s^2 \end{aligned} \right\} \quad (21)$$

Thus (21) represent the non-zero integer solutions to (1).

PROPERTIES

- ❖ $x(r,1) + y(r,1) - w(r,1) - 3P(r^2,1) + 18[36P_r^3 - t_{10,r} - t_{14,r} - t_{16,r}] \equiv 0 \pmod{2}$
- ❖ $y(1,s) + 8[36P_s^3 - P(1,s^2)] \equiv 0 \pmod{48}$
- ❖ $z(1,s) - x(1,s) - y(1,s) - P(1,s^2) + 18[t_{8,s} + t_{10,s} - 12P_s^3] \equiv 0 \pmod{6}$
- ❖ $x(r,1) + 6[72P_r^3 - 5P(r^2,1) - 4t_{3,r} - 2t_{6,r}] \equiv 0 \pmod{4}$
- ❖ $z(r,1) + w(r,1) + 12[12t_{3,r} - 9P(r^2,1) - 72P_r^3 + 2(t_{8,r} + t_{10,r} + t_{12,r} + t_{14,r} + t_{16,r} + t_{18,r} + t_{20,r})] \equiv 48 \pmod{72}$

3. CONCLUSION

In this paper, we have made an attempt to determine different patterns of non-zero distinct integer solutions to the non-homogeneous sextic equations with five unknowns. As the sextic equations are rich in variety, one may search for other forms of sextic equation with variables greater than or equal to five and obtain their corresponding properties.

4. REFERENCES

- [1] L.E. Dickson, History of theory of numbers, vol.11, Chelsea publishing company, Newyork (1952).
- [2] R.D. Carmichael, The theory of numbers and Diophantine analysis, Dover publications, Newyork (1959).
- [3] L.J. Mordell, Diophantine equations, Academic press, London (1969).
- [4] S.G. Telang, Number Theory, Tata MC Graw Hill Publishing Company, New Delhi (1996).
- [5] M.A. Gopalan, Manju Somanath and N. Vanitha, "Parametric Solutions of $x^2 - y^6 = z^2$ ", ActaCiencia Indica XXXIII, vol.3, 2007, 1083-1085.
- [6] M.A. Gopalan, G. Sangeetha, "On the Sextic Equations with three unknowns $x^2 - xy + y^2 = (k^2 + 3)^n z^6$ ", Impact J.Sci.tech, Vol.4, No: 4, (2010), 89-93.
- [7] M.A. Gopalan, R. Srikanth and Usha janaki, "Parametric integral solutions of $x^2 - y^2 = 2z^6$ ", Impact J. Sci. Tech., Vol.4, No:3, 2010, 01-04.
- [8] M.A. Gopalan and A. VijayaShankar, "Integral Solutions of the sextic equation $x^4 + y^4 + z^4 = 2w^6$ ", Indian Journal of Mathematics and Mathematical sciences, Vol.6., No:2, 2010, 241-245.
- [9] M.A. Gopalan, S. Vidhyalakshmi and A. VijayaShankar, "Integral Solutions of Non-homogeneous sextic equation $xy + z^6 = w^6$ ", Impact J. Sci. Tech., Vol.6, No:1, 2012, 47-52.
- [10] M.A. Gopalan, S. Vidhyalakshmi and K. Lakshmi, "On the non-homogeneous sextic equation $x^4 + 2(x^2 + w) + x^2 y^2 + y^4 = z^4$ ", IJAMA, 4(2), Dec 2012, 171-173.
- [11] M.A. Gopalan, G. Sumathi and S. Vidhyalakshmi, "Gaussian Integer Solutions of sextic equation with four unknowns $x^6 - y^6 = 4z(x^4 + y^4 + w^4)$ ", Archimedes J. Math., 3(3), 2013, 263-266.
- [12] M.A. Gopalan, G. Sumathi and S. Vidhyalakshmi, "Integral Solutions of $x^6 - y^6 = 4z(x^4 + y^4 + 4(w^2 + 2)^2)$ "
interms of Generalised Fibonacci and Lucas Sequences, Diophantus J. Math., 2(2), 2013, 71-75.
- [13] M.A. Gopalan, G. Sumathi and S. Vidhyalakshmi, "Integral Solutions of Non-homogeneous sextic equation with four unknowns $x^4 + y^4 + 16z^4 = 32w^6$ ", Antarctica J. Math., 10(6), 2013, 623-629.
- [14] M.A. Gopalan, S. Vidhyalakshmi and A. Kavitha, "Observations on the non-homogeneous sextic equation with four unknowns $x^3 + y^3 = 2(K^2 + 3)z^5 w$ " IJRSET, Vol.2, Issue. 5, 2013, May-2013.
- [15] M.A. Gopalan, S. Vidhyalakshmi and K. Lakshmi, "Integral Solutions of Non-homogeneous sextic equation with five unknowns $x^3 + y^3 = z^3 + w^3 + 3(x + y)T^5$ " IJESRT, 1(10), 2012, 562-564.
- [16] M.A. Gopalan, G. Sumathi and S. Vidhyalakshmi, "Integral Solutions of Non-homogeneous sextic equation with five unknowns $x^3 + y^3 = z^3 + w^3 + 6(x + y)t^5$ " Vol.1, issue.2, 2013, 146-150.
- [17] M.A. Gopalan, S. Vidhyalakshmi and K. Lakshmi, "Integral Solutions of the Sextic equation with five unknowns $x^6 - 6w^2(xy + z) + y^6 = 2(y^2 + w)T^4$ " International Journal of Scientific and research Publications, Vol.4, issue.7, July-2014
- [18] M.A. Gopalan, S. Vidhyalakshmi and A. Kavitha, "Integral Solutions of the Sextic equation with three unknowns $(4k - 1)(x^2 + y^2) - (4k - 2)xy = 4(4k - 1)z^6$ ", International Journal of Innovation Sciences and Research, Vol.4, No:7, July-2015, 323-328.

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The Influence of Mother Tongue on Learning English Language by Arab Learners

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Abstract- This description is a record of literature review whereby the finder explored previous studies and art objects of research conducted to analyze the negative effects of Arabic language interference to learning English. It discusses the definitions and classification of errors committed by Arabic speakers in using English. The errors are explained on the basis of 'principles of unassertive dialect language transfer'. It also aims at pinpointing the differences between Arabic and English and how these differences make Arab learners to commit mistakes at different linguistic levels. The writer explains the types of syntactic, lexical, and morphological errors made by the Arab learners of English as quoted from previous literature. A mistake in forming tenses, relative clauses, adverbs, adjectives, nouns, and articles were listed. A batch of object lessons was applied to illustrate these errors.

At the conclusion of the current report, the researcher listed recommendations as a contribution to guide the English as a second language instructor on what might be regarded good pedagogical strategies and techniques to share with their students' mistakes.

Index Terms- Mother Tongue; Second Language; Contrastive Analysis.

I. INTRODUCTION

It is an admitted fact that technology development in this age of globalization is a great reason to make the whole world as a small village. This compels on every person to learn at least a second/ foreign language in order to be in contact with other people from different countries and nationalities. Many people encounter many challenges of learning a foreign language, since their first language is the best to express themselves in any situation.

1(i). Mother Tongue

Usually, the term (mother tongue) is used to refer as a child first language. It is the primary language that is revealed to the surrounding of a child after he/she is born. As time goes on, this language subconsciously help the child to develop further in reading, writing and speaking it fluently. Mother tongue helps a child to communicate with others by expressing their feelings, emotions and needs. It is also known as native language. Furthermore, it reveals one's identity and nationalities, and it differentiates people from their country of origins.

Ashworth (1992) states that *mother tongue* is the language which the child/person acquires in early years and which naturally becomes his/her means of thought and communication.

1(ii). Second Language

According to online dictionary second language as "a language other than the mother tongue that a person or community uses for public communication, especially in trade, higher education and administration" (The Free Dictionary by Farlex). Another definition of the second language in the same dictionary is "a non-native language officially recognised and adopted in a multilingual country as a means of public communication." The second language is also called the target language. According to Ashworth (1992) second language is a language acquired by a person in addition to her mother tongue.

1(iii). Contrastive analysis

Contrastive analysis is concerned with a systematic comparison of a pair of languages with the purpose of bringing the light to their phonological, morphological, syntactic and lexical differences and similarities. Contrastive analysis is a method that used extensively to find out and explain why some features of a foreign language were more difficult to learn than other. The learner who comes in contact with another language of his/her mother tongue will discover some features of it far easy to learn and others excessively difficult. Lado (1957, p. 2) says that those elements of a foreign language that are similar to the learner's native language will be simple for the learner to learn. Whereas, those elements of a foreign language that are different to the learner's native language will be difficult for him/her to acquire.

In this respect, it is useful to distinguish between Arabic and English languages through contrastive analysis. Arabic is a plant of Semitic languages, whereas English is an Indo-European language primarily originated from the Anglo Frisian dialects.

As for the number of alphabets, Arabic has twenty-eight letters.

"Hamza" the glottal stop has sometimes led the twenty ninth letters. In contrast, English has twenty six letters. Orthographically, there is no distinction between upper letters and lower case letters in Arabic as it is always composed in a cursive form. According to English, the matter is different. In English, at that place is a clear distinction between upper case alphabetic characters and lower case alphabetic characters. English words can be written in both cursive and uncial. One of the most noticeable differences between the two speeches is that Arabic is written from right to left. English, on the other hand, is written from left to right. Most significantly, there are typical

differences between Arabic and English in almost all syntactical, morphological, phonological, lexical, semantic, rhetorical and orthographical aspects. (Ali, 2007:3).

In all the above mentioned differences between Arabic and English languages cause Arab learners unconsciously or involuntarily to make mistakes or even errors. It should be recalled here, it is beneficial to differentiate errors from mistakes. Ellis (1997) stated that errors reflect gaps in the learner's knowledge; they occur because the learner does not know what is correct. Whereas, mistakes reflect occasional lapses in performance; they occur because, in a particular instance, the learner is unable to perform what he or she knows.

In this current literature review, a bulk of previous studies has been delineated and studied according to their findings to determine differences between Arabic and English that causes Arab learners of English to make mistakes in their English learning process in relation to the aspects of James' taxonomy.

II. LITERATURE REVIEW

2(i). Misuse of Singularity, Duality and Plurality of nouns

In a study by Salimi (2013: 131) on morphological errors in noun system between Arabic and English, their findings reveal that

English nouns have two numbers: singular and plural. Whereas, Arabic nouns have threenumbers: singular, dual and plural. The plural is also of two kinds: sound plural (masculine and feminine) and broken plural. In contrast to English, Arabic syntax has singular, dual, and plural for feminine and masculine nouns. Salimi's study also revealed that English has three genders: masculine, feminine, and neuter. Gender is only limited to personal pronouns, whereas Arabic has only two genders: masculine and feminine. Furthermore, English nouns are inflected for genitive case. Whereas, in Arabic, nouns are inflected for three events, namely, nominative, accusative, and possessive. These fonts are differentiated by changing the vowel ling of the final consonant.

Founded on the researcher's knowledge and experience in teaching English to Arab scholars, the following lessons can be rendered to illustrate Salimi's findings.

In Arabic, we suppose:

- *Mu'allim*(Singular masculine) / *Mu'allma* (singular feminine)
- *Mu'allimuun* (plural masculine) / *Mu'allimein* (dual masculine)
- *Mu'allimat* (plural feminine)
- *Mu'alimataan; Mu'allimatayin; (dual feminine; acting as: subject and aim.*

In English, we say: Teacher (feminine and masculine) / teachers (dual/plural for feminine and masculine).

Therefore, about Arab students learning English may not use English plural nouns correctly. Rather, they use numbers to indicate a duality or plurality. The following are examples. They may say, "The two child are crying." Others may misuse the noun after numbers because in Arabic a singular noun is used after numbers "three –ten'. Thus, the beginner Arab students

learning English may say, "He has eleven cousin." Or "There are 21 student in my class."

2(ii). Countable and Uncountable Nouns

There are certain words in English which are classified as uncountable nouns like (information, money, damage, housework, and equipment) but they can be counted in Arabic. So Arab learners of English tend to pluralize them and use plural verbs after them. The following are examples of students' versions:

- The informations I received were useful.
- As housewives do a lot of housework.
- I bought many equipments.

2(iii). Misuse of Prepositions

Essberger (2000) notes differences between Arabic and English prepositions:

- The number of prepositions in Arabic is limited: *min* (from), *ila* (to), *'an* (about), *'alla* (on,over), *ba/bi* (by, with), *la/li* (of, for), and *fi* (in, into).
- In Arabic, some adverbs can be used as prepositions, such as: *khalfa* (behind), *amam* (in front), *bayna* (between), and many others.
- In English, there are approximately 150 prepositions.

The problems in using English prepositions for Arab students learning English result from two factors. First, not every Arabic preposition has a definite equivalent in English and vice versa. Secondly, not every English or Arabic preposition has definite usage and meaning.

Arab students learning English sometimes make the following errors in using English prepositions (Hamadalla and Tushyeh, n.d.; Zughoul, 1973).

1. Unnecessary insertion: They use prepositions with words which do not need prepositions.
 - Incorrect : I will practice on making the exercises.
 - Correct : I will practice doing the exercises.
2. Omission of necessary prepositions: They omit these prepositions from words which need them.
 - Incorrect : I waited the bus two hours.
 - Correct : I waited for the bus two hours.
3. Wrong substitution: They do not use correct prepositions: The preposition "on" is used in places of "over", "above", "at", and "onto".

Arab learners of English tend to say "ashamed from, composed from, object on, blame on, where (of, of, to and for) should be used respectively.

- We were interested with the film. "*nahnu istamta'na bilfilm.*"

The misuse of the preposition “with” instead of “in” in the above example occurs because it is equivalent to the Arabic preposition "bi" – which indicates the meaning of “with”.

Table 1 below displays some errors in the use of prepositions that are made by Arab learners who are learning

English, with their equivalents in Arabic. (Hamadalla and Tushyeh, n.d.; Zughoul, 1973)

Table 1: Errors in the use of prepositions made by Arab ESL learners

Errors in English	Arabic equivalents
He jumped on the wall. (over)	<i>qafaza 'alla aljedar.</i>
We sat on the table. (at)	<i>nahnu jalasna 'alla atawela.</i>
I will come in 7 o'clock. (at)	<i>anna sawfa atti fi alsa'ati alsabe'a.</i>
I like to pick roses with many colors. (of)	<i>ohibbu ,,ann altaqeta wardan bi'edati alwan.</i>
He died from hunger. (of)	<i>huwa Matta minaljuu'.</i>
We have lived in Doha from 1975. (since)	<i>nahnu na'eesh fi aldoha min sanat 1975.</i>
One from my brothers is a doctor. (of)	<i>wahed min ikhwati tabeeb.</i>

2(iv). Misuse of Definite Article

Arabic has one definite article "the". It consists of two letters: "al". It is sequestered to the beginning of nouns and their adjectives. Nevertheless, Arabic has no indefinite articles. The definite article is redundantly used by Arab learners of English with nouns that need the definite article in Arabic but not in English. There are three types of errors in the use of articles by the Arabic-speaking scholars of English (Diab, 1996).

1. Deletion of the definite article

- Incorrect : Arms of soldiers are guns and daggers.
- Correct : The arms of soldiers are guns and daggers.

In the above sentence, the definite article "the" should be used before "arms", but has been dropped because it is not used in Arabic, as it is in the genitive case.

2. Deletion of the indefinite article “a”.

- Incorrect : My father works in bank.
- Correct : My father works in a bank

In the this sentence, the indefinite article "a" should be used before the noun "bank" in English; but it is dropped, possibly because in Arabic such article is non-actual.

3. Wrong Insertion: Arab students tend to use “the” before nouns which are not normally preceded by this definite article, such as the names of most diseases, names of days, names of some situations, and in many idiomatic expressions. The cause for

this is that in Arabic such nouns are usually introduced by the definite article. In English, abstract words referring to ideas, properties, or qualities are employed without the article 'the'. In Arabic, however, such abstract words are preceded by the definite article equivalent to 'the' in English. (Diab, 1996). The following are examples of INCORRECT sentences which have been formed by Arabic-speaking scholars of English.

- The happiness doesn't come from the money.
- People can work in the agriculture or in the industry.
- He went to the Doha.
- He is still in the bed.
- My father suffers from the cancer.
- He was filled with the sadness.
- He studies the music.
- He works in the agriculture.
- When the evil comes, people will die.

The *Correct* forms of all the above sentences should be without the use of the definite article “The”

2(v). Adjectives and Adverbs

Arab learners of English encounter many difficulties while distinguishing between adjectives and adverbs in Arabic and English. Arabic adjectives agree in gender and number with nouns, which might be the reason for these learners to make mistakes. (Marpaung, 2014; Al-Aqad, 2013).

- He is a man tall. (Arabic: *hua rajulun taweelun*)
- They are soldiers brave. (Arabic: *hum junuudun shuja'aan*).

- These are girls beautifuls (Arabic: *hunna fataiaatum jamilaatum*)

Some Arab learners of English might use adjectives plus nouns to express adverbs (Marpaung, 2014; Al-Aqad, 2013). This is attributed to the Arabic use of adverbs as they can be formed in two ways. For instance, the word “quickly” can be translated into Arabic in two ways: "Bisur'a" or ' bishaklen saree3).The following are some examples of such errors.

- Incorrect : The temperature rose a sharp rise.
- Correct : The temperature rose sharply.
- Incorrect : He drove with so fast speed.
- Correct : He drove so fast.
- Incorrect : The singer performed a wonderful performance.
- Correct : The singer performed wonderfully.
- Incorrect : Prices have increased a gradual increase.
- Correct : Prices have increased gradually.

In the above examples, the Arab students’ versions represented in the „incorrect” versions are related to the Arabic grammatical rule about unrestricted or absolute object.

2(vi). Errors in Using Some English Modal Verbs

1. Deletion of the Copula (verb to be) or substituting it with “verb to do”: As there is no “verb to be” in Arabic, Arab learners of English tend to delete them when forming their English sentences. Hence, we can find such sentences in their writings:

- Incorrect : Huda happy.
- Correct : Huda is happy.
- Incorrect : While my mother cooking, I preparing the table.
- Correct : While my mother was cooking, I was preparing the table.
- Incorrect : Does he your teacher?
- Correct : Is he your teacher?

All *Incorrect* versions above are students’ versions.

2. Omitting the third person singular morpheme -s (Muftah1 and Rafik-Galea, 2013). Here are few examples of students’ versions and their CORRECT forms:

- Incorrect : My mother work in a school.
- Correct: My mother works in a school.
- Incorrect : My friend speak English.
- Correct : My friend speaks English

3. Omitting the auxiliary “verb to do”. Here is an example.

- Incorrect : My father not drive a bus.
- Correct : My father does not drive a bus.

4. Replacing only the auxiliary form of “verb to do” with „verb to be”.

- Incorrect : **Is Bob wears** a suit today?
- Correct : Does Bob wear a suit?

2(vii). Word Order

Arab ESL learners make errors in word order when forming English sentences. The following are some examples which are traced in the literature review earlier in this article. Some of the errors the researcher of the current study noticed in her students’ writing.

1. Unlike the English sentence word order, the V-S-O in classical Arabic is the basic word order where the subject is preceded by the verb:

- Incorrect : Hoped the committee to solve the problem.
- Correct : The committee hoped to solve the problem.

However, in colloquial Arabic, the word order of the sentence is S-V-O

2. Arabic uses the secondary clause which acts as an object and starts with „that” where English uses the infinitive:

- Incoorrect : I want that you stay. (Following the Arabic structure).
- Correct : I want you to stay.

3. There are no auxiliary verbs in Arabic. So Arabic-speaking learners of English might not use “verb to do” to form a question. Here is a student’s version and its equivalent *Correct* form:

- Incorrect : Where Huda spend her summer vacation?
- Correct : Where does Huda spend her summer vacation?

4. In Arabic, personal pronouns are often incorporated in the verbs, i.e. certain morphemes are used to indicate what the pronoun is. This makes Arab students learning English use two subjects. Here is an example.

- Incorrect : Her father he lives in California.
- Correct : Her father lives in California.

4. In English, adjectives precede nouns, whereas they follow nouns in Arabic, as in the following example.

- Inorrect : classroom large. (Following the Arabic structure)
- Correct : a large classroom. (Proper English structure)

2(viii) Tenses

There are clear differences between Arabic and English, leading to several mistakes which are made by Arab learners of English. In Arabic, there are only two tenses: the perfect (only the past) and the imperfect (the non-past, simple present and simple future), whereas English has many tenses by conjoining these two tenses with aspects (perfective and progressive). (Ali, 2007; Aoun, Benmamoun, and Chueiri, 2010). Arab learners of English cannot produce progressive and perfect tenses so easily. They use simple present instead. So, we might find such errors in their writing:

- Incorrect : I eat my sandwich now.
- Correct : I am eating my sandwich now.

Another example is this.

- Incorrect : I didn't see you since last Christmas.
- Correct : I haven't seen you since last Christmas.

2(ix) Relative Clauses

Unlike English relative pronouns, Arabic relative nouns (Asmaa Mawsuula) vary according to the nouns they describe. There are relative nouns for masculine, feminine, singular, dual, and plural. They also vary according to their position in the sentence: subject, object, and predicate. Following is a list of these relative nouns.

Allathi (singular masculine), *Allathan* (masculine dual subject), *Alathein* (masculine plural object), *Allati* (feminine singular), *Allatein* (object dual feminine), *Allataan* (dual feminine subject), *Allawati* (plural feminine)

There are several errors which are made by Arabic-speaking learners of English when forming English relative clauses (Ali, 2007:7-8; Hamadalla and Tushyeh, 1998).

1. Insertion (or not omitting) of the connected pronoun because in Arabic this pronoun is not omitted.

- Incorrect: That's the teacher whom I met him.
- Correct : That's the teacher whom I met.

Arabic: *thalika huwa almu'alimalathi qabaltuhu*. The detached pronoun "hu" at the end of the word "qabaltuhu" is the resumptive pronoun that should be deleted when forming an English relative clause. The following are other examples of such errors.

- Incorrect: The girl who she came helped me in doing my homework.
- Correct: The girl who came helped me in doing my homework.
- Incorrect : The driver whom the police gave him a ticket was driving too fast.
- Correct : The driver whom the police gave a ticket was driving too fast.

- Incorrect : The man that I gave a gift to him is my cousin.
- Correct : The man that I gave a gift to is my cousin.
- Incorrect : I lost the key which I opened the door with it.
- Correct : I lost the key which I opened the door with.
- Incorrect : The lady whom her purse was stolen reported to the police.
- Correct : The lady whose purse was stolen reported to the police.

In all the above sentences, the underlined pronouns should be omitted in the CORRECT English versions.

2. Arabic-speaking learners of English make mistakes in subject-verb agreement in subordinate or secondary clauses:

- Incorrect: The teachers who is lecturing this morning is clever.
 - Correct : The teachers who are lecturing this morning are clever.
3. They omit "who" which means „allathi or allati“ because it can be omitted in some

Arabic sentences.

- Inorrect : Ahmad is a student in our class got the highest average. (English version as some Arabic-speaking learners of English may write it.)
- Correct : Ahmad, a student in our class, got the highest average. (The Arabic version of the sentence.)
- Correct : Ahmad, who is a student in our class, got the highest average.
- Incorrect : Saladin, was the Muslim leader, led the Battle of Hitten.
- Correct : Saladin, the Muslim leader, led the Battle of Hitten.
- Correct : Saladin was the Muslim leader who led the Battle of Hitten.

4. In Arabic, relative pronouns are used with nonhuman distinction; and the connected pronoun acting as the object is retained in a restrictive adverbial clause. Thus, Arabic-speaking learners of English might make the following error:

- Incorrect : Here is the student which you met her last week.
- Correct : Here is the student who you met last week.

In Arabic, the relative pronouns „allathi or allati“ are used with human and non-human nouns.

2(x). Lexical Errors

Abi Samara (2003) listed some examples of lexical errors made by Lebanese students in their writing. Due to literal translation from Arabic, students might use “stay on” instead of “continue” or “keep on”; they might use inappropriate equivalent. The following are some examples of lexical errors.

- Incorrect : He has a right health. (Arabic: *huwa bisehaten jayedaten.*)
- Correct : He is healthy.
- Incorrect : He has a strong disease. Arabic: *huwa yamtaleku maradhan shadeedan.*
- Correct : She has a severe illness.
- Incorrect : I am afraid from high sounds. (Arabic: „anna „akhafu minalaswaat al“aaliya.)
- Correct : I am afraid of high sounds.
- Incorrect : For me, to be counted as a good mother is important. (Arabic: *binnesbati li, minaal muhem „an o“utabara ummun.*)
- Correct : For me, it is important to be considered as a mother.

2(xi). Lexico-Semantic Usage

In English, some words have distinctive meanings which count for only one equivalent in Arabic, such as (special and private) . For that reason, Arabic -speaking learners of English are more likely to say:

- My brother went to a special hospital.
- This is a very private occasion.

Besides, in that location is the sentence „He cut the street“ which is practiced instead of „He crossed the street“.

III. PEDAGOGICAL IMPLICATIONS AND RECOMMENDATIONS

“To use two languages familiarly and without contaminating one by the other, is very difficult,” said Samuel Johnson in 1761.” (Cited in Cook, 2002; Abi Samara, 2003).

Making mistakes while reading any new accomplishment is something natural as it is part of using the best of talents and potentials to arrive at a proficiency layer of professionalism. This is exactly the case when learning languages. The teachers' wisdom can be practiced in such situations to guide their students in an attempt to make mistakes a source of learning, not a factor of frustration. Following are some recommendations for teachers on how to deal with their students' mistakes. More focus will be given to the situations of ESL in the Arab countries.

1. Returning selective attention: Terrell used the term “Explicit Grammar Instruction” and defined it as “the employment of instructional strategies to draw the students' attention to or focus on contour and/or structure.” (Terrell, 1991:53). Form-focused instruction or consciousness raising is a dependable solution for grammatical mistakes. “Focused attention may be a practical (though not theoretical) necessity for successful language learning” (Schmidt, 2001 as quoted in Robinson and Ellis, 2008: 389).

2. As most humans' brains are pattern-seekers, it is useful to supply students with rulers and patterns when explaining grammar. Use should precede “usage”.

3. Instructors are advised to apply the correct strategies as follows: student's self-discipline, peer correction and finally teacher's correction. Teachers should correct mistakes which are immediately connected to the target of the lesson.

4. Teachers need to determine that students are practicing English as a way of communication in their group work.

5. Most significantly, teachers of English to Arabic-speaking learners have to indicate respect and recognition to their students' native language. For instance, they can ask their pupils how they utilize a rule in Arabic.

6. Style and lexical differences should be conveyed to the students mind in order to avoid getting to such mistakes.

7. The teachers' attitudes towards errors should change. They need to know when and how to correct the students errors. They ought not to frustrate students by correcting every mistake.

Lastly, it is worth quoting a Von Humboldt's speech, “We cannot really teach language, we can only create conditions in which it will grow spontaneously in the psyche in its own way”.

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REFERENCES

- [1] Salimi, J. (2013). A Contrastive Study of English-Arabic Noun Morphology. *International Journal of English Linguistics*; 3 (3), ISSN 1923-869X E-ISSN 1923-8703
- [2] AbiSamra, N. (2003). An analysis of errors in Arabic speakers' English writings, American university Beirut. Retrieved from <http://abisamra03.tripod.com/nada/languageacq-erroranalysis.html>
- [3] Al-Aqaad, M. (2013). Syntactic analysis between adverbs in Arabic and English: X-bar Theory. *International Journal of Language and Linguistics*, 1 (3), 2013, pp. 70-74. doi: 10.11648/J.ijll.20130103.11 Retrieved from <http://article.sciencepublishinggroup.com/pdf/10.11648.j.ijll.20130103.11>.
- [4] Al-Badawi, K. (2012). An analysis of phonetic, morphological and syntactic errors in English: A case study of Saudi BA students at King Khalid University. *International Journal of Social Science and Humanity*, 2, (6), November 2012. Retrieved from: <http://www.ijssh.org/papers/165-A10037.pdf>
- [5] Al-Buainain, H. (2010). Researching types and causes of errors in Arabic speakers' writings. Qatar University. Retrieved from ling.auf.net/lingbuzz/001054/current
- [6] Ellis, R. 1997, *Second Language Acquisition*, Oxford University Press, Oxford.
- [7] Ali, N. (2007). Some linguistic problems facing Arab learners of English. Retrieved from <http://www.iasj.net/iasj?func=fulltext&Id=33586>
- [8] Lado, R. (1957). *Linguistics across Cultures: Applied Linguistics for language teachers*. Ann Arbor, Michigan: University of Michigan
- [9] Al-Khawaldah, M. and Al-Oliemat, A. (n.d). *Linguistic Transfer: Example from Arabic users of English*. Mutah University, Jordan. Retrieved from <https://arabou.edu.kw/files/lebanon/Linguistic%20Transfer%20Example%20from.pdf>
- [10] Al-Khresheh, M. (2011). An investigation of interlingual interference in the use of "and" as a syntactic coordinating structure by Jordanian EFL learners. *European Journal of Social Sciences*, 18, (3), (Retrieved from <http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&v>

- ed=0CB0Q
FjAA&url=http%3A%2F%2Fwww.researchgate.net%2Fpublication%2F209784360.
- [11] Al-Zuoud, K. and Kabilan, M. (2013). Investigating Jordanian EFL students' spelling errors at tertiary level. *International Journal of Linguistics*, 5, (3), 2013, ISSN 1948-5425.
- [12] Aoun, E. ; Benmamoun, E., & Choueiri, L. (2010). *The syntax of Arabic*. Cambridge: Cambridge University Press. Online books, Retrieved from <http://ebooks.cambridge.org/ebook.jsf?bid=CBO9780511691775>
- [13] Bhela, B. (1999). Native language Interference in learning a second language: exploratory case studies of native language interference with target language usage. *International Education Journal* 1, (1), 1999. Retrieved from: <http://ehlt.flinders.edu.au/education/iej/articles/v1n1/bhela/bhela.pdf>
- [14] Celce - Murcia, M., and Larsen Freeman, D. (1983). *The Grammar Book*. Rowley, MA: Newbury House Publishers.
- [15] Ashworth, M. (1992). *Beyond Methodology*. Malta: Cambridge University Press.
- [16] *The Free Dictionary by Farlex (second language)* Retrieved from <http://www.thefreedictionary.com/second+language>
- [17] Diab, N. (1996). The transfer of Arabic in the English writings of Lebanese students. *The ESP, Sao Paulo*, 18, (1), pp.71-83. Retrieved from <http://lael.pucsp.br/especialist/181diab.ps.pdf>
- [18] Ellis, R. (1997, 1998), *Second Language Acquisition*, Oxford University Press, Oxford.
- [19] Essberger, J. (2000). English prepositions List. An English Club.com eBook. Retrieved from www.englishclub.com.
- [20] Essberger, J. (2006). English Prepositions Listed. Slideshow. Retrieved from <http://www.slideshare.net/crisfreitas/english-prepositions-listed>.
- [21] Ghawi, M. (1993). Pragmatic Transfer in Arabic Learners of English. *E1 Two Talk*, 1 (1), pp. 39- 52.
- [22] Grami, G. and Alzughabi, M. (2012). L1 Transfer among Arab ESL Learners: Theoretical Framework and Practical Implications for ESL Teaching. *Theory and Practice in Language Studies*. 2 (8), pp. 1552-1560
- [23] Terrell, T. (1991). 'The role of grammar instruction in a communicative approach,' *The Modern Language Journal*, vol. 75, pp.52-63.
- [24] Hamadalla, R. and Tushyeh, H. (1998). A contrastive analysis of English and Arabic relativization. *Papers and studies in contrastive analysis*. 34, pp 141-152.
- [25] Hasan, A. and Abdullah, I. (n.d.). Comparative study of English and Arabic use of prepositions amongst Arab native. Retrieved from: http://www.academia.edu/898700/A_Comparative_Study_of_English_and_Arabic_Use_of_Prepositions_Amongst_Arab_Native_Speakers.
- [26] Swan, M. (1997). The influence of the mother-tongue on second language vocabulary acquisition and use. In: Schmitt, N. & McCarthy, M. (eds.) *Vocabulary: Description, Acquisition and Pedagogy*. Cambridge University Press.
- [27] Hashem, N. (1996). English syntactic errors by Arabic speaking learners. Adverbs, conjunction and relative clauses ED. 423660. Retrieved from <http://files.eric.ed.gov/fulltext/ED423660.pdf>
- [28] Hashim, N. (1993). "The acquisition of temporal conjunctions by Saudi Arabian learners of English." *Int. J. Appl. Linguistics* 3 (1): pp.101-2A
- [29] Zughoul, M. (1973). *Teaching English Prepositions to Arab Students*. Unpublished MA Thesis, American University of Beirut.
- [30] Ibrahim, H. and Al-Washali, P. (2013). A comparative study on relative clause structure in English. *Language in India*. Retrieved from www.languageinindia.com ISSN 1930-2940 Vol. 13:3 March 2013 ISSN 1930-2940.
- [31] James, C. (1980). *Contrastive Analysis*. Essex: Long man.
- [32] Slocum, J. (2000). *Indo-European Languages: Evolution and Locale Maps*. Linguistic Research Center. The University of Texas at Austin. Retrieved from <http://www.utexas.edu/cola/centers/lrc/general/IE.html>
- [33] Stern, H. (1983). *Fundamental Concepts of Language Teaching*. Oxford: Oxford University Press
- [34] Swan, M. and Smith, B. (1987) *Learner English: A teacher's guide to interference and other problems*. (1987) eds. Cambridge University Press.
- [35] Schmidt, R. (2001). 'Attention' in P. Robinson (ed.): *Cognition and Second Language Instruction*. Cambridge: Cambridge University Press, pp. 3-32. Schumann, J. 1987.

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Best Linear Unbiased Estimation of Location and Scale Parameters in Generalized Exponential Distribution under Type-II Censoring

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Abstract- For standard generalized exponential distribution (GED) Raqab and Ahsanullah [1] have derived the exact forms of means, variances and covariances of order statistics. Using these expressions they have obtained the necessary coefficients for computing the BLUEs of location and scale parameters of GE distribution for known shape parameter $\alpha = 0.5(0.5)5.0$ for complete samples of size up to 10. In this paper, using the formulae given by Raqab and Ahsanullah [1], we have developed R-program for computing the means of order statistics for samples of size up to 30; and the variances and covariances of order statistics for samples of size up to 20 for standard GE distribution for $\alpha = 1.5(0.5)5.0$. Using these means, variances and covariances, we have extended the computation of the BLUEs of the location and scale parameters of GED for both complete sample and Type-II censored samples of size up to $n=20$. We have tabulated the BLUE coefficients for all complete samples of size $n=11(1)20$ for $\alpha=1.5(0.5)2.0(1.0)5.0$. Further, we have developed R-code for computing the coefficients of the BLUEs of location and scale parameters based on any type II censored sample (including a complete sample) of size up to $n=20$ and for any choice of shape parameter α in the interval $[1.5, 6.0]$. Finally, we demonstrate the computation of the BLUEs with two data sets.

Index Terms- Generalized exponential distribution; Means, variances and covariances of order statistics; BLUEs of location and scale parameters.

I. INTRODUCTION

Gupta and Kundu [2] introduced the three-parameter generalized exponential (GE) distribution with the probability density function (pdf)

$$f(x; \alpha, \mu, \sigma) = \frac{\alpha}{\sigma} e^{-(x-\mu)/\sigma} \left(1 - e^{-(x-\mu)/\sigma}\right)^{\alpha-1}; \quad 0 \leq \mu < x < \infty, \alpha > 0 \text{ and } \sigma > 0 \quad (1.1)$$

and cumulative distribution function (cdf)

$$F(x; \alpha, \mu, \sigma) = \left(1 - e^{-(x-\mu)/\sigma}\right)^\alpha \quad (1.2)$$

Here μ , σ and α are location, scale and shape parameters respectively. Some authors, later, in many articles replaced the scale parameter σ in GE distribution with its reciprocal $\lambda = 1/\sigma$. However, in this paper, we consider the above form of three-parameter GE distribution (which is originally introduced by Gupta and Kundu [2]) because one can compute the BLUEs only for location and scale parameters of a distribution using Lloyd [3] method. We denote the three parameter GE distribution as $GE(\alpha, \mu, \sigma)$. Using a real data set, Gupta and Kundu [2] have shown that the three-parameter GE model (1.1) fits better than the three-parameter gamma or three-parameter Weibull in some practical situations.

Since, μ and σ are location and scale parameters, the distribution of $Z=(X-\mu)/\sigma$ is the standard GE distribution, whose pdf and cdf are given as

$$f(z; \alpha) = \alpha e^{-z} \left(1 - e^{-z}\right)^{\alpha-1} \text{ and } F(z; \alpha) = \left(1 - e^{-z}\right)^\alpha, \quad z > 0, \alpha > 0 \quad (1.3)$$

It is observed that the hazard function is nondecreasing if $\alpha > 1$, it is decreasing if $\alpha < 1$ and for $\alpha = 1$, it is constant. The GE has a unimodal and right-skewed density function. As the shape parameter increases the skewness gradually decreases. If the data come from a right-tailed distribution, then the GE can be used quite effectively for analyzing them.

Gupta and Kundu [4] considered different estimation procedures and compared their performances through numerical situations. Raqab and Ahsanullah[1] derived exact expressions for the single and product moments of order statistics from the standard GE distribution and hence obtained the coefficients of the best linear unbiased estimates (BLUEs) of the location and scale parameters of the GE model (1.1) for complete samples of size up to 10 for shape parameter $\alpha = 0.5(0.5)5.0$. Raqab [5] derived the exact expressions for means, variances and covariances of record statistics from the GE distribution and computed the coefficients of BLUEs of location and scale parameters based on record statistics. Raqab [6] established several recurrence relations satisfied by the single and the product moments of order statistics from the standard GE distribution in terms of polygamma and hypergeometric functions and heexplained the recursive procedure of computing the single and the product moments of all order statistics for all sample sizes. Khan and Kumar [7] studied the explicit expressions and some recurrences relations for single and product moments of lower generalized order statistics from GE distribution.

The main aim of this paper is to extend the work of Raqab and Ahsanullah[1] by providing the coefficients of the BLUEs of location and scale parameters of the GE distribution (1.1) for both complete and type-II censored samples of size up to 20. In Section 2, we have developed R-code for computing the means, variances and covariances of order statistics of standard GE distribution by evaluating the formulae given by Raqab and Ahsanullah[1]. Using these means, variances and covariances. In Section 3, we have tabulated the coefficients of the BLUEs of location and scale parameters for complete samples of size up to 20 for $\alpha = 1.5(0.5)2.0(1.0)5.0$. We have developed R-code for computing the coefficients of the BLUEs of location and scale parameters based on any Type-II censored sample (including a complete sample) of size up to $n=20$ and for any choice of shape parameter α in the interval $[1.5, 6.0]$. Finally, in section 4, we demonstrate the computation of the BLUEs with an illustration.

II. MEANS, VARIANCES AND COVARIANCES OF STANDARD ORDER STATISTICS

In order to compute the coefficients of the BLUEs for location and scale parameters of a population using Lloyd [3] method, we require the means, variances and covariances of order statistics from the corresponding standard population. Therefore, in this section, we have computed the means, variances and covariances of order statistics for standard GE population (1.3) by evaluating the following exact and explicit expressions (derived by [1]) of first and second moments of i^{th} standard order statistic $Z_{i:n}$ ($i = 1, 2, \dots, n$) and the product moment of i^{th} and j^{th} ($1 \leq i < j \leq n$) standard order statistics $Z_{i:n}$ and $Z_{j:n}$.

The explicit expressions of the first and second moments of $Z_{i:n}$ ($i = 1, 2, \dots, n$) are

$$a_{i:n} = E(Z_{i:n}) = [B(i, n-i+1)]^{-1} \sum_{l=0}^{n-i} \frac{(-1)^l \binom{n-i}{l}}{i+1} [\psi((i+l)\alpha + 1) + \gamma] \quad (2.1)$$

$$a_{i:n}^{(2)} = E(Z_{i:n}^2) = [B(i, n-i+1)]^{-1} \sum_{l=0}^{n-i} \frac{(-1)^l \binom{n-i}{l}}{i+1} \left\{ [\psi((i+l)\alpha + 1) + \gamma]^2 - \psi'((i+l)\alpha + 1) + \frac{\pi^2}{6} \right\} \quad (2.2)$$

where $B(\dots)$ is a beta function and $\gamma = -\psi(1)$. Here $\psi(\square)$ and $\psi'(\square)$ are the digamma and tri-gamma functions, given by

$$\psi(u) = \frac{d}{du} \Gamma(u), \quad \psi'(u) = \frac{d}{du} \psi(u) \text{ where } \Gamma(u) = \int_0^{\infty} x^{u-1} e^{-x} dx. \quad (2.3)$$

Similarly, the product moment of $Z_{i:n}$ and $Z_{j:n}$ is given by

$$a_{i,j:n} = E(Z_{i:n} Z_{j:n}) \\ = C_{i,j:n} \alpha^2 \sum_{k=1}^{\infty} \sum_{l=0}^{n-j} \sum_{m=0}^{j-i-1} (-1)^{l+m} \binom{j-i-1}{m} \binom{n-j}{l} \frac{[\psi((j+l)\alpha + k + 1) + \gamma]}{k[(j+l)\alpha + k][(i+m)\alpha + k]} \quad (2.4)$$

where $C_{i,j:n} = \frac{n!}{(i-1)!(j-i-1)!(n-j)!}$

Using Eq. (2.1), we can evaluate the means of order statistics of standard GE distribution. The variance ($b_{i,i:n}$) of order statistic $Z_{i:n}$ ($i = 1, 2, \dots, n$) can be evaluated from the relation $b_{i,i:n} = a_{i:n}^{(2)} - a_{i:n}^2$ using Eqs. (2.1) and (2.2). The covariance ($b_{i,j:n}$) between order statistics $Z_{i:n}$ and $Z_{j:n}$ can be evaluated from the relation $b_{i,j:n} = a_{i,j:n} - a_{i:n} a_{j:n}$ using Eqs. (2.1) and (2.4). For evaluation of these means, variances and covariances of order statistics, we have developed the necessary R-code. Using this R-program, one can compute the means for all samples of size up to 30; variances and covariances for all samples of size up to 20 for shape parameter $\alpha = 1.5(0.5)5.0$. This R-code is presented in the appendix as *R-program 1* along with sample output of the program; means of order statistics for $n=25$ & 30 ; and variances and covariances of order statistics for $n=15$ & 20 .

III. BLUE's OF LOCATION AND SCALE PARAMETERS BASED ON TYPE II CENSORED SAMPLES

In this section, we discuss best linear unbiased estimation of location and scale parameter in three-parameter generalized exponential distribution. We construct the BLUEs of location and scale parameters, with known shape parameter for Type II censored samples.

Suppose $X_{r+1:n} \leq X_{r+2:n} \leq \dots \leq X_{n-s:n}$ is a Type II doubly censored sample (r left most observations and s right most observations are censored from a planned sample of size n) from the GE distribution (1.1). Since, the doubly censored sample includes left censored sample ($s=0$), right censored sample ($r=0$) and complete sample ($r=s=0$), the following development includes all these cases.

Let $Z_{i:n} = (X_{i:n} - \mu) / \sigma$, ($i = r+1, \dots, n-s$) so that $Z_{r+1:n} \leq Z_{r+2:n} \leq \dots \leq Z_{n-s:n}$ is a Type II doubly censored sample from the standard GE distribution (1.3). Now, if the shape parameter α is known then the BLUEs of μ and σ , denoted by μ^* and σ^* , are given by (pl. see Lloyd [3])

$$\mu^* = \frac{\mathbf{a}'\mathbf{B}^{-1}\mathbf{a}\mathbf{1}'\mathbf{B}^{-1} - \mathbf{a}'\mathbf{B}^{-1}\mathbf{1}\mathbf{a}'\mathbf{B}^{-1}}{\Delta} \mathbf{X} \quad \text{and} \quad \sigma^* = \frac{\mathbf{1}'\mathbf{B}^{-1}\mathbf{1}\mathbf{a}'\mathbf{B}^{-1} - \mathbf{1}'\mathbf{B}^{-1}\mathbf{a}\mathbf{1}'\mathbf{B}^{-1}}{\Delta} \mathbf{X} \quad (3.1)$$

Where $\Delta = (\mathbf{a}'\mathbf{B}^{-1}\mathbf{a})(\mathbf{1}'\mathbf{B}^{-1}\mathbf{1}) - (\mathbf{a}'\mathbf{B}^{-1}\mathbf{1})^2$

Here $\mathbf{a} = (a_{r+1:n}, \dots, a_{n-s:n})'$ and $\mathbf{B} = ((b_{ij:n}))$, $r+1 \leq i, j \leq n-s$ are respectively the mean vector and variance-covariance matrix of the order statistics $Z_{r+1:n} \leq Z_{r+2:n} \leq \dots \leq Z_{n-s:n}$ from standard GE distribution and $\mathbf{1}$ is a column vector of 1's of the same dimension of \mathbf{a} .

The variances and covariance of μ^* and σ^* are given by

$$\text{var}(\mu^*) = \sigma^2 \left\{ \frac{\mathbf{a}'\mathbf{B}^{-1}\mathbf{a}}{\Delta} \right\}, \quad \text{var}(\sigma^*) = \sigma^2 \left\{ \frac{\mathbf{1}'\mathbf{B}^{-1}\mathbf{1}}{\Delta} \right\} \text{ and } \text{Cov}(\mu^*, \sigma^*) = -\sigma^2 \left\{ \frac{\mathbf{a}'\mathbf{B}^{-1}\mathbf{1}}{\Delta} \right\} \quad (3.2)$$

Using the above formulae, we extend the computation of the coefficients of the BLUE's μ^* and σ^* for complete samples up to size $n=11(1)20$ and are presented in **Table 1** along with the variances and covariance for shape parameter $\alpha = 1.5(0.5)2.0(1.0)5.0$.

We have developed R-program for computation of the coefficients of the BLUEs μ^* and σ^* along with the variances and covariance of the estimators for any Type-II censored sample including complete samples up to size $n=20$; with any choice of $0 \leq r \leq n-2$ and $0 \leq s \leq n-2$ such that $r+s \leq n-2$; and for any choice of the shape parameter α in the interval $[1.5, 6.0]$. This R-code is given in the appendix as *R-program 2*.

IV. ILLUSTRATIONS

In this section, we demonstrate the computation the BLUE's with two data sets. The first data set is the following ordered sample of size $n=8$ from $GE(\alpha, \mu, \sigma)$ with $\alpha=2$, which is simulated by Raqab and Ahsanullah[1].

8.5347 9.4276 9.4673 9.7726 9.7854 10.1109 11.5356 15.1027

For the above complete sample, Raqab and Ahsanullah[1] computed the BLUE's and are given below along with the variances and covariance of the estimators.

$$\mu^* = 7.93029 \text{ and } \sigma^* = 1.67994,$$

$$\text{Var}(\mu^*) = 0.078448\sigma^2, \text{Var}(\sigma^*) = 0.108276\sigma^2, \text{ and } \text{Cov}(\mu^*, \sigma^*) = -0.055374\sigma^2.$$

We consider the above sample with the last observation (15.1027) censored and based on this right censored sample ($r=0$ & $s=1$), we compute the BLUE's along with the standard errors of the estimates. The necessary coefficients of the BLUE's are computed using *R-program 2* (given in the appendix) with the input of $\alpha=2$, $n=8$, $r=0$ & $s=1$; the output of the program is given below.

ENTER SHAPE PARAMETER OF STANDARD GE DISTRIBUTION (between 1.5 and 6.0)1: 2

2:

Read 1 item

ENTER SAMPLE SIZE (n between 2 and 20)1: 8

2:

Read 1 item

ENTER No. observations LEFT censored (r between 0 and n-2)1: 0

2:

Read 1 item

ENTER No. observations RIGHT censored (s between 0 and n-2)1: 1

2:

Read 1 item

Coefficients of the BLUE of Location parameter:

Coefficients of the BLUE of Scale parameter:
 -0.7885 0.0397 0.0969 0.1210 0.1313 0.1373 0.2623

Variances and covariance of the BLUEs:
 0.0822 0.1235 -0.0629

CHECKS ON BLUE COEFFICIENTS:
 SUM OF the BLUE COEFFICIENTS OF LOCATION= 1.000000
 SUM OF the BLUE COEFFICIENTS OF SCALE= 0.000000

Using the abovecomputed coefficients of the BLUE's, their variances and covariance; we compute the BLUE's μ^* and σ^* along with the standard errors of the estimates based on the given right censored sample (last observation 15.1027 is censored) and are given below.

$$\mu^*=8.0480, \sigma^*=1.4435, S.E.(\mu^*)=\sqrt{0.0822}\sigma^*=0.4139 \text{ and } S.E.(\sigma^*)=\sqrt{0.1235}\sigma^*=0.5073$$

We also obtain the BLUE of the population mean $T=E(Y)=\mu+(\Psi(3)+\gamma)\sigma$ and standard error of the estimate as

$$T^*=\mu^*+(\Psi(3)+\gamma)\sigma^*=10.2132, S.E.(T^*)=0.5976.$$

Further, we compute the BLUE's of μ, σ and T based on the given sample with various choices of r and s and are presented below along with the standard errors of the estimates.

r	s	$\mu^*(S.E.(\mu^*))$	$\sigma^*(S.E.(\sigma^*))$	$T^*(S.E.(T^*))$
0	2	8.1424(0.3689)	1.2479(0.4765)	10.0143(0.5502)
1	0	8.5199(0.5175)	1.3192(0.4872)	10.4987(0.5208)
1	1	8.7959(0.3846)	0.9398(0.3784)	10.2056(0.3889)
1	2	9.0673(0.2413)	0.5576(0.2502)	9.9037(0.2467)

The second data set considered by us is the following type II right censored sample ($r=0$ & $s=5$) of size $n=20$ from $GE(\alpha, \mu, \sigma)$ with $\alpha=3, \mu=0$ and $\sigma=1$, which is simulated by Raqab and Madi [8].

0.65306, 0.67631, 0.68341, 1.05645, 1.46194, 1.71555, 1.73903, 1.78940, 1.79847, 1.82522, 1.95587, 2.16530, 2.35033, 2.38706, 2.39005.

In this example also for computing the coefficients of the BLUE's, we run *R-program 2* with the input of $\alpha=3, n=20, r=0$ & $s=5$ and the output is given below.

```
ENTER SHAPE PARAMETER OF STANDARD GE DISTRIBUTION (between 1.5 and 6.0)1: 3
2:
Read 1 item
ENTER SAMPLE SIZE (n between 2 and 20)1: 20
2:
Read 1 item
ENTER No. observations LEFT censored (r between 0 and n-2)1: 0
2:
```

Read 1 item

ENTER No. observations RIGHT censored (s between 0 and n-2)1: 5

2:

Read 1 item

Coefficients of the BLUE of Location parameter:

0.8997 0.1804 0.1309 0.0244 0.0821 -0.0180 0.0287 -0.0102 -0.0176 0.0014 -0.0444 0.0005
-0.0485 -0.0145 -0.1948

Coefficients of the BLUE of Scale parameter:

-0.5707 -0.0751 -0.0646 0.0506 -0.0495 0.0791 -0.0013 0.0537 0.0447 0.0303 0.0755 0.0186
0.0789 0.0322 0.2976

Variances and covariance of the BLUEs:

0.0468 0.0448 -0.0318

CHECKS ON BLUE COEFFICIENTS:

SUM OF the BLUE COEFFICIENTS OF LOCATION= 1.000000

SUM OF the BLUE COEFFICIENTS OF SCALE= 0.000000

Using the above coefficients of the BLUE's, we compute the BLUE's μ^* and σ^* based on the given type II right censored sample and are given below along with the standard errors of the estimates.

$$\mu^*=0.2163 \text{ and } \sigma^*=1.0402, \text{ S.E.}(\mu^*)=0.2250 \text{ and S.E.}(\sigma^*)=0.2202.$$

APPENDIX

R-program 1: R-code for computing means, variances and covariances of ordered statistics of standard GED

```
#####  
# THIS R-CODE COMPUTES MEANS OF ORDER STATISTICS OF STANDARD GENERALIZED EXPONENTIAL DISTRIBUTION @  
# FOR DIFFERENT CHOICES OF SHAPE PARAMETER alpha FOR ALL SAMPLES OF SIZE UP TO 30 @  
#####  
sink("I:/banu/GEMDS");  
alphav=c(1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0)  
cat("\n MEANS OF SINGLE ORDER STATISTICS FOR STANDARD GENERALISED EXPONENTIAL DISTRIBUTION");  
cat("\n FOR DIFFERENT VALUES OF SHAPE PARAMETER (alpha) FOR SAMPLE SIZE n=1(1)30.");  
cat("\n\n ni alpha=");  
for (alpha in alphav) cat(" ", format(alpha, nsmall=1), " ");  
cat("\n\n");  
for (n in 1:30){  
for (r in 1:n){  
cat(format(n, width=4));  
cat(format(r, width=3), "\t");  
for (alpha in alphav){  
cat(format(round(GEMMI(n, r, alpha), digits=4), nsmall=4), "\t");}  
cat("\n");}  
cat("\n");}  
sink();  
#####  
# THIS R-CODE COMPUTES VARIANCES AND COVARIANCES OF ORDER STATISTICS OF STANDARD GENERALIZED EXPONENTIAL @  
# DISTRIBUTION FOR DIFFERENT CHOICES OF SHAPE PARAMETER alpha FOR ALL SAMPLES OF SIZE UP TO 20 @  
#####  
sink("I:/banu/GEVC");  
alphav=c(1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0);  
cat("\n VARIANCES AND COVARIANCES OF ORDER STATISTICS FOR STANDARD GENERALISED EXPONENTIAL DISTRIBUTION");  
cat("\n FOR DIFFERENT VALUES OF SHAPE PARAMETER (alpha) FOR SAMPLE SIZE n=2(1)20.");  
cat("\n\n ni j alpha=");  
for (alpha in alphav) cat(" ", format(alpha, nsmall=1), " ");  
cat("\n\n");  
for (n in 2:20)  
for (r in 1:n)  
for (s in r:n){cat(format(n, width=4));  
cat(format(r, width=5));  
cat(format(s, width=4), " ");  
for (alpha in alphav){  
if (r==s){cat(format(round(GEMM2(n, r, alpha) - GEMMI(n, r, alpha)**2, digits=6), nsmall=6), " ");}  
else { cat(format(round(GEPM(n, r, s, alpha) - GEMMI(n, r, alpha)*GEMMI(n, s, alpha), digits=6), nsmall=6), " ");}  
}
```

```

    }
    cat("\n");}
    sink();
    #####
    # THIS R-FUNCTION COMPUTES MEAN OF R-th ORDER STATISTICS OF STANDARD GENERALIZED @
    # EXPONENTIAL DISTRIBUTION @
    #####
    GEMOM1=function(n, r, al pha){
    GEMOM1=0;
    for (i in 0:(n-r)) {
    t=di gamma((r+i)*al pha+1)+0. 577215;
    GEMOM1=GEMOM1+(- 1)**i*comb(n-r, i)/(r+i)*t;
    }
    GEMOM1=GEMOM1/beta(r, n-r+1);
    return(GEMOM1);
    }
    #####
    # THIS R-FUNCTION COMPUTES SECOND ORDER MOMENT OF R-th ORDER STATISTIC OF STANDARD @
    # GENERALIZED EXPONENTIAL DISTRIBUTION @
    #####
    GEMOM2=function(n, r, al pha){
    GEMOM2=0;
    for (i in 0:(n-r)) {
    t=(di gamma((r+i)*al pha+1)+0. 577215)**2- tri gamma((r+i)*al pha+1)+pi**2/6;
    GEMOM2=GEMOM2+(- 1)**i*comb(n-r, i)/(r+i)*t;
    }
    GEMOM2=GEMOM2/beta(r, n-r+1);
    return(GEMOM2);
    }

    #####
    # THIS R-FUNCTION COMPUTES PRODUCT MOMENTS BETWEEN R-th AND S-th ORDER STATISTICS OF STANDARD @
    # GENERALIZED EXPONENTIAL DISTRIBUTION @
    #####
    GEPM=function(n, r, s, al pha){
    GEPM=0;
    GEPM1=0;
    crs=(factorial(n)/factorial(r-1)/factorial(s-r-1)/factorial(n-s));
    for (i in 0:(n-s)) {
    for (j in 0:(s-r-1)){
    GEPM1=0;
    for (k in 1:200) GEPM1=GEPM1+(di gamma((s+i)*al pha+k+1)+0. 5772157)/(k*((s+i)*al pha+k)*((r+j)*al pha+k));
    GEPM=GEPM+((- 1)**(i+j))*comb(s-r-1, j)*comb(n-s, i)*GEPM1;
    }
    }
    GEPM=GEPM*(al pha**2)*crs;
    return(GEPM);
    }
    #####
    # THIS FUNCTION COMPUTES COMBINATORIAL(n, r) @
    #####
    comb=function(n, r){
    comb=1;
    if (r==0) return(1);
    for (i in 1:r) comb=comb*(n-i+1)/i;
    return(comb);
    }
    
```

Sample output of R-program 1:

MEANS OF SINGLE ORDER STATISTICS FOR STANDARD GENERALISED EXPONENTIAL DISTRIBUTION FOR DIFFERENT VALUES OF SHAPE PARAMETER (alpha) FOR SAMPLE SIZE n=25 and 30.

nialpha= 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

25 1	0.1121	0.1981	0.2867	0.3731	0.4555	0.5335	0.6069	0.6760
25 2	0.1937	0.3117	0.4249	0.5303	0.6277	0.7177	0.8010	0.8784
25 3	0.2669	0.4061	0.5344	0.6510	0.7569	0.8536	0.9423	1.0242
25 4	0.3368	0.4921	0.6315	0.7561	0.8681	0.9696	1.0621	1.1471
25 5	0.4054	0.5739	0.7222	0.8532	0.9699	1.0751	1.1705	1.2579
25 6	0.4739	0.6537	0.8094	0.9457	1.0664	1.1745	1.2724	1.3617
25 7	0.5432	0.7329	0.8951	1.0359	1.1599	1.2706	1.3705	1.4615
25 8	0.6140	0.8125	0.9804	1.1251	1.2521	1.3651	1.4667	1.5591
25 9	0.6868	0.8933	1.0663	1.2147	1.3443	1.4592	1.5624	1.6561
25 10	0.7624	0.9762	1.1539	1.3054	1.4373	1.5541	1.6587	1.7535
25 11	0.8413	1.0618	1.2438	1.3983	1.5323	1.6507	1.7566	1.8524
25 12	0.9242	1.1511	1.3369	1.4941	1.6301	1.7500	1.8571	1.9539

25 13	1.0120	1.2447	1.4343	1.5940	1.7318	1.8531	1.9612	2.0589
25 14	1.1057	1.3439	1.5369	1.6989	1.8385	1.9610	2.0702	2.1687
25 15	1.2064	1.4499	1.6461	1.8103	1.9515	2.0752	2.1853	2.2845
25 16	1.3158	1.5642	1.7635	1.9298	2.0724	2.1973	2.3083	2.4082
25 17	1.4359	1.6890	1.8912	2.0594	2.2035	2.3294	2.4412	2.5419
25 18	1.5695	1.8271	2.0320	2.2021	2.3475	2.4745	2.5871	2.6883
25 19	1.7207	1.9826	2.1901	2.3620	2.5086	2.6365	2.7499	2.8518
25 20	1.8953	2.1613	2.3714	2.5449	2.6928	2.8216	2.9357	3.0381
25 21	2.1030	2.3730	2.5854	2.7606	2.9096	3.0393	3.1541	3.2571
25 22	2.3605	2.6343	2.8490	3.0257	3.1759	3.3064	3.4218	3.5253
25 23	2.7010	2.9785	3.1954	3.3736	3.5248	3.6561	3.7722	3.8762
25 24	3.2080	3.4890	3.7081	3.8877	4.0399	4.1720	4.2887	4.3931
25 25	4.2148	4.4992	4.7204	4.9014	5.0546	5.1874	5.3046	5.4095

30 1	0.0987	0.1791	0.2634	0.3465	0.4263	0.5021	0.5737	0.6414
30 2	0.1697	0.2804	0.3883	0.4898	0.5842	0.6718	0.7531	0.8289
30 3	0.2328	0.3636	0.4860	0.5983	0.7011	0.7952	0.8820	0.9621
30 4	0.2924	0.4386	0.5717	0.6918	0.8004	0.8993	0.9897	1.0731
30 5	0.3502	0.5089	0.6508	0.7770	0.8906	0.9929	1.0862	1.1714
30 6	0.4076	0.5767	0.7258	0.8577	0.9743	1.0791	1.1751	1.2644
30 7	0.4644	0.6445	0.7989	0.9350	1.0554	1.1632	1.2615	1.3487
30 8	0.5238	0.7094	0.8706	1.0113	1.1349	1.2449	1.3432	1.4366
30 9	0.5783	0.7763	0.9413	1.0830	1.2099	1.3215	1.4235	1.5132
30 10	0.6380	0.8417	1.0124	1.1604	1.2867	1.3962	1.5037	1.5948
30 11	0.7034	0.9098	1.0828	1.2318	1.3641	1.4799	1.5827	1.6748
30 12	0.7629	0.9787	1.1588	1.3111	1.4416	1.5581	1.6640	1.7598
30 13	0.8349	1.0526	1.2334	1.3871	1.5221	1.6399	1.7458	1.8412
30 14	0.8983	1.1253	1.3107	1.4676	1.6026	1.7218	1.8302	1.9265
30 15	0.9729	1.2027	1.3906	1.5495	1.6862	1.8077	1.9148	2.0119
30 16	1.0472	1.2829	1.4742	1.6347	1.7733	1.8950	2.0041	2.1023
30 17	1.1273	1.3668	1.5609	1.7236	1.8636	1.9866	2.0960	2.1946
30 18	1.2123	1.4565	1.6532	1.8176	1.9589	2.0827	2.1931	2.2924
30 19	1.3035	1.5517	1.7509	1.9171	2.0597	2.1845	2.2955	2.3954
30 20	1.4020	1.6542	1.8558	2.0236	2.1674	2.2931	2.4048	2.5053
30 21	1.5093	1.7653	1.9692	2.1386	2.2835	2.4101	2.5225	2.6235
30 22	1.6275	1.8871	2.0933	2.2642	2.4102	2.5376	2.6506	2.7521
30 23	1.7593	2.0225	2.2308	2.4032	2.5502	2.6784	2.7920	2.8941
30 24	1.9088	2.1754	2.3858	2.5596	2.7076	2.8366	2.9508	3.0533
30 25	2.0819	2.3518	2.5642	2.7393	2.8883	3.0180	3.1328	3.2357
30 26	2.2882	2.5612	2.7756	2.9520	3.1019	3.2323	3.3476	3.4510
30 27	2.5443	2.8204	3.0366	3.2143	3.3652	3.4962	3.6120	3.7159
30 28	2.8835	3.1627	3.3807	3.5596	3.7113	3.8430	3.9594	4.0636
30 29	3.3893	3.6714	3.8912	4.0712	4.2238	4.3561	4.4730	4.5776
30 30	4.3949	4.6799	4.9014	5.0826	5.2359	5.3689	5.4862	5.5912

VARIANCES AND COVARIANCES OF ORDER STATISTICS FOR STANDARD GENERALISED EXPONENTIAL DISTRIBUTION FOR DIFFERENT VALUES OF SHAPE PARAMETER (alpha) FOR SAMPLE SIZE n=15 and 20.

ni j alpha= 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

15	1	1	0.013476	0.023858	0.033724	0.042503	0.050140	0.056748	0.062473	0.067458
15	1	2	0.011606	0.018833	0.025165	0.030501	0.034968	0.038725	0.041910	0.044635
15	1	3	0.010616	0.016425	0.021311	0.025324	0.028624	0.031363	0.033663	0.035615
15	1	4	0.009978	0.014949	0.019025	0.022317	0.024995	0.027199	0.029038	0.030592
15	1	5	0.009520	0.013929	0.017475	0.020306	0.022590	0.024459	0.026011	0.027318
15	1	6	0.009172	0.013170	0.016339	0.018845	0.020854	0.022491	0.023845	0.024982
15	1	7	0.008894	0.012576	0.015460	0.017724	0.019528	0.020993	0.022202	0.023214
15	1	8	0.008666	0.012096	0.014755	0.016829	0.018475	0.019807	0.020903	0.021819
15	1	9	0.008474	0.011697	0.014174	0.016094	0.017613	0.018838	0.019844	0.020684
15	1	10	0.008310	0.011359	0.013684	0.015478	0.016891	0.018029	0.018961	0.019739
15	1	11	0.008167	0.011067	0.013263	0.014950	0.016276	0.017340	0.018211	0.018935
15	1	12	0.008042	0.010813	0.012898	0.014493	0.015743	0.016745	0.017563	0.018243
15	1	13	0.007930	0.010588	0.012576	0.014092	0.015277	0.016224	0.016996	0.017638
15	1	14	0.007830	0.010388	0.012291	0.013737	0.014864	0.015763	0.016496	0.017104
15	1	15	0.007741	0.010208	0.012035	0.013419	0.014495	0.015353	0.016051	0.016629
15	2	2	0.021546	0.032373	0.041273	0.048479	0.054348	0.059188	0.063231	0.066651
15	2	3	0.019734	0.028296	0.035054	0.040387	0.044655	0.048130	0.051005	0.053419
15	2	4	0.018560	0.025786	0.031343	0.035657	0.039072	0.041829	0.044097	0.045992
15	2	5	0.017717	0.024044	0.028818	0.032480	0.035356	0.037665	0.039555	0.041129
15	2	6	0.017074	0.022745	0.026961	0.030166	0.032666	0.034664	0.036295	0.037649
15	2	7	0.016560	0.021728	0.025523	0.028386	0.030608	0.032376	0.033816	0.035009

15	2	8	0.016139	0.020904	0.024368	0.026964	0.028969	0.030562	0.031853	0.032921
15	2	9	0.015783	0.020219	0.023414	0.025795	0.027627	0.029077	0.030252	0.031221
15	2	10	0.015479	0.019637	0.022609	0.024812	0.026502	0.027836	0.028914	0.029802
15	2	11	0.015214	0.019136	0.021918	0.023972	0.025542	0.026778	0.027776	0.028597
15	2	12	0.014981	0.018698	0.021317	0.023242	0.024710	0.025864	0.026793	0.027556
15	2	13	0.014774	0.018310	0.020788	0.022602	0.023981	0.025063	0.025933	0.026647
15	2	14	0.014588	0.017965	0.020317	0.022034	0.023335	0.024354	0.025173	0.025844
15	2	15	0.014421	0.017655	0.019896	0.021526	0.022759	0.023722	0.024495	0.025129
15	3	3	0.029255	0.040129	0.048425	0.054835	0.059895	0.063973	0.067322	0.070118
15	3	4	0.027535	0.036614	0.043364	0.048497	0.052505	0.055710	0.058327	0.060501
15	3	5	0.026297	0.034167	0.039909	0.044225	0.047568	0.050226	0.052387	0.054176
15	3	6	0.025350	0.032338	0.037361	0.041103	0.043984	0.046264	0.048111	0.049637
15	3	7	0.024594	0.030904	0.035385	0.038698	0.041235	0.043237	0.044853	0.046185
15	3	8	0.023971	0.029740	0.033796	0.036774	0.039045	0.040830	0.042270	0.043453
15	3	9	0.023448	0.028771	0.032480	0.035190	0.037248	0.038862	0.040158	0.041223
15	3	10	0.022997	0.027949	0.031371	0.033858	0.035740	0.037211	0.038394	0.039363
15	3	11	0.022606	0.027239	0.030417	0.032717	0.034452	0.035807	0.036891	0.037779
15	3	12	0.022261	0.026618	0.029588	0.031727	0.033336	0.034589	0.035592	0.036412
15	3	13	0.021955	0.026069	0.028856	0.030856	0.032357	0.033523	0.034455	0.035216
15	3	14	0.021680	0.025579	0.028206	0.030084	0.031490	0.032580	0.033450	0.034159
15	3	15	0.021431	0.025139	0.027623	0.029393	0.030714	0.031738	0.032553	0.033217
15	4	4	0.037488	0.048348	0.056241	0.062161	0.066740	0.070379	0.073334	0.075781
15	4	5	0.035822	0.045154	0.051812	0.056748	0.060538	0.063532	0.065955	0.067953
15	4	6	0.034543	0.042760	0.048537	0.052783	0.056023	0.058571	0.060626	0.062316
15	4	7	0.033521	0.040880	0.045992	0.049722	0.052553	0.054772	0.056557	0.058022
15	4	8	0.032680	0.039352	0.043942	0.047269	0.049784	0.051749	0.053325	0.054617
15	4	9	0.031969	0.038080	0.042245	0.045248	0.047509	0.049270	0.050682	0.051836
15	4	10	0.031361	0.036998	0.040810	0.043545	0.045598	0.047195	0.048469	0.049510
15	4	11	0.030829	0.036063	0.039578	0.042088	0.043965	0.045421	0.046583	0.047531
15	4	12	0.030362	0.035246	0.038503	0.040820	0.042548	0.043886	0.044952	0.045819
15	4	13	0.029946	0.034522	0.037556	0.039706	0.041305	0.042541	0.043523	0.044322
15	4	14	0.029572	0.033876	0.036714	0.038716	0.040203	0.041349	0.042259	0.042999
15	4	15	0.029234	0.033295	0.035958	0.037831	0.039217	0.040284	0.041131	0.041818
15	5	5	0.046758	0.057594	0.065195	0.070775	0.075029	0.078374	0.081070	0.083288
15	5	6	0.045109	0.054575	0.061121	0.065885	0.069496	0.072323	0.074594	0.076457
15	5	7	0.043787	0.052198	0.057948	0.062101	0.065234	0.067678	0.069637	0.071240
15	5	8	0.042696	0.050265	0.055387	0.059064	0.061827	0.063975	0.065692	0.067096
15	5	9	0.041776	0.048651	0.053264	0.056558	0.059024	0.060936	0.062461	0.063706
15	5	10	0.040985	0.047279	0.051469	0.054447	0.056667	0.058385	0.059754	0.060869
15	5	11	0.040296	0.046093	0.049924	0.052635	0.054651	0.056207	0.057444	0.058451
15	5	12	0.039688	0.045053	0.048577	0.051060	0.052901	0.054319	0.055445	0.056360
15	5	13	0.039147	0.044134	0.047389	0.049674	0.051363	0.052663	0.053693	0.054529
15	5	14	0.038660	0.043312	0.046331	0.048442	0.050000	0.051195	0.052141	0.052909
15	5	15	0.038221	0.042573	0.045382	0.047339	0.048780	0.049883	0.050756	0.051463
15	6	6	0.057583	0.068393	0.075772	0.081098	0.085114	0.088246	0.090755	0.092809
15	6	7	0.055915	0.065449	0.071882	0.076494	0.079954	0.082643	0.084792	0.086548
15	6	8	0.054536	0.063048	0.068737	0.072790	0.075819	0.078166	0.080037	0.081563
15	6	9	0.053371	0.061043	0.066127	0.069730	0.072412	0.074486	0.076136	0.077479
15	6	10	0.052369	0.059335	0.063916	0.067147	0.069545	0.071394	0.072863	0.074057
15	6	11	0.051494	0.057857	0.062012	0.064930	0.067089	0.068750	0.070068	0.071138
15	6	12	0.050723	0.056562	0.060351	0.063000	0.064956	0.066457	0.067646	0.068610
15	6	13	0.050036	0.055415	0.058884	0.061302	0.063081	0.064444	0.065522	0.066396
15	6	14	0.049418	0.054390	0.057577	0.059791	0.061416	0.062659	0.063641	0.064435
15	6	15	0.048859	0.053466	0.056408	0.058437	0.059926	0.061063	0.061959	0.062684
15	7	7	0.070627	0.081414	0.088615	0.093743	0.097575	0.100543	0.102909	0.104839
15	7	8	0.068906	0.078464	0.084784	0.089259	0.092588	0.095161	0.097207	0.098872
15	7	9	0.067449	0.075995	0.081599	0.085546	0.088473	0.090728	0.092518	0.093974
15	7	10	0.066195	0.073889	0.078897	0.082408	0.085003	0.086999	0.088580	0.089863
15	7	11	0.065100	0.072065	0.076568	0.079711	0.082028	0.083806	0.085212	0.086353
15	7	12	0.064132	0.070465	0.074533	0.077362	0.079442	0.081034	0.082291	0.083310
15	7	13	0.063270	0.069047	0.072736	0.075292	0.077166	0.078598	0.079728	0.080641
15	7	14	0.062494	0.067778	0.071133	0.073450	0.075144	0.076436	0.077454	0.078277
15	7	15	0.061791	0.066634	0.069693	0.071797	0.073332	0.074501	0.075421	0.076163
15	8	8	0.086855	0.097623	0.104679	0.109647	0.113330	0.116167	0.118420	0.120251
15	8	9	0.085044	0.094591	0.100797	0.105145	0.108358	0.110826	0.112782	0.114368
15	8	10	0.083481	0.092001	0.097499	0.101334	0.104158	0.106324	0.108036	0.109424
15	8	11	0.082115	0.089754	0.094652	0.098054	0.100552	0.102464	0.103973	0.105195
15	8	12	0.080907	0.087782	0.092162	0.095193	0.097413	0.099108	0.100445	0.101525
15	8	13	0.079828	0.086031	0.089960	0.092669	0.094648	0.096157	0.097345	0.098303
15	8	14	0.078858	0.084464	0.087995	0.090421	0.092190	0.093535	0.094593	0.095445
15	8	15	0.077979	0.083050	0.086228	0.088404	0.089985	0.091187	0.092130	0.092889
15	9	9	0.107795	0.118545	0.125479	0.130314	0.133874	0.136605	0.138765	0.140515
15	9	10	0.105845	0.115348	0.121434	0.125659	0.128761	0.131132	0.133001	0.134509
15	9	11	0.104136	0.112569	0.117936	0.121647	0.124363	0.126435	0.128065	0.129378
15	9	12	0.102623	0.110126	0.114873	0.118142	0.120529	0.122346	0.123773	0.124920
15	9	13	0.101272	0.107956	0.112161	0.115047	0.117148	0.118745	0.119996	0.121000
15	9	14	0.100054	0.106011	0.109738	0.112287	0.114138	0.115542	0.116640	0.117518
15	9	15	0.098949	0.104255	0.107557	0.109807	0.111437	0.112670	0.113631	0.114397
15	10	10	0.136047	0.146782	0.153612	0.158334	0.161791	0.164432	0.166513	0.168197
15	10	11	0.133891	0.143309	0.149262	0.153357	0.156339	0.158597	0.160355	0.161747
15	10	12	0.131978	0.140250	0.145448	0.149010	0.151595	0.153548	0.155061	0.156252
15	10	13	0.130267	0.137529	0.142067	0.145164	0.147406	0.149092	0.150393	0.151409
15	10	14	0.128723	0.135087	0.139041	0.141731	0.143670	0.145123	0.146236	0.147097
15	10	15	0.127321	0.132879	0.136314	0.138640	0.140310	0.141553	0.142495	0.143211
15	11	11	0.176474	0.187197	0.193936	0.198561	0.201930	0.204493	0.206508	0.208135
15	11	12	0.174007	0.183274	0.189043	0.192947	0.195723	0.197745	0.199220	0.200267
15	11	13	0.171798	0.179791	0.184736	0.188062	0.190408	0.192094	0.193295	0.194109
15	11	14	0.169801	0.176660	0.180874	0.183689	0.185652	0.187036	0.187985	0.188580
15	11	15	0.167986	0.173823	0.177381	0.179733	0.181344	0.182439	0.183136	0.183497
15	12	12	0.239363	0.250075	0.256735	0.261274	0.264566	0.267062	0.269020	0.270597
15	12	13	0.236332	0.245216	0.250499	0.253785	0.255767	0.256783	0.257008	0.256537
15	12	14	0.233656	0.241042	0.245352	0.247936	0.249365	0.249910	0.249706	0.248823
15	12	15	0.231208	0.237225	0.240629	0.242529	0.243379	0.243384	0.242642	0.241194

15	13	13	0.350830	0.361533	0.368122	0.372586	0.375811	0.378248	0.380156	0.381689
15	13	14	0.345448	0.352125	0.354433	0.353897	0.351170	0.346579	0.340313	0.332495
15	13	15	0.341700	0.346156	0.346754	0.344670	0.340397	0.334180	0.326160	0.316437
15	14	14	0.601159	0.611853	0.618379	0.622777	0.625940	0.628326	0.630189	0.631684
15	14	15	0.562571	0.546852	0.522994	0.493077	0.458262	0.419325	0.376840	0.331267
15	15	15	1.601463	1.612150	1.618620	1.622957	1.626067	1.628406	1.630228	1.631689
20	1	1	0.008802	0.016750	0.024691	0.031975	0.038442	0.044118	0.049089	0.053453
20	1	2	0.007537	0.013099	0.018210	0.022644	0.026427	0.029652	0.032414	0.034795
20	1	3	0.006867	0.011355	0.015310	0.018650	0.021448	0.023801	0.025796	0.027503
20	1	4	0.006434	0.010289	0.013596	0.016341	0.018615	0.020511	0.022106	0.023467
20	1	5	0.006129	0.009554	0.012436	0.014802	0.016739	0.018350	0.019709	0.020850
20	1	6	0.005874	0.009005	0.011585	0.013682	0.015410	0.016808	0.017972	0.018978
20	1	7	0.005734	0.008569	0.010932	0.012841	0.014354	0.015654	0.016718	0.017620
20	1	8	0.005486	0.008239	0.010417	0.012127	0.013555	0.014653	0.015626	0.016374
20	1	9	0.005478	0.007934	0.009964	0.011651	0.012919	0.014033	0.014904	0.015732
20	1	10	0.005261	0.007694	0.009597	0.011049	0.012327	0.013279	0.014033	0.014630
20	1	11	0.005200	0.007507	0.009349	0.010814	0.011856	0.012754	0.013684	0.014336
20	1	12	0.005162	0.007295	0.008972	0.010311	0.011503	0.012395	0.012897	0.013584
20	1	13	0.004998	0.007158	0.008832	0.010117	0.011049	0.011842	0.012709	0.013169
20	1	14	0.005007	0.006992	0.008558	0.009777	0.010799	0.011603	0.012142	0.012773
20	1	15	0.004900	0.006880	0.008390	0.009571	0.010485	0.011223	0.011883	0.012355
20	1	16	0.004864	0.006751	0.008213	0.009341	0.010237	0.010965	0.011542	0.012046
20	1	17	0.004806	0.006650	0.008058	0.009149	0.010007	0.010695	0.011264	0.011734
20	1	18	0.004760	0.006550	0.007916	0.008968	0.009796	0.010462	0.011006	0.011460
20	1	19	0.004717	0.006461	0.007786	0.008804	0.009604	0.010246	0.010771	0.011208
20	1	20	0.004677	0.006378	0.007666	0.008653	0.009428	0.010048	0.010556	0.010977
20	2	2	0.013677	0.021964	0.029096	0.035034	0.039960	0.044076	0.047547	0.050505
20	2	3	0.012475	0.019074	0.024521	0.028936	0.032533	0.035499	0.037976	0.040071
20	2	4	0.011696	0.017300	0.021804	0.025391	0.028281	0.030645	0.032609	0.034257
20	2	5	0.011130	0.016075	0.019955	0.023023	0.025473	0.027454	0.029088	0.030471
20	2	6	0.010739	0.015148	0.018613	0.021297	0.023415	0.025183	0.026600	0.027789
20	2	7	0.010280	0.014462	0.017577	0.019957	0.021888	0.023317	0.024640	0.025626
20	2	8	0.010233	0.013830	0.016655	0.019002	0.020721	0.022283	0.023231	0.024393
20	2	9	0.009677	0.013415	0.016085	0.017933	0.019576	0.020563	0.021787	0.022314
20	2	10	0.009722	0.013039	0.015545	0.017554	0.018739	0.020096	0.021281	0.022330
20	2	11	0.009557	0.012423	0.014717	0.016333	0.018295	0.019415	0.019409	0.020296
20	2	12	0.009064	0.012441	0.014766	0.016468	0.017079	0.017997	0.020027	0.020245
20	2	13	0.009394	0.011949	0.013946	0.015440	0.017228	0.018312	0.017980	0.019338
20	2	14	0.008891	0.011881	0.013875	0.015432	0.016290	0.017123	0.018437	0.018539
20	2	15	0.009020	0.011512	0.013473	0.014840	0.016046	0.016971	0.017441	0.018257
20	2	16	0.008809	0.011417	0.013214	0.014598	0.015613	0.016379	0.017131	0.017613
20	2	17	0.008758	0.011194	0.012960	0.014256	0.015254	0.016072	0.016682	0.017214
20	2	18	0.008661	0.011041	0.012734	0.013986	0.014946	0.015693	0.016306	0.016807
20	2	19	0.008584	0.010888	0.012523	0.013729	0.014649	0.015374	0.015957	0.016437
20	2	20	0.008511	0.010749	0.012331	0.013494	0.014381	0.015077	0.015638	0.016099
20	3	3	0.018050	0.026366	0.032992	0.038248	0.042469	0.045914	0.048768	0.051168
20	3	4	0.016932	0.023937	0.029370	0.033610	0.036976	0.039700	0.041944	0.043823
20	3	5	0.016132	0.022249	0.026908	0.030496	0.033323	0.035601	0.037466	0.039023
20	3	6	0.015490	0.020998	0.025104	0.028223	0.030688	0.032618	0.034252	0.035568
20	3	7	0.015087	0.019994	0.023648	0.026532	0.028670	0.030553	0.031828	0.033099
20	3	8	0.014481	0.019217	0.022651	0.025034	0.027035	0.028262	0.029837	0.030654
20	3	9	0.014439	0.018568	0.021605	0.024100	0.025745	0.027625	0.028467	0.029747
20	3	10	0.013970	0.017739	0.020653	0.022714	0.024906	0.025835	0.026463	0.027172
20	3	11	0.013495	0.017975	0.020684	0.022666	0.022895	0.024388	0.027090	0.027516
20	3	12	0.014024	0.016605	0.018973	0.020894	0.023877	0.025133	0.023425	0.025563
20	3	13	0.012773	0.017047	0.019421	0.021432	0.021386	0.022384	0.025568	0.024641
20	3	14	0.013477	0.016049	0.018451	0.019922	0.021991	0.022984	0.022401	0.024336
20	3	15	0.012816	0.016263	0.018243	0.020007	0.020868	0.021690	0.022985	0.023018
20	3	16	0.012887	0.015663	0.017838	0.019245	0.020457	0.021545	0.022058	0.022777
20	3	17	0.012659	0.015576	0.017514	0.018970	0.020056	0.020805	0.021554	0.022093
20	3	18	0.012564	0.015303	0.017198	0.018566	0.019594	0.020425	0.021054	0.021579
20	3	19	0.012444	0.015100	0.016920	0.018234	0.019224	0.019992	0.020610	0.021115
20	3	20	0.012339	0.014907	0.016659	0.017921	0.018870	0.019608	0.020198	0.020680
20	4	4	0.022443	0.030742	0.037029	0.041864	0.045667	0.048725	0.051231	0.053319
20	4	5	0.021385	0.028594	0.033950	0.038020	0.041197	0.043734	0.045807	0.047526
20	4	6	0.020579	0.026988	0.031675	0.035222	0.037954	0.040150	0.041906	0.043386
20	4	7	0.019906	0.025734	0.029956	0.033033	0.035479	0.037311	0.038952	0.040200
20	4	8	0.019459	0.024721	0.028474	0.031341	0.033493	0.035395	0.036595	0.037840
20	4	9	0.018841	0.023707	0.027237	0.029888	0.032041	0.033214	0.034570	0.035450
20	4	10	0.018532	0.023514	0.026748	0.028879	0.029999	0.031790	0.033675	0.034517
20	4	11	0.018646	0.021818	0.024791	0.027216	0.030479	0.031754	0.030286	0.031985
20	4	12	0.017307	0.022649	0.025507	0.027755	0.027137	0.028224	0.032680	0.031271
20	4	13	0.018309	0.020789	0.023674	0.025152	0.028702	0.029837	0.027350	0.031114
20	4	14	0.017025	0.021586	0.023726	0.025949	0.026076	0.027168	0.029867	0.028625
20	4	15	0.017395	0.020258	0.023047	0.024303	0.026156	0.027412	0.027368	0.028919
20	4	16	0.016937	0.020566	0.022586	0.024381	0.025461	0.026030	0.027125	0.027524
20	4	17	0.016865	0.019920	0.022125	0.023603	0.024732	0.025838	0.026397	0.027000
20	4	18	0.016665	0.019724	0.021758	0.023224	0.024326	0.025122	0.025830	0.026387
20	4	19	0.016521	0.019439	0.021393	0.022785	0.023823	0.024632	0.025272	0.025790
20	4	20	0.016379	0.019190	0.021066	0.022398	0.023391	0.024158	0.024769	0.025267
20	5	5	0.027083	0.035356	0.041398	0.045941	0.049461	0.052260	0.054536	0.056421
20	5	6	0.026064	0.033386	0.038654	0.042576	0.045600	0.047991	0.049933	0.051534
20	5	7	0.025252	0.031836	0.036517	0.039985	0.042638	0.044748	0.046419	0.047818
20	5	8	0.024552	0.030575	0.034800	0.037940	0.040292	0.042104	0.043653	0.044872
20	5	9	0.024050	0.029647	0.033509	0.036148	0.038227	0.040021	0.041434	0.042559
20	5	10	0.023603	0.028326	0.031924	0.034653	0.037153	0.038533	0.039045	0.040323
20	5	11	0.022748	0.028438	0.031591	0.033932	0.034427	0.035887	0.039022	0.038866
20	5	12	0.023236	0.026719	0.029799	0.031703	0.035178	0.036509	0.034559	0.037997
20	5	13	0.021920	0.027131	0.029840	0.032340	0.032091	0.033634	0.037108	0.034741
20	5	14	0.022251	0.025597	0.028750	0.029841	0.032804	0.033744	0.032872	0.036051
20	5	15	0.021709	0.026170	0.028054	0.030479	0.031175	0.031940	0.033488	0.033236
20	5	16	0.021608	0.024883	0.027585	0.029010	0.030457	0.031898	0.032342	0.033200
20	5	17	0.021322	0.024896	0.027067	0.028772	0.030001	0.030649	0.031583	0.032167

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20	5	18	0.021149	0.024393	0.026576	0.028094	0.029214	0.030165	0.030817	0.031378
20	5	19	0.020944	0.024084	0.026153	0.027611	0.028694	0.029521	0.030184	0.030728
20	5	20	0.020769	0.023776	0.025748	0.027136	0.028164	0.028955	0.029583	0.030091
20	6	6	0.032132	0.040381	0.046233	0.050559	0.053871	0.056484	0.058594	0.060333
20	6	7	0.031134	0.038524	0.043704	0.047505	0.050399	0.052674	0.054508	0.056017
20	6	8	0.030317	0.037018	0.041671	0.045041	0.047626	0.049640	0.051263	0.052591
20	6	9	0.029608	0.035705	0.039942	0.043043	0.045399	0.047190	0.048569	0.049785
20	6	10	0.028954	0.034821	0.038629	0.041423	0.043274	0.044934	0.046637	0.047468
20	6	11	0.028726	0.033552	0.037259	0.039628	0.042129	0.043675	0.043749	0.045732
20	6	12	0.027741	0.033118	0.036344	0.039039	0.039972	0.041263	0.044007	0.042912
20	6	13	0.027802	0.031998	0.035225	0.037031	0.039777	0.040732	0.040309	0.043416
20	6	14	0.027259	0.031877	0.034463	0.037136	0.037635	0.039065	0.040827	0.039959
20	6	15	0.026910	0.030688	0.033760	0.035148	0.037179	0.038417	0.038933	0.040363
20	6	16	0.026609	0.030710	0.032981	0.035113	0.036301	0.036930	0.038023	0.038490
20	6	17	0.026354	0.029921	0.032434	0.034013	0.035261	0.036474	0.037067	0.037710
20	6	18	0.026082	0.029602	0.031870	0.033488	0.034683	0.035536	0.036303	0.036890
20	6	19	0.025852	0.029176	0.031335	0.032850	0.033965	0.034828	0.035508	0.036051
20	6	20	0.025630	0.028804	0.030860	0.032296	0.033353	0.034163	0.034804	0.035326
20	7	7	0.037749	0.045975	0.051678	0.055833	0.058984	0.061452	0.063437	0.065065
20	7	8	0.036757	0.044184	0.049282	0.052975	0.055764	0.057942	0.059688	0.061119
20	7	9	0.035917	0.042700	0.047302	0.050625	0.053106	0.055056	0.056633	0.057896
20	7	10	0.035223	0.041398	0.045625	0.048597	0.050927	0.052672	0.053965	0.055232
20	7	11	0.034489	0.040327	0.044156	0.046983	0.048905	0.050489	0.052124	0.052687
20	7	12	0.034132	0.039384	0.042935	0.045346	0.047504	0.048904	0.049581	0.051449
20	7	13	0.033495	0.038549	0.041800	0.044339	0.045648	0.047170	0.048694	0.048381
20	7	14	0.033035	0.037618	0.040789	0.042628	0.044838	0.045839	0.046754	0.048325
20	7	15	0.032683	0.037196	0.039873	0.042292	0.043424	0.044510	0.045534	0.045886
20	7	16	0.032305	0.036295	0.039205	0.040799	0.042347	0.043650	0.044363	0.045142
20	7	17	0.031965	0.035935	0.038371	0.040258	0.041560	0.042409	0.043336	0.043963
20	7	18	0.031655	0.035332	0.037727	0.039378	0.040591	0.041577	0.042283	0.042881
20	7	19	0.031370	0.034869	0.037123	0.038691	0.039843	0.040722	0.041419	0.041991
20	7	20	0.031106	0.034426	0.036553	0.038031	0.039115	0.039944	0.040599	0.041127
20	8	8	0.044113	0.052320	0.057898	0.061915	0.064937	0.067292	0.069176	0.070718
20	8	9	0.043115	0.050563	0.055585	0.059179	0.061878	0.063972	0.065644	0.067012
20	8	10	0.042250	0.049065	0.053620	0.056876	0.059299	0.061182	0.062697	0.063897
20	8	11	0.041517	0.047782	0.051951	0.054892	0.057110	0.058810	0.060119	0.061336
20	8	12	0.040820	0.046612	0.050464	0.053176	0.055128	0.056743	0.058038	0.058795
20	8	13	0.040250	0.045654	0.049150	0.051592	0.053611	0.054896	0.056026	0.057271
20	8	14	0.039730	0.044763	0.048004	0.050479	0.051948	0.053364	0.054291	0.054940
20	8	15	0.039241	0.043879	0.047022	0.048912	0.050671	0.051902	0.052902	0.053753
20	8	16	0.038797	0.043250	0.045964	0.048145	0.049515	0.050542	0.051496	0.052191
20	8	17	0.038390	0.042492	0.045197	0.046971	0.048339	0.049456	0.050200	0.050887
20	8	18	0.038026	0.041910	0.044396	0.046135	0.047406	0.048358	0.049147	0.049768
20	8	19	0.037680	0.041340	0.043674	0.045290	0.046475	0.047381	0.048095	0.048664
20	8	20	0.037362	0.040816	0.043012	0.044527	0.045635	0.046481	0.047146	0.047686
20	9	9	0.051453	0.059642	0.065117	0.069019	0.071935	0.074195	0.075997	0.077467
20	9	10	0.050435	0.057891	0.062839	0.066349	0.068964	0.070987	0.072596	0.073910
20	9	11	0.049543	0.056371	0.060874	0.064053	0.066415	0.068241	0.069693	0.070861
20	9	12	0.048761	0.055046	0.059157	0.062059	0.064221	0.065859	0.067178	0.068275
20	9	13	0.048055	0.053856	0.057648	0.060321	0.062238	0.063786	0.064946	0.065878
20	9	14	0.047429	0.052806	0.056310	0.058683	0.060544	0.061897	0.063047	0.063958
20	9	15	0.046844	0.051868	0.055046	0.057415	0.059005	0.060267	0.061245	0.062060
20	9	16	0.046331	0.050976	0.054032	0.056611	0.057576	0.058785	0.059667	0.060425
20	9	17	0.045858	0.050219	0.052973	0.054941	0.056350	0.057408	0.058306	0.058982
20	9	18	0.045406	0.049484	0.052078	0.053864	0.055176	0.056180	0.056957	0.057594
20	9	19	0.045003	0.048818	0.051237	0.052903	0.054120	0.055049	0.055779	0.056375
20	9	20	0.044624	0.048202	0.050459	0.052012	0.053144	0.054006	0.054684	0.055230
20	10	10	0.060071	0.068245	0.073631	0.077435	0.080262	0.082443	0.084176	0.085587
20	10	11	0.059020	0.066471	0.071349	0.074781	0.077324	0.079281	0.080835	0.082098
20	10	12	0.058089	0.064913	0.069354	0.072467	0.074765	0.076535	0.077935	0.079072
20	10	13	0.057259	0.063533	0.067592	0.070422	0.072520	0.074120	0.075399	0.076430
20	10	14	0.056508	0.062295	0.066012	0.068628	0.070521	0.071988	0.073129	0.074072
20	10	15	0.055837	0.061178	0.064626	0.066965	0.068727	0.070066	0.071122	0.071973
20	10	16	0.055212	0.060174	0.063309	0.065529	0.067123	0.068338	0.069325	0.070102
20	10	17	0.054643	0.059242	0.062169	0.064172	0.065648	0.066778	0.067644	0.068365
20	10	18	0.054126	0.058394	0.061096	0.062955	0.064312	0.065347	0.066166	0.066825
20	10	19	0.053639	0.057612	0.060113	0.061832	0.063084	0.064035	0.064784	0.065386
20	10	20	0.053190	0.056888	0.059207	0.060795	0.061949	0.062828	0.063517	0.064073
20	11	11	0.070391	0.078552	0.083861	0.087581	0.090330	0.092444	0.094118	0.095478
20	11	12	0.069292	0.076728	0.081537	0.084895	0.087370	0.089270	0.090773	0.091992
20	11	13	0.068308	0.075107	0.079480	0.082525	0.084763	0.086479	0.087833	0.088931
20	11	14	0.067423	0.073656	0.077648	0.080411	0.082445	0.083999	0.085227	0.086218
20	11	15	0.066618	0.072347	0.075991	0.078522	0.080369	0.081781	0.082896	0.083797
20	11	16	0.065885	0.071157	0.074504	0.076804	0.078492	0.079780	0.080785	0.081605
20	11	17	0.065214	0.070070	0.073136	0.075249	0.076789	0.077960	0.078889	0.079633
20	11	18	0.064591	0.069074	0.071890	0.073823	0.075231	0.076302	0.077142	0.077819
20	11	19	0.064018	0.068152	0.070741	0.072512	0.073800	0.074779	0.075548	0.076168
20	11	20	0.063484	0.067300	0.069679	0.071303	0.072482	0.073376	0.074077	0.074642
20	12	12	0.083029	0.091178	0.096419	0.100065	0.102748	0.104802	0.106427	0.107743
20	12	13	0.081863	0.089272	0.094012	0.097299	0.099712	0.101556	0.103012	0.104188
20	12	14	0.080811	0.087562	0.091860	0.094833	0.097009	0.098671	0.099980	0.101037
20	12	15	0.079855	0.086018	0.089924	0.092616	0.094585	0.096085	0.097265	0.098217
20	12	16	0.078983	0.084615	0.088168	0.090612	0.092394	0.093751	0.094819	0.095678
20	12	17	0.078181	0.083333	0.086568	0.088787	0.090403	0.091631	0.092594	0.093370
20	12	18	0.077444	0.082154	0.085101	0.087117	0.088582	0.089694	0.090567	0.091268
20	12	19	0.076759	0.081066	0.083750	0.085581	0.086909	0.087916	0.088704	0.089337
20	12	20	0.076123	0.080059	0.082500	0.084162	0.085365	0.086276	0.086988	0.087558
20	13	13	0.098922	0.107061	0.112241	0.115823	0.118446	0.120450	0.122029	0.123307
20	13	14	0.097666	0.105035	0.109702	0.112919	0.115269	0.117058	0.118462	0.119589
20	13	15	0.096523	0.103201	0.107412	0.110307	0.112417	0.114021	0.115278	0.116284
20	13	16	0.095479	0.101534	0.105336	0.107942	0.109838	0.111277	0.112402	0.113302
20	13	17	0.094519	0.100009	0.103441	0.105788	0.107492	0.108783	0.109791	0.110594
20	13	18	0.093634	0.098607	0.101703	0.103815	0.105345	0.106502	0.107404	0.108120

20	13	19	0.092813	0.097312	0.100101	0.101999	0.103371	0.104407	0.105212	0.105849
20	13	20	0.092050	0.096111	0.098619	0.100321	0.101549	0.102473	0.103188	0.103751
20	14	14	0.119578	0.127708	0.132834	0.136358	0.138929	0.140886	0.142427	0.143670
20	14	15	0.118199	0.125509	0.130097	0.133237	0.135516	0.137233	0.138561	0.139599
20	14	16	0.116935	0.123506	0.127611	0.130415	0.132443	0.133968	0.135141	0.136053
20	14	17	0.115774	0.121672	0.125342	0.127841	0.129644	0.130996	0.132031	0.132828
20	14	18	0.114701	0.119984	0.123259	0.125482	0.127081	0.128276	0.129185	0.129876
20	14	19	0.113706	0.118425	0.121337	0.123309	0.124723	0.125773	0.126565	0.127159
20	14	20	0.112780	0.116978	0.119558	0.121298	0.122540	0.123456	0.124136	0.124632
20	15	15	0.147586	0.155708	0.160785	0.164257	0.166781	0.168698	0.170203	0.171416
20	15	16	0.146034	0.153257	0.157739	0.160770	0.162923	0.164486	0.165616	0.166399
20	15	17	0.144606	0.151015	0.154975	0.157640	0.159523	0.160875	0.161833	0.162469
20	15	18	0.143285	0.148950	0.152433	0.154767	0.156403	0.157562	0.158359	0.158855
20	15	19	0.142059	0.147039	0.150087	0.152116	0.153524	0.154500	0.155143	0.155500
20	15	20	0.140917	0.145265	0.147909	0.149654	0.150844	0.151638	0.152115	0.152309
20	16	16	0.187801	0.195916	0.200949	0.204374	0.206855	0.208735	0.210208	0.211394
20	16	17	0.185982	0.193032	0.197291	0.200025	0.201774	0.202791	0.203203	0.203070
20	16	18	0.184316	0.190438	0.194104	0.196417	0.197842	0.198590	0.198763	0.198403
20	16	19	0.182766	0.188033	0.191149	0.193068	0.194179	0.194657	0.194574	0.193959
20	16	20	0.181319	0.185788	0.188382	0.189909	0.190686	0.190842	0.190426	0.189443
20	17	17	0.250503	0.258611	0.263603	0.266985	0.269428	0.271274	0.272719	0.273880
20	17	18	0.248043	0.254449	0.257753	0.259131	0.259052	0.257721	0.255230	0.251626
20	17	19	0.245988	0.251245	0.253768	0.254526	0.253889	0.252007	0.248941	0.244716
20	17	20	0.244037	0.248174	0.249873	0.249897	0.248512	0.245812	0.241821	0.236539
20	18	18	0.361803	0.369906	0.374861	0.378203	0.380610	0.382426	0.383845	0.384984
20	18	19	0.355213	0.357370	0.354819	0.348695	0.339504	0.327533	0.312983	0.296016
20	18	20	0.351871	0.351815	0.347198	0.338883	0.327259	0.312560	0.294965	0.274637
20	19	19	0.611981	0.620080	0.625000	0.628306	0.630681	0.632469	0.633863	0.634982
20	19	20	0.550267	0.516451	0.472497	0.420706	0.362544	0.299082	0.231159	0.159457
20	20	20	1.612150	1.620244	1.625133	1.628406	1.630750	1.632512	1.633884	1.634984

R-program 2: R-code for computing the coefficients of the BLUEs of Location and Scale Parameters of GED

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#####
# THIS R-CODE COMPUTES COEFFICIENTS OF THE BLUEs OF LOCATION AND SCALE PARAMETERS OF GENERALIZED @
# EXPONENTIAL DISTRIBUTION FOR A SPECIFIED VALUE OF SHAPE PARAMETER (alpha) FOR A GIVEN COMPLETE @
# SAMPLE OR RIGHT CENSORED OR LEFT CENSORED OR DOUBLY CENSORED SAMPLE FOR ANY SAMPLE SIZE UP TO 20 @
#####
cat("\n ENTER SHAPE PARAMETER OF STANDARD GE DISTRIBUTION (between 1.5 and 6.0)");
alpha=scan();
cat("\n ENTER SAMPLE SIZE (n between 2 and 20)");n=scan();
cat("\n ENTER No. observations LEFT censored (r between 0 and n-2)");r=scan();
cat("\n ENTER No. observations RIGHT censored (s between 0 and n-2)");s=scan();
m=n-r-s;
I=rep(1, m); a=rep(0, m); B=a%*t(a);
for (i in 1:m) a[i]=GEMOMI(n, r+i, alpha);
for (i in 1:m)
for (j in i:m) { if (i==j) {B[i, i]=GEMOM2(n, r+i, alpha) - GEMOMI(n, r+i, alpha)**2;}
else { B[i, j]=GEPM(n, r+i, r+j, alpha) - GEMOMI(n, r+i, alpha)*GEMOMI(n, r+j, alpha); }
}
for (i in 1:(m-1)) for (j in (i+1):m) B[j, i]=B[i, j];
del ta=sum(a*solve(B, a))*sum(I*solve(B, I))-sum(a*solve(B, I))**2;
BI=solve(B);
A=BI%*(I%*t(a)-a%*t(I));
A=A%*BI;
BLMUC=(-t(a)%*A)/del ta;
BLSIGC=(t(I)%*A)/del ta;
cat("\n\nCoefficients of the BLUE of Location parameter:\n", " ", format(round(BLMUC, 4), nsmall=4));
cat("\n\nCoefficients of the BLUE of Scale parameter:\n", " ", format(round(BLSIGC, 4), nsmall=4));
vmu=sum(a*solve(B, a))/del ta;
vsi g=sum(I*solve(B, I))/del ta;
cov=-sum(I*solve(B, a))/del ta;
cat("\n\nVariances and covariance of the BLUEs: \n", " ",
format(round(vmu, 4), nsmall=4), format(round(vsi g, 4), nsmall=4), format(round(cov, 4), nsmall=4));
cat("\n");
cat("\n\nCHECKS ON BLUE COEFFICIENTS: \n");
cat("\n SUM OF the BLUE COEFFICIENTS OF LOCATION= ", format(round(sum(BLMUC), 6), nsmall=6));
cat("\n SUM OF the BLUE COEFFICIENTS OF SCALE= ", format(round(sum(BLSIGC), 6), nsmall=6));
cat("\n");

#####
# THIS R-FUNCTION COMPUTES MEAN OF R-th ORDER STATISTICS OF STANDARD GENERALIZED @
# EXPONENTIAL DISTRIBUTION
#####
GEMOMI=function(n, r, alpha){
GEMOMI=0;
for (i in 0:(n-r)) {
t=di gamma((r+i)*alpha+1)+0.577215;
GEMOMI=GEMOMI+(-1)**i*comb(n-r, i)/(r+i)*t;
}
GEMOMI=GEMOMI/beta(r, n-r+1);
return(GEMOMI);
}

#####
# THIS R-FUNCTION COMPUTES SECOND ORDER MOMENT OF R-th ORDER STATISTIC OF STANDARD @
# GENERALIZED EXPONENTIAL DISTRIBUTION
#
```


Note: Against each α and n the figures in the first two rows are corresponding to location parameter and the figures in the second two rows are corresponding to scale parameter.

REFERENCES

- [1]. M. Z.Raqab and M. Ahsanullah, "Estimation of location and scale parameters of generalized exponential distribution based on order statistics". *J. Statist. Computat. Simul.*, vol. 69, 2001, pp.109-124.
- [2]. R. D.Gupta and D.Kundu, "Generalized exponential distribution", *Austral. N. Z. Statist.*, vol. 41, 1999, pp.173-188.
- [3]. E. H. Lloyd (1952), "Least squares estimation of location and scale parameters using order statistics", *Biometrika*, vol. 39, 1952, pp.88-95.
- [4]. R. D.Gupta and D. Kundu, "Generalized exponential distributions: different methods of estimation", *J. Statist. Comput. Simul.*, vol. 69, 2001, pp.315-338.
- [5]. M. Z.Raqab, "Inferences for generalized exponential based on record statistics". *J. Statist. Plann. Infer.*, vol.104, 2002, pp.339-350.
- [6]. M. Z.Raqab, "Generalized Exponential Distribution: Moments of Order Statistics", *Statistics*, vol. 38, 2004, pp.29-41.
- [7]. R. U.Khan and D. Kumar, "Exponential Distribution of Lower generalized Order Statistics from Generalized Exponential Distribution and a Characterization". *Mathematical methods of Statistics*, vol.20, 2011, pp.150-157.
- [8]. M. Z.Raqab and M. T. Madi, "Bayesian inference for the generalized exponential distribution". *J. Statist. Computat. Simul.*, vol. 75, 2005, pp.541-852.

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Islamism and Electoral Politics: A Case Study of Jama'at-i-Islami Jammu and Kashmir (1971-87)

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Abstract:

Islamism and electoral politics are, theoretically, placed differently and in fact quite opposite to each other in the religious circles. However, practically, sometimes even the flag holders of Islam imbibe the 'antagonistic' electoral methods to achieve their goal of Islamism. The present paper substantiates the same concept with respect to Jama'at-i-Islami Jammu and Kashmir. Despite taking a strong confrontation against the modern concepts of democracy, secularism and their constituent element of electoral politics, Jama'at used electoral politics as a means for attaining the ultimate end i.e., Islamism. Through electoral politics Jama'at not only operated as a strong political pressure group, but also widened its base among people, thus, making its road towards Islamism more secure and guaranteed.

Keywords: Jama't-i-Islami, Islamism, Electoral Politics, Iqamat-i-Din, State

I. Introduction

Islam is just not a religion, but a way of life. It is not a set of rituals rather a system with socio-economic and political dimensions. Therefore, it cannot fit any other system, be it democratic secularism, socialism, capitalism or any other '-ism'. Amongst all the twentieth century Islamic ideologue and revivalists, Sayyid Abu A'la Maududi, founder of Jama'at-i-Islami, has been the most vocal in this regard. While presenting Islam a complete code of life and an absolute system,¹ he downgraded the prevalent ideologies of secularism, socialism and capitalism by highlighting their loopholes.² Maulana Maududi holds that, "the basic principle of Islamic politics is that, both individually and collectively, human beings should waive all rights of legislation and all power to give commands to others. None is entitled to make laws on own authority and none is obliged to abide by them. The right vests in Allah alone."³ Maududi, derives authority from the Quran in order to validate this concept:

"The decision rests with Allah only, who hath commanded that ye worship none save Him. This is the right faith".⁴

"They ask: have we also got some authority? Say: "all authority belongs to God alone."⁵

"Do not say wrongly with your tongues that this is lawful and that is unlawful. Who so judgeth not by that which Allah hath revealed, such are disbelievers."⁶

As per to this theory, as Maududi holds, Sovereignty belongs to God only. He alone is the law-giver. No man, even if he be a prophet, has the right to order others in his own right do or not to do things.

"It is not (possible) for any human being unto whom Allah has given the scripture and wisdom and the prophet-hood that he should afterwards have said unto mankind: Be slaves of me instead of Allah; but (what he said, was) Be ye faithful servants of Lord."⁷

Thus, quoting from the Quran, Maulana Maududi tries to substantiate that Islam is not democracy: for democracy [as per Maulana Maududi] is the name given to that particular form of Government in which sovereignty ultimately rests with the people, in which legislation depends both in its form and content on the force and direction of public opinion and laws are modified and altered, to correspond to changes in that opinion. There is no such thing in Islam which, therefore, cannot be called democracy in this sense of the term.⁸

Despite this criticism, Jama'at could not hold itself back from the ingredient element of electoral politics associated with the system against which Maududi showed reservation. Not only JI Pakistan, but JJK also contested elections. Thus, there has been

¹For an elaborated study see, Sayyid Abu A'la Maududi, *Economic System of Islam* (Lahore: Islamic Publications Ltd.); also see *Social System of Islam* (Lahore: Islamic Publications Pvt. Limited, 1997); *The Islamic Law and Constitution* (Lahore: Islamic Publications Pvt. Limited); *Ethical View Point of Islam* (Lahore: Islamic Publications Pvt. Limited).

²For details see, Maududi, *Islam aur Jadeed Ma'ashi Nazariyat* (n.p., n.d).

³Sayyid Abu A'la Maududi, *Political Theory of Islam*, (New Delhi: Markazi Maktaba Islami Publishers, May 2011) p. 19-20.

⁴Al-Quran (12:40).

⁵Ibid.: 3.

⁶Al-Quran: 5.

⁷Ibid. 3.

⁸Maududi, *Political Theory*, op. cit., p. 21

an interesting inter-play of ideological rigidity and methodological flexibility in case of Jama'at-i-Islami while pursuing its goal of Islamism. Beyond any doubt, platform of electoral politics has become an interesting tool for Islamism in recent times.

II. Jama'at and Electoral Politics:

The Jama'at-i-Islami did not take part in the electoral politics of the state for about twenty years of its independent existence. During that period, it prepared a dedicated, trained and trustworthy cadre, besides it tried to strengthen its roots among the masses. Finally the party decided to participate in the electoral politics in early seventies. The first election it fought was the Parliamentary election of 1971.

Now the question arises "If any system other than Islamic was prohibited and If people owe their allegiance to Allah", which Maulana Maududi and Jama'at-i-Islami had been reiterating and asserting⁹, then was not it self-contradictory on the part of JJK to contest such elections under a (what they called) non-Islamic political set up?

The JJK defends its stand of participation in the state elections as a methodological tool or as a means to an end to reach their ultimate goal or *Nesb-ul Ain* of *Iqamat-i-Din*.¹⁰ They held that in a democratic and constitutional state, the only way to change the political leadership in order to facilitate the ways of *Iqamat-i-Din* is through elections. They further assert that using unconstitutional and undemocratic means in a democratic system to change the system is against the Jama'at's own constitution.¹¹ Further, JJK asserted elections can be used to generate political consciousness among the people. They held that JJK had participated in the elections for safeguarding the democratic rights of the people as Government has failed in fulfilling its promises done to people.¹² According to Syed Ali Shah Geelani, "JJK had two basic objectives behind participating in elections. Firstly, articulation and spread of JJK message and principles on ideological level and keep alive the 'Kashmir issue'. Secondly, to strive through democratic ways, in order to provide the masses their basic and fundamental rights".¹³

While using Maulana Maududi's arguments JJK articulated in Azan that 'Dawah and participation in elections should go hand in hand'. They assert that 'remaining away from elections will make *Tabligh* or *Dawah* (preaching) irrelevant, as unless the keys of political leadership do not come in the hands of *Din*, the goal of *Iqamat-i-Din* can't be achieved'; 'religion and politics are inseparable... such an articulation becomes quite insignificant if it didn't participate in elections... The non participation of elections will surely kill the ideological distinction of Jama'at-i-Islami with the rest of the Islamic religious organizations'. Moreover, 'election nonparticipation on the part of Jama'at can make people disappointed who have been so far kept hope on us... we would be killing the choice of voters... Plus non participation will give impetus to those forces which will always try to curb Islamic forces'.¹⁴

The JJK also advocates their ideological consistency and methodological changes and defends their stand on Islamic basis. In the words of Ghulam Muhammad Bhat, Amir-i-Jama'at, JJK :

Islam is a religion of *Hikmah* (Reason/logic). It permits logical strategical change as long as such methods do not contradict with Quran and *Sunnah*. Prophets of Islam including Prophet Muhammad (SAW) have changed their strategies as per demanding circumstances like for example Hazrat Yousuf accepted an offer to become financial minister of an un-Islamic system. Even there are many examples when Prophet Muhammad (P.B.U.H) also made strategical changes as per demanding circumstances, for example in *Sulah Hudeibiah* (a peace treaty between infidels of Makkah on one hand and Prophet (P.B.U.H) and Muslims of Madinah on other hand). In this treaty Infidels displayed objection on the name Muhammad *Rasoolullah* (Muhammad the Prophet of God) to be written in treaty. Instead they demanded that the name be replaced by Muhammad bin Abdullah (Muhammad, the Son of Abdullah) because they do not accept him prophet. None of the companions of the Prophet dared to rub *Rasoolullah*. However, Prophet himself rubbed *Rasoolullah* and directed Hazrat Ali (R.A) to write Muhammad bin Abdullah rather than Muhammad *Rasoolullah*. That does not mean prophet's declaration of Prophet-hood went self-contradictory. It was in fact a methodological change as per demanding circumstances. Also other conditions of the treaty were apparently harsh for Muslims as in one of the conditions it was demanded by infidels that if any one accepts Islam among the people of Makkah and migrates to Madinah, he should be sent back. But if any amongst the Muslims of Madinah happens to come Makkah, he will not be sent back. Prophet (P.B.U.H) even accepted these conditions keeping in view long-term gains owing to which within few years The Prophet (P.B.U.H) successfully established Islamic state in the whole of the Arabia. Same has been the case of Jama'at-i-Islami --- it has changed its strategies as per demanding circumstances, keeping in view the longer benefits to prolong the movement in order to reach its goal of *iqamat-i-din*. So, there is no scope for the thinking that Jama'at has undergone ideological change".¹⁵

⁹ For more details see Syed Abul'ala Maududi, *political theory of Islam, Khilafat wa Mulukiyat, Islam ka Siyasi Nizam etc; Constitution of JJK, Articles 3 and 4.*

¹⁰ An interview with *Ashique Kashmiri*, Srinagar, 02.10.2013.

¹¹ The Constitution of JJK, Article 5.

¹² Azan, 11 & 17 June, 1975

¹³ Syed Ali Shah Geelani, *Deed wa Shanneed* (Srinagar: Tulu' Publications, 2006), p. 35.

¹⁴ For more details see Syed Abu A'la Maududi, *Tahreek-i-Islamika Aayindah Layhe Amal* (Lahore: Islamic Publications Private Limited, n.d, n.p), cited in Azan, 5-11 February, 1987.

¹⁵ An interview with Ghulam Muhammad Bhat, Srinagar, 14.10.2013.

The party for the first time participated in the Parliamentary elections of 1971. Since then it took part in every elections up to 1977 held in the state including the Assembly elections of 1972, Bi-election of 1975, Assembly election of 1977, and Assembly election of 1983. Subsequently, in 1987 it fought elections as a constituent of the *Muslim united Front (MUF)*.¹⁶

In the Parliamentary election of 1971, the Jama'at filed nomination for all the three seats in the Kashmir valley and one in Jammu for Doda constituency. The nominator form of Qari Saif-ud-Din from Srinagar was rejected. All the remaining three candidates of Jama'at were defeated by the *Congress* candidates. Jama'at-i-Islami alleged that their candidates lost because of large scale rigging in the elections.

In the Assembly elections of 1972, Jama'at contested 22 seats and won 5 of them. It polled 98985 votes out of a total of 139006 votes cast, which work out to be 7.18% of total polled votes in the whole state. The winners included, Qari Saif-ud-Din (who contested the election from the Jail) from Khanyar constituency (Srinagar), Syed Ali Shah Geelani from Sopore seat in District Baramulla, Ab. Razak Mir from Kulgam constituency (Anantnag) and A. M. Dar from Nandi constituency (Anantnag).¹⁷

In 1975 an important accord was signed between Indian Prime Minister Indira Gandhi and Sheikh Mohammad Abdullah as a result of which Sheikh Mohammad Abdullah became the Chief Minister of state, however, with the support of the Congress majority in the legislature. For securing the membership of assembly, he had to contest Bi-elections in which the Jama'at was the only party to stand against him and his associate Mirza Mohammad Afzal Beigh (Deputy Chief Minister). The two were contesting from Ganderbal and Devsar constituencies respectively. In this Bi-election the Jama'at lost badly and both their candidates could not even save the securities. At the end, it accused the Government of mass rigging of votes and harassing Jama'at activists.¹⁸ Qari Saif-ud-Din, one of the prominent leaders of Jamaat said, "We were just returning from the electoral fields of Ganderbal and Devsar in the mid-night of July 4, 1975 and found that our offices were looted and locked up by the Government and our workers were rounded up. We could not account for this sudden development but soon we discovered the reason; we had been found guilty of challenging the ruling party in the electoral battle and as such we could not spare".¹⁹

The party could not fight the Parliamentary elections of 1977 because it stood banned. However, it fielded an independent candidate, Abdul Razak Mir, in the Anantnag constituency, who lost to the Congress candidate, Mohammad Shafi Qureshi, by a margin of 8331 votes. Another independent candidate fielded by the party from Baramulla constituency was Syed Ali Shah Geelani, while he was himself behind the bars. He got 100202 votes but lost to his rival Abdul Ahad Wakil of 'National Conference' by a margin of 47020 votes.²⁰

In March 1977, Indira Gandhi withdrew the emergency and called general elections. She was defeated. Now wearing the mantle of political martyrdom, the Jama'at sought to capitalize on the new situation. At this time Mirwaiz Molvi Farooq supported Janta Party. Jama'at fought this election on its own. Main contest was between Janta Party and National Conference, where as Jama'at was a peripheral actor.

Islam, leaders of the National Conference insisted, would be in danger if the Jama'at-Janta alliance came to power. Mirza Afzal Beigh, Abdullah's key deputy, would often open a green handkerchief containing Pakistani rock-salt as opposed Indian sea salt signaling support for that country. National Conference cadre administered oaths on Quran to potential voters, while clerics were imported from Uttar Pradesh and Bihar to campaign in Muslim majority areas of Jammu.²¹ These were the methods adopted by National Conference for their vote bank as the general atrocities in the emergency period had raised a kind of wave against National Conference. The green handkerchief symbolized color of Islamic flag and also of Pakistan and showing Pakistani rock-salt was a move to pretend their Pakistani inclination against India for which an attempt was made by National Conference to use the sentiments of the people in their own favor.

It paid off: the National Conference won 47 out of 75 seats in the Jammu and Kashmir assembly, a decisive majority. Moreover, the National Conference secured over 46 percent of the popular vote, an exceptionally high proportion in Indian elections. By contrast, the JJK could secure just one out of 19 seats it contested and received only 3.59 percent of the statewide vote, this was a performance poorer than even that of the fledgling Janta Party, which picked up 13 seats in Jammu and secured 23.7 percent of the popular vote.²²

The election manifesto of Jama'at-i-Islami reminded its struggle against undemocratic trends in the state and reiterated that "Jama'at wants to ensure the freedom of press and platform within moral bounds and considers democracy meaningless without fundamental human rights being guaranteed to the people, without any discrimination."²³

The Assembly elections of 1983 in the state uprooted the political image of the Jamaat-i-Islami. It fielded 26 candidates for the assembly elections, but all of its candidates were defeated. The prominent leader of the party Syed Ali Shah Geelani lost to Hakim Habibullah of National Conference nominee from Sopore constituency, a stronghold of Jamaat in the state. In four constituencies the candidates of Jama'at got second place the other important leader who lost was Gh. Nabi Nawshehri from Idgah (Srinagar) constituency, Gh. Mohammad Sofi (Safi) from Baramulla constituency, Ab. Razak Mir and S.G. Hassan from

¹⁶V.B.Singh, S.Bose, *State Elections in India, Data Handbook on Vidhan Sabha Elections* (New Delhi: Stage Publications, Vol.1, 1987), pp.161-165.

¹⁷ Ghulam Nabi Lone, "The Role of Jama'at-e-Islami in the Politics of Jammu and Kashmir (1972-1989)" (M. Phil. Dissertation, 1993, Political Science Department, University of Kashmir), p.82

¹⁸ S.N. Kaul, *Dynamics of Kashmir Politics* (New Delhi: Rajat Publications, n.d), p.306.

¹⁹ Singh, op. cit., p. 517.

²⁰ Praveen Swami, "Jamaat in retreat" in *Frontline*, Vol. 25, Issue 05, March 2008, p. 42.

²¹ Ibid.

²² Ibid.

²³ Azan, 22 June, 1977.

Anantnag District. Though no candidate of the party won the election but the percentage of its votes increased to 3.88% of polled votes which was more than the percentage of 1977 Assembly elections, in which it had won one seat.²⁴

The 1987 Assembly elections were different from the early elections held in the state, that election was fought between two different alliances i.e. National Conference (F) Congress (I), combine and Muslim United Front (MUF) – a combination of many religious oriented groups. The important constituents of the Muslim United Front were, Jamaat-i-Islami, Umat-e-Islami of Dr. Qazi Nisar, Jameit-i-Ahl-i-Hadith, and a faction of *Shia* Muslims led by Maulana Abbas Ansari.

During the election, the Muslim United Front got as much as 18.9% of the total votes polled in state. Interestingly, in the valley it secured as high as 31.9% of the total valid vote's cost.²⁵ In terms of seats the Muslim United Front (MUF) won only four seats.²⁶

However, JJK could not do well in any of the elections it contested. JJK alleged election rigging on the part of the ruling Government responsible for it. The last election it fought was under Muslim United Front (MUF) – a combination of many religious oriented groups. The important constituents of the Muslim United Front were, Jama'at-i-Islami, Umat-e-Islami of Dr. Qazi Nisar, Jamaat-i-Ahl-i-Hadith, a faction of *Shia* Muslims led by Maulana Abbas Ansari.

Nevertheless, it is an established fact that 1987 was rigged election. Former National Conference leader and Member Parliament Abdul Rashid Kabuli said on 29 September 2013 that the 1987 Assembly elections in Jammu and Kashmir were rigged. Kabuli, who was the former election campaigner of the National Conference, said, "The Muslim United Front participated in the elections. But the elections were rigged. I am witness to the fact that today's biggest militant commander (United Jihad Council Chief) Syed Salah-ud-Din who participated in 1987 elections had won his assembly seat but he was forced to accept defeat".²⁷ A leader of the Congress Party at the time, Khemlata Wukhloo, recalls: "I remember that there was a massive rigging in 1987 elections. The losing candidates were declared winners. It shook the ordinary people's faith in the elections and the democratic process."²⁸

During the election, In terms of seats the Muslim United Front (MUF) won only four seats owing to the massive rigging in the elections.... This disappointed those who so far had high hopes from elections..... The rigging of election in 1987 changed the entire political discourse of Kashmir. This thing brought a paradigm shift in the political climate of Kashmir and had a direct impact on the politics of JJK as well. The impact it had on the JJK and its policy and politics vis-a-vis Kashmir issue goes for a totally new study and not the field of study in present research, keeping in view the time period of the present research.

III. Jama'at's Role through Electoral Politics:

The JJK acted as a strong political pressure group against the ruling state Government (especially post 1970s) by highlighting the Government failures while meeting out the democratic and fundamental necessities of the masses. JJK highlighted such things in their various conventions, meetings, public conferences, resolutions, Azan and even inside state Legislative Assembly. Few instances are as follows.

The JJK Assembly group leader, Qari Saifuddin in a written press note on 14th May 1975, while criticizing State Government's policy of rising prices of commodities asserted that Government should before hiking the prices keep in view purchasing power of the people of the state.²⁹ On 7 June 1975, *Amir-i-JJK*, Sa'uddin in his press release asserted that the Kashmiri masses irrespective of their religions should support principles rather than persons and added that the present State Government has failed in its promises of curbing corruption.³⁰

Syed Ali Shah Geelani, the then M.L.A Sopore of JJK on 25 June 1975, in his written press release criticized the state Government for mishandling the food problems faced especially by poor or middle class people in District Baramulla, which he had observed after visiting its various areas such as Lolab, Kupwara, Trigam, Kralpora, Ramyal, Baramulla, Sopore, Bandipora and Sonawari. He also exerted a serious concern on the sorry state of affairs pertaining to Government reaction in dealing such crises as the affected masses of Baramulla who had gathered in procession to draw the attention of masses were severely dealt with by police by using 250 tear gases. Geelani appealed to State Government to distribute rice and other necessity food stuff to affected area.³¹ Similarly, on 9th July, in a one day public conference of JJK at Dooro, Syed Ali Geelani criticized State Government for promoting corruption.³² Syed Ali Geelani while speaking on the bill of illegal constructions, in the Assembly, criticized ruling party's policies in curbing it.³³

On 16 August, 1988, in a Monthly meeting of District Baramulla Management of JJK at District office Sopore, under *Amir-i-Zillah* (Head of a District), while discussing the State Governments negligent and favoritism policies pertaining to

²⁴ Singh, op. cit., p. 151.

²⁵ S. Bhatnagar, Pradeep Kumar; *Geo-Regional Political Parties in India* (New Delhi: Ess Publications, 1988), p.19.

²⁶ Ibid.

²⁷ Greater Kashmir, Srinagar, Monday, 30 September, 2013.

²⁸ "Kashmir's Flawed Elections," BBC News World Edition, South Asia, Saturday, 14 September, 2002.

²⁹ Azan, 15 May 1975.

³⁰ Ibid, 8 June, 1975.

³¹ Ibid., 26 June, 1975.

³² Ibid., 10 July, 1980.

³³ Ibid., 18 August, 1988.

common issues of the people, a resolution was passed demanding solution of increasing unemployment from the state Government.³⁴

JJK also highlighted the responsibilities and lapses on the part of Government through the editorials of official organ Azan in which failure of State Government's policies in curbing dishonesty, corruption, unemployment, starvations at the time of floods; ruling party's election rigging and its tactics of favoritism and partiality towards their own agents and followers; and its malfunctioning in fulfilling basic necessities to the masses like drinking, electricity etc used to be highlighted.³⁵

Thus, Jama'at used electoral politics as an effective tool to sanction for itself an effective political place for pursuing its goal of Islamism.

IV. Jama'at: A Political Threat for State:

No doubt, participation in electoral politics did fetch certain fortunes for JJK, but, it was not always a bed of roses. As a result of Jama'ats' basic ideology of *Iqamat-i-Din* (establishment of an Islamic state), advocating Islam as a system and emphasizing that Islam and politics are inseparable, and for vehemently rejecting and opposing all political models other than Islam, JJK was always considered a threat by the state. As a result, JJK had to face State repression from its very inception.³⁶ As in the words of Syed Ali Shah Geelani (who became the member of JJK in 1949):

From 1947-1953, When Sheikh Abdullah was busy in crushing those who challenged state's accession towards India and those who supported accession towards Pakistan, JJK was no exception to his atrocities as JJK stand on the Kashmir issue from the very beginning had been that it was disputed. Sa'duddin was suspended from his Government post and deprived of gazetted post which he deserved. Further, When Sheikh Abdullah was put behind bars in 1953, then Bakshi Gulam Muhammad tried to bribe JJK members including me, which I totally denied and when JJK members supported plebiscite movement we were jailed on several occasions for example in 1962 and 1965.³⁷

However, JJK became the more target of the state as well as central Government especially after they came in the electoral politics. According to Qari Saifuddin, before JJK participated in the elections Sheikh Abdullah used to speak highly about the educational programme of the Jama'at which included mainly the network of its schools. But once JJK participated in elections he considered them as his political rival.³⁸

The Government of India has regarded Jama'at-i-Islami as a major challenge to its position and principles in the state. From time to time the state government at the instance of Central Government tried to contain the activities of Jama'at-i-Islami. The party was banned in 1975 and in 1990. The JJK was banned at the time of emergency imposed by Indira Gandhi and its schools were also banned on the pretext that sectarianism is propagated. Finally, the state sponsored election rigging in 1987 election acted as the last nail in the coffin. No doubt, the betrayal through State sponsored election rigging forced Jama'at to leave the arena of electoral politics, but who knows; in the impending times they may again switch to electoral politics to chase their goal of Islamism.

V. Conclusion:

Thus, it can be concluded that theoretically there may be disharmony between Islamism and electoral politics, but on realistic grounds there seems concordance between them. The case study of Jama'at-i-Islami vividly proves this point. Despite, categorically criticizing the modern secular democracy and its ingredient of electoral politics, Jama'at, practically, did adopt the 'antagonist' system from 1971-1987. Electoral Politics was used by them as means to end i.e., Islamism. Through this method, they not only acted as political pressure group against the ruling Government, but also widened their base among the people, thus, trying to make their road towards Islamism more secure. Even though mass election rigging forced Jama'at to detach from electoral Politics, however, their chances of adopting it in the demanding times cannot be ruled out.

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³⁴ JI District Baramulla Resolution, 16 August 1988, quoted in Azan, 18 August, 1988.

³⁵ Azan, editorials, 25 Jan. 1975; 13 August, 1977; 11 September 1980; 23 Feb. 1984; 19 Apr. 1984; 15-21 Oct. 1987; 22-28 Oct. 1987; 19 Jul. 1988; 27 Aug. 1988 etc.

³⁶ The details of initial State repression of the founders of JJK have already been discussed in Chapter 2, while discussing the biographies of its founders.

³⁷ Syed Ali Shah Geelani, *Deed waShaneed*, op. cit., pp. 31-33.

³⁸ Bisati, op. cit., p. 40.

Big Data and E-Learning

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Abstract

Research related to information, retrieval on web has come a long way in influencing today's techniques to extract data. Application of big data with e-learning has been creating a huge impact in education system. In current trends social media plays a vital role with respect to e-learning system. The effective usage of information totally lies with the way the learners and the learned utilize these data. The paper provides few impact and consequences of Big Data in ELearning.

Keywords: Big data , E-learning , feedback , personalisation ,data , trends

Introduction BIG DATA?

“Big Data” means enormous volumes of data. The data can be divided as structured data and unstructured data. Various methods are applied to collect these data. As the usage grows data gets piled up enormously. These data can be analyzed and designed in such a way to fit the institution or e-Learning professionals. With the availability of data, opportunity can be created to determine how the e-learner can acquire various information for problems that may exist. Advanced computing technologies and with other technical tools the data can be tailored for specific usage which benefits the requirement. Big data are used for studying the trends of the industry, user behaviour pattern by applying logical association within data set. Both big data and analytics play a vital role which impacts e-learning.

Sources of data for e-Learning

Structured and unstructured data can be collected from various sources. Internet forms a main source of information with respect to e-learning. For example data can also gets created during an e-Learning sessions or training module. Other form of data are also resourced from email, facebook, twitter, instagram, learning management system like online learner performance, online Learner Feedback, assessment results, website analytics, surveys, interviews and to much more. E-Learning proves to be an excellent way to achieve quality results within a shorttimeframe.

To Study the relationship between e-Learning and Big Data

With a clear understanding of idea between e- Learning and Big Data their impact and their consequence can be studied. e-Learning is a process that is based on various instructional design models (IDM) principles. Various methodologies and practices, depend extensively on the computing technology used. Trends in modern education consist of distance learning, virtual classes and cloud-based knowledge sharing etc. IDM Principles are tested to improve their pedagogical effectiveness by reducing external loads that possibly affectlearning.

Due to Online study and e-learning trends, traditional class room method are getting replaced. The impact and consequence of these trends throw a challenge to universities and institutes in dealing with the ever-growing learner data. Learner data analysis from cognitive, emotional and behavioural perspectives, largely benefit the e-learning industry.

I. Providing Invaluablefeedback.

Online surveys and discussions offer feedback regarding the effectiveness of e-Learning courses and modules. The consequence of Big data gives to e-Learning professionals the chance to receive invaluable feedback. These feedbacks can be used to give the status of the learner, and the e-Learning course itself which, may need to be improved. Thus the consequence of the invaluable feedback provides an impact on the learner as well as the faculty. This impact will give rise to improvement of thecourse.

II. Allowing e-Learning professionals to design more personalized e-Learning courses.

e-Learning professionals are given the opportunity to know about the learners by acquiring information and by

specifying the works which will be best for the learner. In terms of content delivery the result given will impact with more personalized e-Learning courses

III. Targeting effective eLearning strategies and eLearninggoals.

Big data in e-Learning gives a complete in depth look at which e-Learning strategies are working. It identifies the working and non working strategies which in terms help to achieve the goal of e-Learning.

IV. Tracking learnerpatterns.

Big data, e-Learning professionals gain the rare ability to track a learner throughout the entire process therefore, from the start to the finish. This tracking helps to predict the pattern of the e-Learner. By predicting

patterns of the e-Learner behaviours of the individual learner can be studied. In spite of the impact of prediction the consequence is that the predictive analysis is applied to the whole group of learners.

V. Expanding the understandingofthe eLearningprocess.

With enormous data, e-Learning professionals, it's essential that learning acquiring and digesting knowledge is vital. Big data gives the chance to gain an in depth understanding of the e-Learning process. It also finds the learners response to the eLearning courses that were delivered to learners. This information can then be used to take the e-Learning strategies to the next level.

Future Support From Big Data

Few ways Big Data is expected to help education in the near future:

- a) **With Feedback:** Big learning data can be informative from a feedback and context perspective.
- b) **With Personalization:** Big Data will change the way to approach e-learning design thereby enabling developers to personalize courses that caters the learner's needs. This will allow e-learning professionals to continue with quality e-learning courses.
- c) **With Efficiency:** Big Data can save time and effort when it comes to realizing the goals and the strategies needed to achieve.

Recommendations

"The problem with learning data, historically, is that we've always gone for the low-hanging fruit," says Elliott Masie for the American Society for Training and Development[23]. *"Learning professionals have collected inexpensive, easily acquired data from people while they are in our domain, usually the classroom or program. In a big learning data world, we will need to rethink our data sources."* says Elliott Masie, American Society for Training and Development[23].

Ideas to be considered for e-learning using big data are:

1. **BeingTransparent.**
2. **Maintaining thePrivacy.**
3. **Value to thelearner.**
4. **Depth ofmeasurement.**
5. **Cost.**
6. **Other factors influencinglearning.**
7. **Presentingdata.**
8. **Readiness.**
9. **Infrastructure**

Technology is revolutionizing the way learning and development practitioners do their work. Leveraging big data is the next logical step in the process of evolution. Having access to volumes of data, and clear understanding the association among them it is easy to know the dos and don'ts. Thereby going forward, the need to recognize their potential and their risks are important.

Conclusion

E-learning is now the technology widely spreading By trying to implement the recommendation to get better impact analysis and to keep the consequence in track. Moreover practical implementation will provide a better understanding towards e-Learning impact and consequence. Students will avail this opportunity to maximize the usage of e-learning rather the same lecture classes since learning is made easier, faster, cost effective and reliable. Various statistical test might throw light on the

impact of big data in e-Learning. In near future Big Data will have a great impact on e-Learning.

Reference

- [1] E. AbuKhoussa and Y. Atif (2014), "Big learning data analytics support for engineering career readiness," Interactive Collaborative Learning (ICL), 2014 International Conference on, Dubai, 2014, pp. 663-668.
- [2] Banavar, G.S. (2015), Watson and the era of cognitive computing, in Proceedings of the 2015 IEEE International Conference on Pervasive Computing and Communications (PerCom), 95-95.
- [3] Coccoli M., Guercio A., Maresca P. and Stanganelli L. (2014) "Smarter Universities: a Vision for the Fast Changing Digital Era", in Proceedings of 20th International Conference on Distributed Multimedia Systems (DMS2014)
- [4] Coccoli M., Maresca P., Stanganelli L. (2012) "Cognitive computing in Education", Journal of e-Learning and Knowledge Society (Je-LKS), Vol. 12, n. 2, May 2016, pp. 55 – 69.
- [5] Ferguson, R. and Buckingham Shum, S. (2012). Social Learning Analytics: Five Approaches. LAK 2012.23--33.
DOI: 10.1145/2330601.2330616
- [6] Gašević, D., Dawson, S., & Siemens, G. (2015). Let's Not Forget: Learning Analytics are about Learning. *TechTrends*, 59(1), 64--71. DOI: 10.1007/s11528-014-0822-x
- [7] Holtel, S. (2014), More the end of information over now: how IBM Watson turn upside down our view on information appliances, in Proceedings of the 2014 IEEE World Forum on Internet of Things (WF-I.T), 187-188.
- [8] Coccoli M., Maresca P., Stanganelli L., and Guercio A. (2015) "Teaching Computer Programming in a Platform as a Service Environment", in Proceedings of 21th International Conference on Distributed Multimedia Systems (DMS2015)
- [9] Riffai M. M. M. A., Duncan P., Edgar D. and Al-Bulushi A. H., "The potential for big data to enhance the higher education sector in Oman," 2016 3rd MEC International Conference on Big Data and Smart City (ICBDSC), Muscat, Oman, 2016, pp.1-6. doi: 10.1109/ICBDSC.2016.7460346
- [10] Sundararajan, S.C. and Nitta, S. (2015), Designing engaging intelligent tutoring systems in an age of cognitive computing, *IBM Journal of Research and Development*, 59(6), pp. 1-9.
- [11] Vozniuk, A., Govaerts, S., & Gillet, D. 2013. Towards Portable Learning Analytics Dashboards. *ICALT 2013*, IEEE, 412--416. DOI: 10.1109/icalt.2013.126
- [12] West, D. 2012. Big Data for Education: Data Mining, Data Analytics, and Web Dashboards. *Governance Studies at Brookings*, pp. 1-10.
- [13] Youdou,
<https://www.youtube.com/watch?v=LiOI07dQVTI>
- [14] Colazzo, L.; Molinari, A.; Villa, N.; , "Collaboration vs. Participation: The Role of Virtual Communities in a Web 2.0 World," *Education Technology and Computer, 2009. ICETC '09. International Conference on*, vol., no., pp.321- 325, 17-20 April 2009
- [15] edbrix, <http://www.edbrix.com/single-post/2016/05/05/Role-of-Big-Data-and-Analytics-in-Elearning>
- [16] elearningindustry, <https://elearningindustry.com/big-data-in-elearning-future-of-elearning-industry>
- [17] elearningindustry <http://tech.co/top-8-elearning-trends-for-2016-2016-05>
- [18] Kerry Blinco, Jon Mason, Neil McLean, Scott Wilson – "Trends and Issues in E-learning Infrastructure Development", July 2004
- [19] Joe Pulichino - "Current Trends in e-Learning" - Research Report, March 2005
- [20] Alexandros Paramythi and Susanne Loidl-Reisinger – "Adaptive Learning

Role of Learning in Achieving Competitive Advantage of State Corporations: An Evaluation of State Corporations in Kenya

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Abstract-Despite overwhelming theoretical suggestions that organizational learning is strong positive determinant of competitive advantage, little empirical work exists to this theoretical underpinning. The relative absence of such research does not motivate leaders, managers and employees to adopt learning initiatives. This study examined the role of organizational learning in achieving competitive advantage of State Corporations in Kenya with a focus on organization's learning culture, learning processes, systems thinking among state corporations. The study employed a descriptive, cross-sectional research design and used both quantitative and qualitative methods to gather data from 198 staff from 35 state corporations comprising of senior managers, middle manager and non-management staff. Regression analysis was used to make inference on the associations between the dependent and independent variables using SPSS Version 22. Qualitative was analyzed using ATLAS.ti. Results from both simple and multiple linear regression revealed that each of independent variables was positively and significantly associated with competitive advantage. Both formal and informal learning processes that maximize utilization-focused knowledge acquisition and sharing approach are encouraged. To ensure staff or fully engaged in the learning process, organizations need to invest in building capacity of new and existing employees and partners to encourage reflective practices within the organization. Longitudinal studies can help strengthen similar future studies.

Index Terms- Organizational Learning, Learning Processes, Culture, Competitive Advantage

I. INTRODUCTION

Organizational learning is largely theorized for its role in improving performance and competitiveness of organizations. Senge (1990) argued that the speed of organizational learning may become the only sustainable source of competitive advantage in the future. Garvin, Edmondson, & Gino, (2008) concurred by noting that higher rate of learning is positively associated with competitive advantage. In essence, a learning organization purposefully designs and constructs its structure, culture and strategy to enhance and maximize the potential for organizational learning to take place (Dodgson, 1993; Fang et al., 2010). Learning organizations are seen to adapt to unpredictable environments more quickly than their competitors. "how difficult the learning process is, even with

built-in intent (Kransdorff, 2006)". Organizational Learning efforts are no longer merely an option but rather a core necessity for organizations anywhere in the world, if they have to compete successfully (Singh and Kant, 2008).

Empirical studies have demonstrated the significant role that learning plays in fostering performance in various industries and sectors. For example, the public sector (Ferguson et al., 2013), non-governmental organizations (Corfield et al., 2013), banking industry, (Oluikpe, 2012), small- to medium-sized enterprises, (Durst and Edvardsson, 2012), manufacturing organizations (Birasnav and Rangnekar, 2010), and human service and professional services firms (Palte et al., 2011); and life insurance business (Huang et al., 2011). These studies have clearly shown that learning is an important determinant of organizational success measured by superior performance and competitive advantage.

Despite the clarity and consensus that organizational learning leads to competitive advantage, adoption of learning practices are still low among organizations, particularly for state corporations. This low adoption is partly blamed on inadequacies in past research which have not sufficiently furnish managers with concrete prescriptions on how to become a learning organization, have targeted the partial audience by focusing only chief executives and excluded departmental managers and non-managerial staff. For the Kenyan context, state corporations have been left out of most research even though they are tasked to drive economic growth in highly dynamic and unpredictable environments, that requires them to compete. So, this study is aimed to contribute to the literature by examining the relationship between organization learning and competitive advantage. It will build on the work of other authors, (Garvin et al., 2008; P. Senge, Art, & Roberts, 2001; P. M. Senge, 1990), by exploring the mechanism through which organizational learning variables (organizational culture, learning processes and systems thinking) to influence competitiveness of state corporations. The study addressed the following research questions:

- a) How does the efficacy of organization's learning culture affect competitive advantage of state corporations?
- b) What is the effectiveness of learning processes in fostering competitive advantage of state corporations?
- c) What is the relationship between systems thinking and competitive advantage of state corporations?

This paper follows the following structure: Section 2 presents literature reviewed and research hypotheses. Section 3 contains research methodology to test hypotheses and sets results of data analyses. Section 4 brings together the implications, limitations, and directions for future research.

II. LITERATURE REVIEW

2.1. Theoretical Review

2.1.1. Competitive Advantage

Rationale for state corporations to seek and gain competitive advantage is deeply rooted in the dynamic and challenging environment under which they operated. Increasingly, state corporations are facing fierce competition from each other, and from a vibrant and innovation-minded private and civil society organizations (Buheji, n.d.). A highly educated and quality driven public continues to demand more efficient and effective goods and services from all business actors in equal measure. The legal and political environment has become less favorable for state corporations as they no longer operate as monopolies. They compete under relatively the same legal context as the private and civil society sectors. Furthermore, the perception or negative reporting on corruption has worsened among public institutions during the past decade making it difficult for state corporations to assure the public of quality services and fair cost. For example, in 2016 Kenya was ranked 139 out of 168 indicating a high perception of bribery within the country. These corruption perception indices further erode public trust and complicate efforts of state corporations to grow their market share. These circumstances have triggered state corporations to actively engage in the search of a solution that will accord them a competitive advantage to guarantee their success in the market place.

In pursuit of competitive advantage, researchers offer useful theoretical propositions. The resource-based view theory of competitive advantage posits that firms are bundles of resources and capabilities and that a firm can gain competitive advantage based on its unique set of resources (Barney, 1991). Those resources are valuable, rare, perfectly inimitable and non-substitutable and a firm's potential for competitive advantage also requires a firm be organized to exploit its resources and capabilities (Barney, 2007). The fact that resources must enable the creation of value and must also resist the duplicative efforts of competitors suggests that firms are bundles of resources and capabilities. In conditions of open competition, rival firms will seek to imitate, acquire or try to substitute for the resources that are a source of advantage. Organizations facing uncertain, changing or ambiguous market conditions similar to those experienced by state corporations need to be able to learn. Theories posit that organizational learning can help firms amass and use these kinds of resources and capabilities. For example, Karash (2002) identified the organizational learning concept as a resource-oriented approach that is based on the ability of the organization to turn standard resources that are available to all into competences that are unique and non-imitable by competitors.

2.1.2. Organizational Learning

The concept of organizational learning is a well-researched topic in a range of academic disciplines from economics, management science, psychology and sociology to anthropology (Easterby-Smith and Lyles, 2011). Senge, (2006) describes organizational learning as 'the changing of organizational behavior' which occurs through a collective learning process. Organizational learning is a unique resource that is critical in today's dynamic and discontinuous environment of change and a crucial determinant of competitive advantage (Garvin, Edmondson, & Gino, 2008). Organizational learning emphasizes the development and application of new knowledge that has the potential to change employees' behavior which is ultimately tipped to strengthen the organization's competitive position. A learning organization uses management philosophy based on knowledge and understanding, as opposed to fear, for the complexity of the real world. Therefore, organizational learning has the potential to promote a sense of empowerment in the workforce that motivates them for continuous learning (Bryson et al., 2006).

For learning to be fully entrenched in the organization, it has to happen at multiple levels. Argyris and Schön, (1978) notes that organizations learn through individuals acting as agents for them and individuals' learning activities, which in turn are facilitated or inhibited by an ecological system of factors. Gareth Morgan, (1986) points out that organizations cannot, themselves, learn; it is the individuals within them who learn. Evidently, there is more to a learning organization than simply a collection of individuals who are learning. Swieringa and Wierdsma (1992) define organizational learning as 'the changing of organizational behavior' which occurs through a collective learning process. They note that individual learning is a necessary but not a sufficient condition for organizational learning. Learning organizations are organized in such a way that learning is a prominent feature at a number of different levels: individual learning; team or work group learning; cross-functional learning; operational organizational learning; and strategic organizational learning (Britton, 1998).

Organizational learning manifests itself in various ways depending on the focus of learning. Single loop learning focuses on fixing errors in the current system while double loop learning which goes a level here to question the policies and procedure rather than focusing only on error correction (Linz & Resch, 2010; Witherspoon, 2014). Single-loop learning involves detecting and correcting 'errors' so that the organization can continue to achieve its present policies or objectives in more efficient ways. In single-loop learning, outcomes are measured against organizational norms and expectations. According to Senge, (1990), Single-loop learning focuses on doing things in the right way without necessarily questioning whether they are the right things to be done. It explores more productive ways, doing it cheaper, using alternative methods or approaches for the same objectives. On the other hand, double loop learning not only requires changes in the rules and procedures of the organization but may also question the underlying assumptions and principles that form the basis of the rules and procedures.

The implications of double loop learning are possibly far-reaching and may even lead to what has been called triple loop learning which involves challenging the organization's principles and assumptions, requiring an open and often robust exchange of views (Peeters & Robinson, 2015).

2.1.3. Relationship Between Organizational Learning and Competitive Advantage

The effect of organizational learning on performance was initially demonstrated by the learning curve model from an industrial organization's economics perspective. Barney, (2007) argued that in some circumstances, firms with the greater experience in manufacturing a product or service will attain lowest costs in an industry and, thus, will acquire a cost-based advantage. Beyond manufacturing sector, the learning curve-cost advantage association can be associated with many business functions, from purchasing raw materials through distribution and service. The Boston Consulting Group (BCG, 1970) estimated learning curves for over 20 industries and demonstrated how firms can take cost advantage by having more operating experience. Although the industrial organization economics perspective demonstrates the importance of organizational learning to a firm's gaining a cost advantage, the model has been criticized for being silent on the mechanisms by which experience leads to cost advantage and why some firms learn better than others.

Strategic management literature discusses the link between organizational learning and competitive advantage from the resource-based view (RBV) of the firm. The RBV posits that organizations can gain sustained competitive advantage through amassing and using strategic resources and capabilities, which are valuable, rare, difficult to imitate and non-substitutable (Barney, 1991). And a firm's potential for competitive advantage also requires a firm be organized to exploit its resources and capabilities (Barney, 2007). On one hand, organizational learning is believed to be able to help firms amass and use these kinds of resources and capabilities. For example, Karash (2002) identified the organizational learning concept as a resource-oriented approach that is based on the ability of the organization to turn standard resources that are available to all into competences that are unique and cannot be easily copied by competitors (Karash, 2002). On the other hand, recent literature suggests that organizational learning is an idiosyncratic and complex capability, which is difficult to imitate, replicate and transfer and which constitutes a source of competitive advantage (Pralhad and Hamel, 1990; Grant, 1996; Simonin, 1997; Lei et al., 1999).

Although organizational learning is widely accepted as an essential element to successfully compete in a marketplace, various factors hinder organizations from building a learning organization. Senge (2006), identifies three barriers, including; the lever, which refers to the inability of organizations to understand the complexity and thus unable to target specific points within the system that would bring tremendous benefits; learning disability, which comprises of seven learning disabilities among individuals within organizations that hinder them from learning thus impacting the rate and quality of organizational learning and; prisoners of our thinking, which is fueled by lack of

knowledge. Garvin et al. (2008) further identified what they considered as barriers to learning in organizations. These include the fact that managers do not know the steps for building a learning organization, they lack tools to assess whether their teams are learning or how that learning is benefiting the company. Zhou, Hu, & Shi, (2015) further noted that the components of organizational learning in the literature are still descriptive due to the multi-dimensional nature of the construct.

To address the aforementioned barriers, authors, both from a strategic management perspective and from an organizational theory perspective, stress different characteristics of organizational learning, for example, open communications by Philips (2003), risk taking by Appelbaum and Reichart (1998) and Richardson (1995), support and recognition for learning by Bennett and O'Brien (1994), team learning by Anderson (1997) and Senge (1990a) and knowledge management by Loermans (2002) and Selen (2000). Argote (2011), however, conceived organizational learning as having three sub-processes: creating, retaining and transferring knowledge. Some empirical studies provide support for the relationship between organizational learning and firm performance (Day, 1994; Slater and Narver, 1995). Ellinger et al. (2002) suggests a positive association between learning organization practices and objective firm financial performance.

Senge, (2006), points out five key competencies or 'disciplines' that he suggests all leaders must have to build and lead a learning organization. These competencies are personal mastery, mental models, shared vision, team learning and systems thinking. Personal mastery is to do with 'self-awareness' and is based on the premise that organizations grow because the people in the organizations are themselves growing. It assumes that individuals must learn for organizations to learn and it is reflected in one's drive towards continuous improvement by learning. Mental models look at the process and outcome of surfacing deep-seated beliefs, values, and assumptions that determine the way people think and act. Garvin et al., (2008) proposed three foundational blocks for building a learning organization. These are a supportive learning environment, concrete learning processes, and leadership that reinforces learning. A supportive learning environment gives organizations an opportunity reflecting in the action and encourages thoughtful review of the organization's processes (Akhtar, Ahmed, & Mujtaba, 2013). Concrete learning processes ensure that a team or company has formal processes for generating, collecting, interpreting, and disseminating information.

2.2. Empirical Studies on OL and Competitive Advantage

Researchers have invested the past decade in determining whether and how organizational learning affects performance and competitiveness of organizations. These researches focused on the theorized variables of learning culture, learning processes and systems thinking. For example, the public sector (Ferguson et al., 2013), non-governmental organizations (Corfield et al., 2013), banking industry, (Oluikpe, 2012), small- to medium-sized enterprises, (Durst and Edvardsson, 2012), manufacturing organizations (Birasnav and Rangnekar, 2010), and human service and professional services firms (Palte et al., 2011); and

life insurance business (Huang et al., 2011). This section reviews the works of these researchers.

2.2.1. Effect of Organizational Culture and Competitive Advantage

Many scholars have paid attention to the role played by culture in relation to corporate performance. Gordon&DiTomaso (1992) found that the strength of the organizational culture can predict the corporate performance. Dension& Mishra (1995) found that different cultural characteristics have different impact on organizational performance, leading to the conclusion that cultural differences can lead to competitive advantage. This conclusion was also reached by Chan (2004). Attempts have also been made at looking for specific cultural attributes that influence learning and competitive advantage of organizations. Garvin et al., (2008), identified psychological safety, appreciation of differences, and openness to new ideas as essential components of a supportive learning environment. Weihong, Caitao, & Dan, (2008) study showed that openness of the organizational culture had a significant impact on the enterprise sustainable competitive advantage. Culture is seen as a source of competitiveness due to its difficulty to imitate or duplicate (Fitzgerald, 1988; Mueller, 1996). This results from its inherent tacit nature, complexity and specificity (Reed and DeFillippi, 1990). Bwegyeme&Munene, (2015) study reinforced the importance of culture in influencing organization outcomes including problem-solving and performance. Mikkelsen et al. (2000) argued that a positive learning climate reduces job stress, and also had a direct and positive impact on job satisfaction and employee commitment. Theorists and researchers seem to agree that a culture which promotes open communication practices, prioritizes and promotes staff empowerment, supports supporting staff development and promotes team learning is likely to lead to competitive advantage. However, the evidence has not targeted state corporations in particular those in developing countries partly due to their perceived non-competitive nature. The study predicts that a learning culture will have a positive and significant effect on their performance of state corporations in Kenya in line with the following hypotheses:

H₀₁: There exists no relationship between learning culture and the competitive advantage of state corporations in Kenya

H_{a1}: There exists a relationship between learning culture and the competitive advantage of state corporations in Kenya

2.2.2. Effect of Learning Processes and Competitive Advantage

A learning organization is cultivated through a series of concrete steps and widely distributed activities, (Sokhanvar, Matthews, &Yarlagadda, 2014). Theorists have made efforts at explicating the learning processes essential to influencing learning and attaining competitive advantage. Garvin et al., (2008) consider learning processes to involve the generation, collection, interpretation, and dissemination of information. Learning processes include experimentation to develop and test new products and services; intelligence gathering to keep track of competitive, customer, and technological trends; disciplined analysis and interpretation to identify and solve problems; and education and training to develop both new and established

employees. USAID, (2016) presented a more comprehensive model, collaborating learning and adapting (CLA) model, which considers learning processes to include knowledge management, institutional memory and decision making. According the CLA model, KM processes include the process of acquiring knowledge internally and externally, distilling the knowledge and sharing knowledge internally and externally. Institutional memory includes the processes of accessing institutional knowledge, and managing of staff transitions. Decision-making include the awareness of decision-making processes, autonomy to make decisions and appropriate stakeholder involvement in decision making processes.

Empirical studies have been conducted and shown results in support of theory. Learning processes ensure that an organization and employees continually create, acquire, and transfer knowledge and use it to adapt to the ever-changing internal and external environment.To achieve maximum impact, Garvin, (2008) suggests that knowledge should be shared in systematic and clearly defined ways among individuals, groups, or whole organizations. Knowledge can move laterally or vertically within a firm. By implementing knowledge management processes as part of daily business activities, organizations can confidently compete and sustain in the competitive markets (Daud and Yusuf, 2008).Sangari, Hosnavi, & Zahedi, (2015)results also showed that knowledge management processes have a significant impact on supply chain performance. Considering the theoretical underpinning and the empirical support, the study predicts that learning processes will have a positive effect on competitive advantage of state corporations. The study poses the following hypotheses:

H₀₂: There is no relationship between learning processes and competitive advantage of state corporations in Kenya.

H_{a2}: There is a relationship between learning processes and competitive advantage of state corporations in Kenya.

2.2.3. Systems Thinking and Competitive Advantage

Senge (2006) made his contribution to organizational learning theory through his concept of systems thinking, which is viewed as an ability to discover structural causes of behavior. It is necessary for sustaining generative learning which is a foundation for people's creativity. Systems Thinking focuses on interrelationships between parts of an organization and emphasizes the importance of recognizing the effects of one level of learning on another. It shows the interrelated patterns within a business and enables people to see the whole organization instead of focusing only on the parts. Using a more holistic perspective, systems thinking helps people to solve problems with a context of a larger scenario instead of fixing the problem as a discrete activity. According to Prugsamat, (2010), systems thinking provides a means of understanding systems at a deeper level in order to see the paths available to bring about changes more effectively. A systems thinker is able to understand the interrelationship of activities happening inside the organization (Akhtar et al., 2013).

Empirical results show that systems thinking tends to have a positive effect on performance and competitiveness of petroleum

industry firms (Akhtar et al., 2013). Systems thinking can be taught, and as such, it should become a requirement for all employees to acquire for better coping with constant changes (Cooper, 2005). Systems thinking produces major impacts on organizational learning and change (Fullan, 2004). In fact, Kumar et al. (2005, p. 267) emphasizes that an individual must utilize systems thinking to become a decision-maker. Some organizations provide systems thinking training for their staff to improve the quality of their performance (Martin, 2005; Seligman, 2005). Kim, Akbar, Tzokas, & Al-Dajani, (2013) found that systems thinking had a positive effect in the absorptive capacity (ACAP) of high-tech small and medium-sized enterprises from South Korea with an overall impact on firm performance. They found that firms outperforming others in their ACAP also showed a clear element of systems thinking. Even though studies have alluded to its importance while discussing the organizational competencies necessary for competitiveness, systems thinking has not received significant attention, particularly in the public sector, where it may be most needed of the interdependent nature of these institutions. This study will assess the role of systems thinking in achieving competitive advantage among state corporations with a focus on the following hypotheses:

H₀₃: There is no relationship between systems thinking and competitive advantage of state corporations in Kenya.

H_{a3}: There is a relationship between systems thinking and competitive advantage of state corporations in Kenya.

Based on the analysis of theories and empirical work associated with learning and competitive advantage, the study proposes a conceptual framework that pits learning culture, learning process and systems thinking as the independent variables and competitive advantage as the dependent variable. These are not only considered as essential elements of a learning organization, but important preconditions in achieving competitive advantage. All the three factors are difficult to imitate due to their subtle nature. Figure one presents the schematic of the conceptual framework showing the hypothesized relationships.

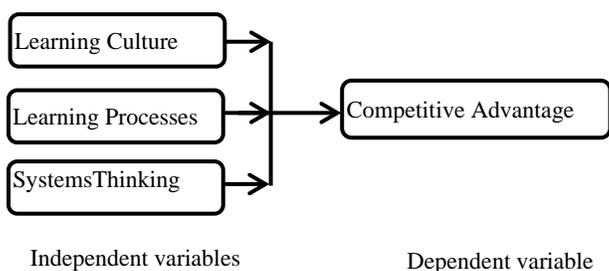


Figure 1: Conceptual Model of The Study

III. RESEARCH METHODS

3.1. Research Design

The study employed descriptive and cross-sectional research design to address the research questions. Descriptive designs

help determine the way things are with the subjects by providing answers to the questions of who, what, when, where, and how associated with a particular research (Cooper & Schindler, 2008; Saunders et al., 2015). To evaluate the relationships between the independent variables and competitive advantage, the study employed a correlational design. This type of design is recommended and has been used by various authors to determine whether or not variables are correlated by studying the joint variation of the hypothesized relationships, (Džini, 2015; Reich, Gemino, & Sauer, 2014; Saunders et al., 2015).

3.2. Target Population and Sample

The study population comprised of all 139 state corporations operating in Kenya as identified by that state corporations' advisory committee (SCAC). The SCAC is the official body mandated to advise on all matters pertaining state corporations by section 27 of the State Corporations Act, Chapter 446, (Government of Kenya, 2012, 2015). From the list of 139 state corporations, 53 fulfilled the selection criteria (operating in a competitive landscape, selling goods or services public, and mandated to make profits or surplus). Sample size determination formula by Cochran (1977), and procedures for categorical data was used to calculate a sample size of 40 state corporation. Table 3.1 shows the population, sampled organizations and number of staff targeted by sector. Three staff were targeted from every state corporation including one senior manager, one middle level manager and one non-management staff leading to a total of 240 staff.

Table 1: Population and Sample

Sector	Population	Sample	Staff
Finance	9	7	42
Tertiary Education and Training	5	4	24
Public Universities	7	5	30
Commercial and Manufacturing	32	24	144
Total	53	40	240

3.3. Data Collection Instruments

Two instruments were used to collect data from the study respondents; semi-structured questionnaire, and qualitative interview guide. A semi-structured questionnaire gathered data on the dependent variable (competitive advantage), independent variables (learning culture, learning processes and systems thinking). The qualitative interview gathered in-depth information from the 16 employees on the existing leadership and management practices and their implication for organizational culture, learning performance and competitive advantage within state corporations. Furthermore, the researchers reviewed available state corporation records including fiscal year audited reports of 2013, 2014 and 2015 and organization's annual progress reports. These documents helped to provide additional triangulation information on profitability, sales growth, operating context as well performance trends of the state corporations.

3.4. Statistical Measurement Models

Pearson’s correlation analysis was used to assess linear relationships between the independent variables and competitive advantage Saunders, Lewis, & Thornhill., (2015). To examining the effect of organizational learning on competitive advantage, step-wise multiple regression models which is commonly used to measure the linear relationship that exists between variables was used (Kanji, 2006). This was done by assessing the role of each of the independent variable on competitive advantage.

3.5. Measures

The study drew items from different studies from the literature review to measure the constructs. Learning culture was based on items adopted from Dimensions of Learning Organizations Questionnaire (DLOQ) by Leufvén, Vitrakoti, Bergström, Ashish, & Målvqvist, (2015) and Learning Organization Questionnaire by Garvin et al., (2008). Six items were used to evaluate the organization’s learning culture. The items comprised of four components namely open communication practices, learning practices, staff empowerment and supporting staff development. These items were measured on a five-point Likert-type scale to permit the measurement of the dependent variable at the interval scale, (Leedy and Ormrod, 2001). The study adapted scales from various researchersto design the learning processes variable (Donate & Sánchez de Pablo, 2015; Garvin et al., 2008; María Martínez-León & Martínez-García, 2011). The final scale comprised of 11 items assessing processes for generating, collecting, interpreting, and disseminating information; experimenting with new offerings; identifying and solving problems and developing employee knowledge, skills and attitude. Systems thinking was adapted from the DLOQ and the study questionnaire by, (Bess, Perkins, & McCown, 2011). Five items were used to measure systems thinking using a five-point Likert scale. The items included organization's practices to promote external alignment and practices to promote internal alignment. Similar to previous studies, competitive advantage was measured by assessing profitability, sales growth, market share and customer satisfaction, (Hardeep & Bakshi, 2014; Porter, 2008). The study used a scale comprising of 6 items to measure competitive advantage through Likert scale.

IV. RESULTS AND DISCUSSION

4.1 Response Rate

Even though the study sample comprised of 240 staff from 40 state corporations, only 198 (83%) staff from 35 (88%) state corporations responded to the study. This is a relatively high response rate that was a result of structured follow-up visits by the trained research team.

Table 2: Response Rate

Sector	Sample	Actual	Response Rate
Finance	7	7	100%
Tertiary Education and Training	4	4	100%
Public Universities	5	5	100%
Commercial and Manufacturing	24	19	79%

Total	40	35	88%
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4.2 Background Information

4.2.1 Respondent Background Information

A simple majority of the respondents were female 52.5% as shown in table 4.2. This distribution depicts a fair balance of gender in the sampled state corporations. Considering that majority of the responses are perceptual in nature, this kind of distribution helps to accommodate opinions and views from either gender. On another note, this balance in gender in state corporations’ points to the progress achieved by the ongoing efforts in Kenya’s public service to mainstream gender in response to the constitutional threshold on gender which requires at least a third representation from either gender in recruitment and appointments in the public-sector organizations. Majority of the respondents (64.1%) indicated that they had at least a degree level of education while a relatively high percentage (42.4%) possessed a higher degree at postgraduate level. This was expected due to high levels of tertiary education in the country and considering that 62% of respondent were middle or senior managers who are required to have higher academic credentials to qualify for their roles.

Table 3: Summary of student demographics

	Frequency	Percent
<i>Gender</i>		
Male	94	47.5
Female	104	52.5
Total	198	100.0
<i>Respondent Job Level</i>		
Senior Manager	22	11.1
Middle-level Management	101	51.0
Non-Management staff	75	37.9
Total	198	100.0
<i>Department or unit</i>		
Production/Services	46	23.2
Purchasing	20	10.1
Human Resource Management	54	27.3
Research and Development	21	10.6
Marketing (Including the selling function)	15	7.6
Accounting and Finance	42	21.2
Total	198	100.0

Majority of the respondents were middle-level managers (51%) and the least were senior managers (11%). This distribution shows the staffing situation in state corporations which indicates that the span of control within the firms allowed approximately 4 middle managers per senior manager in the targeted departments. Additionally, learning occurs at all levels of the organizations hence it is important to capture opinions and facts from all key staffing categories. Furthermore, over-reliance on the opinion of senior managers was noted in the literature as a limitation of most organizational learning studies. High responses were received from the 36-45 and 26-35 age brackets giving 33.33% and 28.8% respectively. The mean age was 39.6 years with a standard deviation of 10.9 years. These results are consistent

with the fact that majority of the respondents were middle managers and the non-management staff whose age ranged from 25-45 years. This is a common phenomenon in public organizations in Kenya where employees move up the professional ladder with time hence the length of service often reflect a growth in job-levels. Lastly, these results demonstrate that the workforce in the public service is young which aligns to the country's population dynamic that is dominated by a young working population aged 25-45.

To determine the length of service in years by employees, majority (78.8%) had worked for less than 11 years with 60% having worked for five years or less. The mean years of service for the employees was 7.3 with a standard deviation of 7.6 years. This presents diversity of experience that enriches the analysis of the study variables. Similarly, these results show that majority of the staff were hired in their current organizations or roles within the past ten years which is also around the same time that organizational learning and the knowledge economy became a 'household' concepts in state corporations in Kenya and also the time Kenya was launching its economic transformation blue print, Vision 2030(Government of Kenya, 2007). State corporations typically consist of a number of departments or functions and organizational learning may be more pronounced in some departments than others for various contextual reasons. With this background, the study was keen to identify the departments in which the respondents worked. Majority of the respondents were from human resources (27%), and the production departments (23%). Cumulatively, departments dealing with the core business including production, service, purchasing, research and development and marketing were 51% while those associated with support functions including accounting, finance and human resources were 49%. This departmental diversity accords the study an opportunity to assess the role of some organizational learning variables like systems thinking which partly looks at relationships between various departments in the organization.

4.2.2 Background of State Corporations

Majority (54%) of the sectors were classified as commercial and manufacturing while 24% were from either training, tertiary education or public universities. The finance sector was represented by 20% of the sample state corporations. The high proportion of the commercial and manufacturing sector was expected and planned during sample selection since they form the highest proportion of state corporations. The representation from all key sectors that met the selection criterion is key in assessing differences within sectors.

Table 4: Sectors of state corporations

Sector	Frequency	Percent
Finance	7	20%
Tertiary Education and Training	4	11%
Public Universities	5	14%
Commercial and Manufacturing	19	54%
Total	35	100%

4.3 Descriptive Statistics Results

4.3.1 Organizational Culture in State Corporations

The study sought to establish the extent to which the state corporations nurtured and promoted a culture that reinforced learning at departmental level. Majority (63%) of the respondents were of the view that the culture within their departments supported learning and learning opportunities. These high scores were noted particularly in open discussions of mistakes (68.2%), giving of open feedback (71.7%) and ready access to information (69.2%). However, when it comes to rewards, only 45% of the respondents said that in their departments people are rewarded for exploring new ways of working. Similarly, there were low scores for support to requests for learning opportunities and training as well recognition of people for taking initiative. This shows that even though majority of the state corporations appear to support a learning culture, they do not resource it by rewarding innovative thinking and practice.

4.3.2 Learning Processes

In assessing learning processes, the study found that 61% of the respondent agreed or strongly agreed that learning processes were implemented within their state corporations. Despite this appreciation of the learning processes within their institutions, it was clear that learning processes associated with training were weak within state corporations. There were 44% of respondents who indicated that experienced employees were provided with training when switching to new positions. This has been attributed to the fact that they are seen or considered to know their work hence limited investment in their knowledge and skills. In addition to the weak training systems, there were limited mechanisms within the organization to guarantee sharing of emerging, good, and best practices across departments which essentially compromised inter-departmental learning within the state corporations. Other areas that employees scored low included seeking out dissenting views during discussions (57%), revisiting well-established perspectives during discussions (58%), and employees joining formal or informal networks made up of people from outside the organization (58%).

4.3.3 Systems Thinking

The study also sought the extent to which state corporation applied systems thinking practices within their organizations. Results showed that 64.5% of the respondent felt that their organizations adopted systems thinking practices. Specifically, majority (71.7%) felt that their leaders ensured that the organization's actions were consistent with its values and the organization worked together with the outside stakeholders to meet mutual needs (70.7%). These were fairly high scores compared to the other variables and can be partly explained by the nature of state corporations and Government policy and bureaucracy which requires that state corporations conduct elaborate stakeholder consultations as part of their decision-making process. On the other hand, a smaller percentage of respondents (55.6%) felt that their organizations considered the impact of decisions on employee morale and encourages people to get answers from other departments and staff when solving problems (59%).

4.4 Factor Analysis

4.4.1 Normality of the Dependent Variable

To test the assumption of normality of the dependent variable, the study employed three normality tests. These included the observation of histogram, normal probability plot and statistical test using the Shapiro-Wilki test. The Shapiro-Wilk test is commonly used by statisticians and is typically tested at the $\alpha = .005$ level of significance. This is a statistical test of the hypothesis that sample data have been drawn from a normally distributed population (Conover, 1999; Shapiro and Wilk, 1965; Royston, 1995). The formula for the test is as follows: Table 4.17 shows the Shapiro-Wilk results obtained by this test for the dependent variable, competitive advantage. Considering that the null-hypothesis of the Shapiro-Wilki test is that the population is normally distributed, if p-value is less than the chosen alpha level, then the null hypothesis is rejected and there is evidence that the data tested are not from a normally distributed population; in other words, the data are not normal. On the contrary, if the p-value is greater than the chosen alpha level, then the null hypothesis that the data came from a normally distributed population cannot be rejected (e.g., for an alpha level of 0.05, a data set with a p-value of 0.02 rejects the null hypothesis that the data are from a normally distributed population). Given that p-value was 0.128 for competitive advantage which is greater than the α of 0.05, the null hypothesis was accepted and the study concluded that the samples were drawn came from a normally distributed population. However, considering that the Shapiro-Wilki test is biased by sample size, the test may be statistically significant from a normal distribution in any large samples the study used a normal probability plot (Q-Q plot) for further verification of the normality assumption. In a Q-Q plot, each observed variable is paired with its expected value from the normal distribution. If the sample is from a normal distribution, then the cases are expected to fall more or less in a straight line. Figure 1 shows that the cases fall more or less in a straight line indicating that the sample was from a normal distribution.

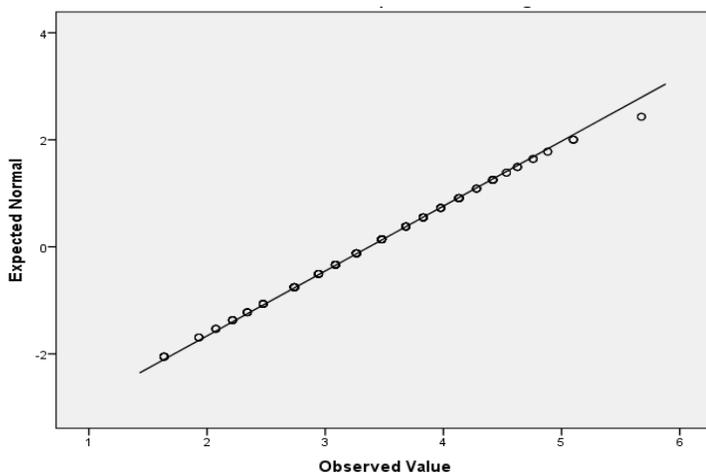


Figure 1: Q-Q plot for dependent variable

4.4.2 Reliability and Validity Analysis

In order to conduct regression analysis for the purpose of testing the model, the study conducted a series of tests on the variables to improve reliability of the various constructs. Using SPSS version 21, the study employed Cronbach's Coefficient Alpha to

test for internal consistency of the constructs within the six variables of study. The data on each of the variables were separately analyzed based on the values of coefficient of reliability and item total correlation as shown in table 4.22. For the purpose of analysis, each variable was abbreviated as follows: Competitive Advantage (CA.); Learning Culture (LC.); Learning Processes (LP.); and Systems Thinking (ST.). Items under variable were numbered accordingly. Since the coefficient alpha of individual scales indicated that the reliability estimate of three items were marginal, a secondary analysis was conducted after dropping these items. The reliability estimates and item-total correlations of the remaining items under learning process improved after dropping these items. The researchers decided to delete items to enhance Cronbach's coefficients. Table 5 shows a summary of the Cronbach's alpha coefficient for each of the variables. After the deletion process, all the four independent variables and dependent variable registered an acceptable Cronbach's alpha coefficient of above 0.7. This is line with findings by Saunders Lewis and Thornhill (2009) and Christensen, Johnson and Turner (2011) who noted that scales of 0.7 and higher, suggest satisfactory reliability. The study concluded that the constructs each of the variables in this study had sufficient internal consistency and hence, reliable for the analysis.

Table 5: Summary of Reliability Estimates and Item-Total Correlations

Competitive Advantage	Cronbach's Alpha	Item-Correlations
Competitive Advantage (CA)	.876	
CA1		.580**
CA2		.694**
CA3		.688**
CA4		.713**
CA5		.702**
CA6		.727**
Learning Culture (LC)	.804	
LC1		.630**
LC2		.606**
LC3		.531**
LC4		.597**
LC5		.573**
LC6		.429**
Learning Processes (LP)	.848	
LP1		.606**
LP2		.559**
LP3		.639**
LP4		.593**
LP5		.505**
LP6		.564**
LP7		.477**
LP9		.411**
LP11		.416**
LP12		.529**
LP14		.558**
Systems Thinking (ST)	.846	
ST1		.551**

ST2		.686**
ST3		.712**
ST4		.670**
ST5		.650**

Note, ** item-total correlation is significant at the $p < 0.05$ level (2-tailed).

4.4.3 Sampling Adequacy

To examine whether the data collected was adequate for further statistical tests, such as factor analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity were performed on all the study variables. For a data set to be regarded as adequate and appropriate for statistical analysis, the value of KMO should be greater than 0.5 (Field, 2000). Results from table 6 show that all the KMO coefficients were above the critical level suggested of 0.5). Similarly, all the results of the Bartlett's Test of Sphericity were highly significant ($p < 0.05$). These two results confirm that the variables were suitable for planned analyses.

Table 6: Summary KMO and Bartlett's Chi-Square Tests for Sampling Adequacy

Variable Name	KMO	Bartlett's Chi-Square	Df.	Sig.
Learning Culture	0.728	236.591	15.000	0.000
Learning Processes	0.848	685.511	55.000	0.000
Systems Thinking	0.823	391.985	10.000	0.000
Competitive Advantage	0.860	567.388	15.000	0.000

4.5 Inferential Analysis and Hypothesis Testing

The hypotheses associated with the relationship between the independent variables and the depending variable were tested through linear regression analysis using SPSS version 21 software.

4.5.1 Effect of Learning Culture on Competitive Advantage

The study sought to test the following null hypothesis in evaluating the effect of learning culture on competitive advantage.

H_{01} : There exists no relationship between learning culture and the competitive advantage of State Corporations in Kenya

First, the study conducted a bivariate Pearson Correlation analysis to determine the linear relationship between learning culture and competitive advantage. The results showed that learning culture and competitive advantage were significantly and positively correlated, $r = .475$, $p < .05$. The magnitude, or strength, of the association is moderate ($.3 < |r| < .5$). After confirming a positive and significant linear relationship between learning culture and competitive advantage, the study went ahead to employed linear regression analysis using SPSS to assess if learning culture significantly predicted competitive advantage of state corporations. The results of the regression indicated that learning culture explained 38% of the variance ($R^2 = .38$, $F(1,197) = 120.06$, $p < .000$). For regression through the origin (the no-intercept model), R Square measures the proportion of the

variability in the dependent variable about the origin explained by regression. The model had an R square value of 0.38 thus indicating that the model accounted for 38% of the change in the dependent variable, competitive advantage, for every change in the independent variable, learning culture. This is a strong prediction model for the intended analysis. Using the coefficients model, the results showed learning culture was significantly associated with competitive advantage ($p < .000$).

Table 7: Coefficients Table for Learning Culture and competitive advantage

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.022	.132		15.361	.000
Learning Culture	.451	.041	.616	10.957	.000

Therefore, the study rejected the null hypothesis and concluded that there exists a positive and significant relationship between learning culture and the competitive advantage of state corporations in Kenya. Based on these results, for every one unit change in learning culture, a corresponding change of .45 units occurred in the competitive advantage of state corporations. The findings suggest that state corporations with a high levels of learning culture have higher chances gaining competitive advantage over their counterparts that have lower levels of learning culture.

4.5.2 Effectiveness of Learning Processes on Competitive Advantage

The study also sought to test the following null hypothesis in assessing the effects of learning processes on competitive advantage.

H_{02} : There is no relationship between learning processes and competitive advantage of State Corporations in Kenya.

Bivariate Pearson correlation analysis to determine the linear relationship between learning processes and competitive advantage established that learning processes and competitive advantage had a statistically significant positive linear relationship, $r = .683$, $p < .001$. The direction of the association suggested that a higher measure of learning processes score was associated with greater competitive advantage score. The strength of the association was high ($.5 < |r| < 1$). A simple linear regression was calculated to predict the influence of learning processes on competitive advantage of state corporations. From Results of linear regression indicated a significant regression equation ($F(1,197) = 155.22$, $p < .05$) with an R^2 of .442. The model had an R square value of 0.442 thus indicating that the model accounted for 44.2% of the change in the depending variable, competitive advantage, for every change in the independent variable, learning culture. This is a strong prediction model for the intended analysis. The results showed that $Y = .383(LP) + e$ where Y is the dependent variable (competitive advantage), LP is the dependent variable (learning processes) and e is the error term.

Table 8: Coefficients Table for Learning Processes and competitive advantage

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.835	.131		14.024	.000
Learning Processes	.383	.031	.665	12.459	.000

Based on the analysis, the study rejected the null hypothesis and concluded that there exists a relationship between learning processes and competitive advantage of state corporations in Kenya. The means that competitive advantage of state corporations increased by .385 units for each unit increase in learning processes. The independent variable, learning processes, was a significant predictor of competitive advantage, $p < .05$.

4.5.3 Effect of Systems Thinking on Competitive Advantage

The study also tested the following null hypothesis in assessing the effects of systems thinking on competitive advantage.

H_{03} : There is no relationship between systems thinking and competitive advantage of State Corporations in Kenya.

Bivariate Pearson correlation analysis to determine the linear relationship between systems thinking and competitive advantage established that systems thinking and competitive advantage had a statistically significant positive linear relationship, $r = .631$, $p < .001$. The direction of the association suggests that a higher measure of learning processes score is associated with greater competitive advantage score. The strength of the association was high ($.5 < |r| < 1$). A simple linear regression was calculated to predict the influence of systems thinking on competitive advantage of state corporations. Results of linear regression a significant regression equation ($F(1,197) = 108.41$, $p < .000$) with an R^2 of .356. The model had an R square value of 0.961 thus indicating that the model accounted for 35.6% of the change in the depending variable, competitive advantage, for every change in the independent variable, learning culture. This is a strong prediction model for the intended analysis. The results showed that $Y = .470(LP) + e$ where Y is the dependent variable (competitive advantage), LP is the dependent variable (systems thinking) and e is the error term.

Table 9: Coefficients Table for Learning Processes and competitive advantage

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	2.198	.122		17.984	.000
Learning Processes	.470	.045	.597	10.412	.000

Therefore, the study rejected the null hypothesis and concluded that there exists a relationship between systems thinking and competitive advantage of state corporations in Kenya. This shows that competitive advantage of state corporations increased

by .470 units for each unit increase in systems thinking. The independent variable, Learning Processes, was a significant predictor of competitive advantage, $p < .05$.

4.5.4 Multivariate Linear Regression Analysis for Competitive Advantage

A multiple regression was calculated to predict competitive advantage of state corporations based on three independent variables namely: learning culture (LC), learning processes (LP) and systems thinking (ST). Results of the regression indicated that a significant regression equation was found ($F(3,194) = 68.661$, $p < .05$) with an R^2 of .52. In this model, the R Square measures the proportion of the variability in the dependent variables about the origin explained by regression. The model had an R square value of 0.515 thus indicating that 52% of the change in the depending variable, competitive advantage, was accounted for the changes in the independent variables. The resultant equation was $Y = .170(LC) + .200(LP) + .187(ST) + e$ where Y is the dependent variable (competitive advantage), LC is learning culture, LP is learning processes, and ST is systems thinking and e is the error term. Competitive advantage increased 0.170 for each unit of learning culture, 0.200 for each unit of learning processes, and 0.187 for each unit of systems thinking. The independent variables, learning culture ($P < .002$), learning processes ($P < 0.000$) and systems thinking ($P < 0.001$) were all significant predictors of competitive advantage at $p < 0.005$.

Table 10: Coefficients Table for Learning Culture and competitive advantage

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	1.596	.131		12.213	.000		
Learning culture	.170	.053	.233	3.192	.002	.471	2.125
Learning Processes	.200	.045	.346	4.451	.000	.413	2.419
Systems Thinking	.187	.053	.237	3.515	.001	.550	1.818

4.6 Summary and Discussion of Major Findings

4.6.1 Effect of learning culture on competitive advantage of state corporations

Linear regression results revealed that the independent variable learning culture had a significant and positive influence on the competitive advantage of state corporations. This influence remained positive and significant in a multiple regression analysis showing that learning culture played a significant role with the two other variables in influencing competitive advantage. These results are consistent with (Weihong et al., 2008) who found that openness of the organizational culture and the organizational learning capability has a significant impact on the enterprise sustainable competitive advantage. Similarly, the results are supported by (Gbenro&Agboola, 2015) whose study found trust was an important aspect of organizations that predicted the willingness of worker to share and use tacit knowledge and (Sanz-Valle et al., 2011) who found that organizational culture can foster both organizational learning and

technical innovation. The study found that organizations that possessed higher attributes of a learning culture were also the ones that scored highly on the competitive advantage scale. The degree of tolerance towards adventurous spirit, democratic participation and innovation activities, which drive organizations to accept new things, discover new needs better and faster is positively associated with competitive advantage. Therefore, leaders of state corporations should nurture and build organizational culture that encourages people to openly discuss mistakes to learn from them, and give and receive open and honest feedback. Managers are also encouraged to develop reward systems that recognizes individuals and teams who take initiative and explore new ways of working.

4.6.2 Effectiveness of learning processes in fostering competitive advantage

In determining the effectiveness of learning processes in fostering competitive advantage, the study found that a positive and significant relationship existed in both single and multiple linear regression analysis. Of the three independent variables, learning processes had the highest strength of association to the competitive advantage. This affirms the positive and significant role that concrete learning processes play in influencing the performance and competitive advantage of state corporations. Similar to the result of Garvin et al. (2008), the findings suggest that for organizations to learn effectively and attain the desired competitive advantage, they need to have more effective and comprehensive learning processes than their competitors. When an organization masters the processes and practices of generation, collection, interpretation, and dissemination of information, to sets itself up for successful competition. Encouraging employees to join formal or informal networks made up of people from outside the organization ensures that there is continuous generation of information within and outside the organization and helps create forums for meeting with and learning from experts from outside the organization. Interpretation of information is essential and this can be achieved by the conduct of regular post-audits, after-action reviews as well as executing formal mechanisms for sharing of best practices among the different activity fields. State corporations need to engage in productive conflict and debate during discussions and intentionally seek out dissenting views during discussions.

The results of the study emphasized the importance state corporations to have concrete formal processes for generating, collecting, interpreting, and disseminating information. As Garvin et al., (2008) pointed out, concrete learning processes and practices ensures that the team and company values to experiment with new offerings, to gather intelligence on competitors, customers, and technological trends and solving problems. State corporations that attain competitive advantage prioritizes developing employees' skills because it appreciates that it is when employees grow that organizations grow. Therefore, learning processes ensure capacity of employees is continuously strengthened to meet the work needs. These efforts targets both the experience employees, new employees, and employees switching to new positions. The study has demonstrated that when organizations consistently and systematically invests in training and growth of staff by availing

time for education, training and mentorship activities of staff, they lay a strong foundation for competitiveness.

4.6.3 Effect of systems thinking on the competitive advantage

System thinking was found to have a strong positive and significant effect on competitive advantage. These results reinforce the works of other scholars who regarded systems thinking as the conceptual cornerstone of a learning organization (Alegre and Chiva, 2008; Alegre et al., 2013). Higher scores of systems thinking scale were associated with high scores in competitive advantage. Organizations that have cultivated strong systems thinking practice encourage people to think beyond their individual and departmental roles and responsibility and look at how others' roles and responsibilities affect their work. These kinds of organizations approach issues from a stakeholder perspective and works with the outside stakeholders to meet mutual needs. When leaders ensure that the organizations actions are consistent with its values and considers organizations actions on employee morale, and when they encourage people to seek answers from across the organizations, the organization benefits from multiple perspectives and achieve a high sense of ownership that smoothens implementation of strategic choices to realize better success. These are fundamental ingredients to building a learning organization and achieving a sustained competitive advantage.

The present study faced number of limitations, which should be considered in interpreting the results. First, the study adopted a cross-section design which limits its assessment of causality. Longitudinal studies that examine the lagged effect of learning activities may further contribute to our understanding of how organizational learning can enhance competitive advantage of state corporations. Secondly, accessing financial data from state corporations was virtually impossible during the time of the study. Many visits were done by the research assistance and the team lead but only 15% of the expected financial records were found. This limits the level of analysis that the study could conduct. To mitigate this effect, the study opted for the perception based assessment of competitive advantage similar to what was used by other authors (Azad et al., 2014; Martinette & Obenchain-leeson, 2012). Accessing the financial data may have had varying results.

V. CONCLUSION

The study results have validated the theoretical underpinning that organizational learning is positively associated with competitive advantage of state corporations. It is evident that state corporations that seek to outperform their opponents in the respective industries need to establish an enabling learning environment manifested in a learning culture, concrete learning processes and the practices of systems thinking.

The results have demonstrated that managers who focus on developing concrete learning processes, a learning culture and systems thinking practices stand a greater chance of gaining and sustaining competitive advantage. Both formal and informal learning processes that maximize utilization-focused knowledge

acquisition and sharing approach are encouraged. To ensure staff or fully engaged in the learning process, organizations need to invest in building capacity of new and existing employees and partners to encourage reflective practices within the organization.

Results of the study reinforced the importance of an enabling culture to foster learning by facilitating the innovative exploitation of learning processes and opportunities for the success of the organizations. Organizational leaders are encouraged to nurture organizational culture that ensure support for learning and creates appropriate and safe learning environment. Components of a learning culture that leaders, managers and employees need to nurture include psychological safety, appreciation of differences, and openness to new ideas. These factors will guarantee employees the safety needed to be creative, encourage to challenge their own assumptions without fear of being out-casted.

Similar to studies by, Senge, (2006) and Skaržauskiene, (2010), Systems thinking practice had a significant in influencing on competitive advantage. In order to correctly and comprehensively diagnose sources and nature of organizational problems and design holistic solutions, leaders, managers and employees are encouraged to adopt system thinking practices. System's thinking practices provide an objective lens and framework to assess inter-relationships and intra-relationships that underlie complex situations and interactions rather than simplistic and often inaccurate linear cause-effect chains (Senge, 2006).

APPENDIX

Appendix 1: Regression Results Tables

Code	Constructs
Competitive Advantage	
CA1	Profitability
CA2	Sales growth
CA3	Market share
CA4	Customer satisfaction
CA5	Offers value to customers
CA6	Customer retention
Learning Culture	
LC1	Openly discuss mistakes
LC2	Open and honest feedback
LC3	Reward for exploring new ways of working
LC4	Information access with ease
LC5	Recognition for taking initiative
LC6	Leadership support for learning opportunities and training
Learning Processes	
LP1	Collects information on technological trends
LP2	Employees participation in external formal or informal networks
LP3	Forums for meeting with and learning from external experts
LP4	Post-audits and after-action reviews
LP5	Formal mechanisms for sharing best practices

LP6	Engages in productive conflict and debate during discussions
LP7	Seeks out dissenting views during discussions
LP9	Identifies and discusses underlying assumptions
LP11	Training for experienced employees
LP12	Training when switching to a new position
LP14	Time is made available for education, training and mentorship
Systems Thinking	
ST1	Encourage people to think from a stakeholders' perspective
ST2	Working with external stakeholders to meet mutual needs
ST3	Organizations actions are consistent with its values
ST4	Considering impact of decisions on employee morale
ST5	Encourage people to get answers from across the organization (other departments and staff) when solving problems.

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REFERENCES

Akhtar, N., Ahmed, R., & Mujtaba, B. G. (2013). Exploring and measuring organizational learning capability and competitive advantage of petroleum industry firms. *International Business and Management*, 6(1), 89–103. <http://doi.org/10.3968/j.ibm.1923842820130601.1170>

Amitay, M., Popper, M., & Lipshitz, R. (2005). Leadership styles and organizational learning in community clinics. *The Learning Organization*, 12(1), 57–70. <http://doi.org/10.1108/09696470510574269>

Andreou, P. C., Louca, C., & Petrou, A. P. (2016). Organizational learning and corporate diversification performance. *Journal of Business Research*, 69(9), 3270–3284. <http://doi.org/10.1016/j.jbusres.2016.02.022>

Azad, N., Mehrabi Majolan, E., Peej, V., Buheji, M. J., Cong, X., Pandya, K. V., ... Aggestam, L. (2014). Knowledge creation and competitive advantage in turbulent environments: a process model of organizational learning. *Knowledge Management Research & Practice*, 11(3), 374–388. <http://doi.org/10.1057/kmpr.2012.33>

Bell, E. (2013). Organisational culture and learning: A case study. *Nurse Education Today*, 33(11), 1337–1341. <http://doi.org/10.1016/j.nedt.2013.02.009>

Bess, K. D., Perkins, D. D., & McCown, D. L. (2011). Testing a measure of organizational learning capacity and readiness for transformational change in human services. *Journal of Prevention & Intervention in the Community*, 39(April 2015), 35–49. <http://doi.org/10.1080/10852352.2011.530164>

Britton, B. (1998). The Learning NGO. *International NGO Training and Research Centre*, (July).

Buheji, M. J. (n.d.). Knowledge Management Influence on Government

- Organisations Competitiveness . Mohamed Jasim Buheji, 305.
- Donate, M. J., & Sánchez de Pablo, J. D. (2015). The role of knowledge-oriented leadership in knowledge management practices and innovation. *Journal of Business Research*, 68(2), 360–370.
<http://doi.org/10.1016/j.jbusres.2014.06.022>
- Džini, J. (2015). Correlation between the administrative leadership style and inclination towards organizational learning in local administrative organizations, 3–27.
- Garcia-Morales, V. J., Jimenez-Barrionuevo, M. M., & Gutierrez-Gutierrez, L. (2012). Transformational leadership influence on organizational performance through organizational learning and innovation. *Journal of Business Research*, 65(7), 1040–1050.
<http://doi.org/10.1016/j.jbusres.2011.03.005>
- Garvin, D. A., Edmondson, A. C., & Gino, F. (2008). Is yours a learning organization? *Harvard Business Review*, 86(3).
<http://doi.org/10.1037/e413842008-018>
- Government of Kenya. (2007). Kenya Vision 2030 - A Globally Competitive and Prosperous Kenya, (October), 1–180.
- Hardeep, P. C., & Bakshi. (2014). Examining intellectual capital and competitive advantage relationship: Role of innovation and organizational learning. *International Journal of Bank Marketing*, 33(3), 376–399. Retrieved from www.emeraldinsight.com/0265-2323.htm
- Kanji, G. (2006). *100 Statistical Tests*. Sage Publications. California.
<http://doi.org/10.1017/CBO9781107415324.004>
- Kim, Y. A., Akbar, H., Tzokas, N., & Al-Dajani, H. (2013). Systems thinking and absorptive capacity in high-tech small and medium-sized enterprises from South Korea. *International Small Business Journal*, 32(8), 876–896.
<http://doi.org/10.1177/0266242613483632>
- Kothari, C. (2004). *Research methodology: methods and techniques*. Vasa. Retrieved from <http://medcontent.metapress.com/index/A65RM03P4874243N.pdf%5Cnh>
<http://books.google.com/books?hl=en&lr=&id=8c6gkbKi-F4C&oi=fnd&pg=PR7&dq=Research+Methodology+-+Methods+and+Techniques&ots=iGoAmVQ5mJ&sig=HDstqLuUosKAeZklgQUht4YnUg0%5Cnh>
<http://books.google.com/book>
- Leufvén, M., Vitrakoti, R., Bergström, A., Ashish, K. C., & Mälqvist, M. (2015). Dimensions of Learning Organizations Questionnaire (DLOQ) in a low-resource health care setting in Nepal. *Health Research Policy and Systems / BioMed Central*, 13(1), 6. <http://doi.org/10.1186/1478-4505-13-6>
- Linz, A., & Resch, O. (2010). Double loop learning in work based settings. *CEUR Workshop Proceedings*, 575, 57–65.
- MacNeill, F., & Vanzetta, J. (2014). Appreciative leadership: delivering sustainable difference through conversation and inquiry. *Industrial and Commercial Training*, 46(1), 16–24. <http://doi.org/10.1108/ICT-09-2013-0058>
- María Martínez-León, I., & Martínez-García, J. a. (2011). The influence of organizational structure on organizational learning. *International Journal of Manpower*, 32(5/6), 537–566.
<http://doi.org/10.1108/01437721111158198>
- Martinette, L. A., & Obenchain-leeson, A. (2012). Of Competitive Advantage : A Service Organization Perspective. *Journal of Service Science*, 5(1), 43–58.
- Ollows, L., & Moro, A. (2015). Intra- Organizational Knowledge Transfer in the SME Lending Process: A Study of Commercial Banks in Kenya. *European Conference on Knowledge Management U6 - ctx_ver=Z39.88-2004&ctx_enc=info%3Aofi%2Fenc%3AUTF-8&rft_id=info:sid/summon.serialssolutions.com&rft_val_fmt=info:ofi/fmt:kev:mtx:book&rft.genre=proceeding&rft.title=European+Conference+on+Knowledge+Manage*, 578. Retrieved from http://asu.summon.serialssolutions.com/2.0.0/link/0/eLvHcXmWnV1NSwMxEB20XjxZseJHhQHPq7vZbrP1UIRaFBUEBfFUZpMsFDWrVg_992ayu3ax0IPnkJCQ8CaZeS8PIBYnYfAHE1yQ7ZOOUimTTGkRUjoQMs0VGWIE4guojcpMKernTEG52zVleuTWheKk-SkbK7nHSZj2hu8fAdtIcbm18tRYhw3BX9K6Ay6fnpdw1mPmeAv
- Peeters, A., & Robinson, V. (2015). A Teacher Educator Learns How to Learn from Mistakes: Single and Double-loop Learning for Facilitators of In-service Teacher Education. *Studying Teacher Education*, 11(3), 213–227.
<http://doi.org/10.1080/17425964.2015.1070728>
- Porter, M. E. (2008). The Five Competitive Forces that Shape Strategy. *Harvard Business Review*, 86(January), 78–94. <http://doi.org/Article>
- Prugsamat, R. (2010). Factors that influence organization learning sustainability in non-profit organizations. *The Learning Organization*, 17(3), 243–267.
<http://doi.org/10.1108/09696471011034937>
- Sangari, M. S., Hosnavi, R., & Zahedi, M. R. (2015). The impact of knowledge management processes on supply chain performance. *The International Journal of Logistics Management*, 26(3), 603–626.
<http://doi.org/10.1108/IJLM-09-2012-0100>
- Saunders, M., Lewis, P., & Thornhill, A. (2015). *Research Methods for Business Students*. *Research methods for business students*.
- Senge, P. (2006). *The Fifth Discipline: The Art and Practice of the Learning Organization*.
- Skaržauskiene, A. (2010). Managing complexity: systems thinking as a catalyst of the organization performance. *Measuring Business Excellence*, 14(4), 49–64. <http://doi.org/10.1108/13683041011093758>
- USAID. (2016). Collaborating, Learning, and Adapting Framework and Key Concepts.
- Weihong, X. W. X., Caitao, S. C. S., & Dan, Y. D. Y. (2008). A Study on the Relationships between Organizational Culture, Organizational Learning, Technological Innovation and Sustainable Competitive Advantage. *2008 International Conference on Computer Science and Software Engineering*, 5, 9–13. <http://doi.org/10.1109/CSSE.2008.92>
- Witherspoon, R. (2014). Double-Loop Coaching for Leadership Development. *The Journal of Applied Behavioral Science*, 50(3), 261–283.
<http://doi.org/10.1177/0021886313510032>
- Zhou, W., Hu, H., & Shi, X. (2015). Does organizational learning lead to higher firm performance? *The Learning Organization*, 22(5), 271–288.
<http://doi.org/10.1108/TLO-10-2012-0061>

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Detection of Anomalous Observations Using Wavelet Analysis in Frequency Domain

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Abstract- This study used wavelet analysis to detect Anomalous Observations (AOs) in non-stationary and non-periodic simulated data while extending it to the parametric method using a developed test statistic. In the three series analysed, it was discovered that Turkey’s method (TM), the Modified Turkey’s method (MTM) and the developed test statistic were found to be very effective and efficient in the detection of these anomalous observations even when the data are compressed, they still retained their statistical properties

Index Terms- Anomalous, Coefficients, Resolution, Spectrum, Software,

I. INTRODUCTION

Wavelet analysis is known as non-parametric orthogonal series estimator which are capable of providing the necessary time and frequency information on time series data simultaneously in a highly flexible fashion. It is an alternative to the spectral method and it reduces the size of the series into resolutions without losing the statistical properties of the series. In statistics, (AOs) are observations that are numerically distinct from the rest of the data. They occur by chance in any distribution but are often indicative either of measurement error or that the population is heavy tailed. Section 2 will dwell on the overview of wavelet analysis using matrix representation, key advantages of wavelet analysis and the aim and objectives of this paper. Section 3 shows the tables of the analysis and its discussions while Section 4 includes summary of findings, interpretation of results, conclusion, recommendations and suggested area for further work.

II. WAVELET ANALYSIS

Wavelet analysis is a statistical tool that can be used to extract information from any kind of data and are generally

needed to analyze data fully at different resolution (scale) and location. Eckley,A.I. et. al (2005)

Discrete Wavelet Transform re - expresses a time series in terms of coefficients that are associated with a particular time and a particular dyadic scale 2^j . These coefficients are fully equivalent to the original series from its Discrete Wavelet Transform coefficients. Nason, G.P. (2002), Armando D. M et. al (2003)

The Discrete Wavelet Transform allows us to partition (decompose) the information in a time series into pieces that are associated with different scales and time. This decomposition is very close to the statistical technique known as the Analysis of variance (ANOVA), so DWT leads to a scaled – based ANOVA that is quite analogous to the frequency – based ANOVA

provided by the power spectrum Graps A.(1995),

2.1 MATRX REPRESENTATION

Like the orthonormal discrete Fourier transform, the discrete wavelets transform (DWT) of X_t is an orthonormal transform Neill P. (2012). Let $[W_n; n = 0 \dots \dots N - 1]$ be the DWT coefficients then, we can write $W = w_n$ where W is a column vector of length $N = 2^2$ whose n^{th} DWT and satisfying $w^T w = I_N$ orthonormality implies that $X = w^T w$ and $\|W\|^2 = \|X\|^2$. Hence W_n^2 represents the contribution to the energy attributable to the DWT coefficient with index n .

Whereas ODFT coefficients are associated with frequencies the n^{th} wavelet coefficient W_n is associated with a particular scale and with a particular set of times Daubechies, I (1988, 1992).

Explicitly, the rows of this mature for $n=0, 8, 12, 14,$ and 15 are

$$w_0^T = \left[-1/\sqrt{2}, 1/\sqrt{2}, \underbrace{0 \dots \dots 0}_{14 \text{ zero}} \right]$$

$$w_8^T = \left[-1/2, -1/2, 1/2, 1/2, \underbrace{0 \dots \dots 0}_{12 \text{ zero}} \right]$$

$$w_{12}^T = \left[-1/\sqrt{8}, \dots \dots \dots, -1/\sqrt{8}, 1/\sqrt{8} \dots \dots \dots 1/\sqrt{8}, \underbrace{0 \dots \dots 0}_{8 \text{ zero}} \right]$$

$$w_{14}^T = \left[-1/\sqrt{4}, \dots, -1/\sqrt{4}, 1/\sqrt{4}, \dots, 1/\sqrt{4} \right]$$

$$w_{15}^T = \left[1/\sqrt{4}, \dots, 1/\sqrt{4} \right]$$

The remaining eleven rows are shifted version of the above;

$$w_1 = T^2 w_0, \quad w_2 = T^4 w_0 \dots \dots \dots w_7 = T^{14} w_0$$

$$w_9 = T^4 w_8, \quad w_{10} = T^8 w_8 \quad w_{11} = T^{12} w_8$$

$$w_{13} = T^8 w_{12}$$

Let us now, define exactly what the notation of scale means for a positive integer k let

$$\bar{X}_t(k) = \frac{1}{k} \sum_{l=0}^{k-1} X_{t-l} \tag{2.13}$$

Percival, et. al (2000)

2.2 The Key advantages of Wavelet Analysis over Other Methods. (Nason, 2008)

- Sparsity of representation for a wide range of data as resolution decreases including those with discontinuities guaranties the presence of required statistics.
- The ability to analyze data at a number of resolutions and also to work with information at such resolutions.

- Ability to detect aberrant observations and represent neighbourhood features and also to create localized features on synthesis (the process of combining differences into a new whole)
- Efficiency in terms of compilation speed and storage.

2.3 AIM AND OBJECTIVES

The major goal of this paper is to compare the efficiency of wavelet coefficients as a tool for detecting aberrant observations in both simulated and real data.

Below are the underlying objectives are to :

- Use Turkey’s and modified Turkey’s methods in wavelet analysis for

detection of aberrant observations even at lower resolutions.

- Compare the performance of these two methods with a view of identifying the methods with a better detective mechanism of aberrant observations time series data.
- Use a derived test statistic to analyse such data and compare their results.

Section 3

III. DATA ANALYSIS AND DISCUSSION OF RESULTS

Since wavelet analysis is dyadic, the data analysed were three simulated data from normal distribution

using R-Software involving 512, 1024 and 2048 data sets containing four, four, and eight injected AOs.

3.1 DATA ANALYSIS

Table 3.1: Wavelet Analysis of simulated data N = 512, A.O. = 4 using Turkey’s Method

Resolutions Level (No of Observations)	Location (L) of Aberrant Observations	Aberrant Observation Values	T L	TU
9 (512)	1, 256, 257, 512	43, -44, 41, 47	-2.61	2.68
8 (256)	1, 128, 129, 256	30.35, 31.66, 28.94, -32.68	-2.44	2.63
7 (128)	1, 64, 65, 128	21.41, -21.89, 20.41, 23.61	-2.65	2.93
6 (64)	1, 32, 33, 64	16.43, 15.45, 15.72, -16.73	-2.84	3.42

5 (32)	1, 16, 17, 32	12.25, -10.69, 11.75, 12.06	-2.53	2.02
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Note: T_U and T_L represent upper and lower limits for both Turkey's and Modified Turkey's Methods.

Table 3.2: Wavelet analysis using modified Turkey's method by Neil Patterson (2012)

Resolutions Level (No of Observations)	Location (L) of Aberrant Observations	Aberrant Values	Observation	T L	TU
9 (512)	1, 256, 257, 512	43, -44, 41, 47		-5.85	5.92
8 (256)	1, 128, 129, 256	30.35, 31.66, 28.94, -32.68		-5.55	5.74
7 (128)	1, 64, 65, 128	21.41, -21.89, 20.41, 23.61		-6.06	6
6 (64)	1, 32, 33, 64	16.43, 15.45, 15.72, -16.73		-6.77	7.25
5 (32)	1, 16, 17, 32,	12.25, -10.69, 11.75, 12.06		-5.32	4.81

Series: B: Simulated data N =1024,A.O. = 4

Table 3.3: Wavelet analysis using Turkey's method

Resolutions Level (No of Observations)	Location (L) of Aberrant Observations	Aberrant Values	Observation	T L	TU
10 (1024)	1, 512, 513, 1024	32,41,40,-37		-2.75	2.75
9 (512)	1, 256, 257, 512	22.57,-28.89, 26.26.	28.23,	-2.92	3
8 (256)	1, 128, 129, 256	15.91 , 21.15, 19.91, -17.85	-	-3.14	3.35
7 (128)	1, 64, 65,128	12.54, -14.36, 15.36,13.21		-3.18	3.44
6 (64)	1, 32, 33, 64	9.50, 10.10, 11.50, -9.40		-2.4	2.41

Table 3.4: Wavelet analysis using modified Turkey's method by Neil Patterson (2012)

Resolutions Level (No of Observations)	Location (L) of Aberrant Observations	Aberrant Values	Observation	T L	TU
10 (1024)	1, 512, 513, 1024	32,41,40,-37		-6.11	6.11
9 (512)	1, 256, 257, 512	22.57,-28.89, 28.23,26.26.		-6.54	6.63
8 (256)	1, 128, 129, 256	15.91 , 21.15, 19.91, -17.85		-7.11	7.32
7 (128)	1, 64, 65,128	12.54, -14.36, 15.36,13.21		-7.23	7.49
6 (64)	1, 32, 33, 64	9.50, 10.10, 11.50,-9.40		-5.34	5.35

Series: C Simulated data N = 2048, A.O. = 8

Table 3.5: Wavelet analysis using Turkey's method

Resolutions Level (No of Observations)	Location (L) of Aberrant Observations	Aberrant Observation Values	T L	TU
11 (2048)	1, 512, 513, 1024, 1025,1536, 1537, 2048	45,-51, 50, -52, 48, -49,47, 46	-2.75	2.75

10 (1024)	1, 256, 257, 512, 513, 768, 769, 1024	31.76, 36.16, 35.30, 36.8, 33.89, 34.75, 33.18, 32.43	-2.92	3.00
9 (512)	1, 128, 129, 256, 257, 384, 385, 512	22.41, -24.85, 24.91, 25.35, 23.91, -23.85, 23.41, 23.65	-3.14	3.35
8 (256)	1, 64, 65, 128, 129, 192, 193, 256	17.13, 18.16, 18.90, 18.52, 18.19, 17.46, 17.84, -16.13	-3.18	3.45
7 (128)	1, 32, 33, 64, 65, 96, 97, 128	12.75, -12.90, 14.00, 13.15, 13.50, -12.40, 13.25, 11.35	-2.4	2.41

Table 3.6: Wavelet analysis using modified Turkey’s method by Neil Patterson (2012)

Resolutions Level (No of Observations)	Location (L) of Aberrant Observations	Aberrant Observation Values	T L	TU
11 (2048)	1, 512, 513, 1024, 1025, 1536, 1537, 2048	45, -51, 50, -52, 48, -49, 47, 46	-6.11	6.11
10 (1024)	1, 256, 257, 512, 513, 768, 769, 1024	31.76, 36.16, 35.30, 36.87, 33.89, 34.75, 33.18, -32.43	-6.54	6.63
9 (512)	1, 128, 129, 256, 257, 384, 385, 512	22.41, -24.85, 24.91, -25.35, 23.91, -23.85, 23.41, 23.65	-7.11	7.32
8 (256)	1, 64, 65, 128, 129, 192, 193, 256	17.13, 18.16, 18.90, 18.52, 18.19, 17.46, 17.84, -16.13	-7.23	7.49
7 (128)	1, 32, 33, 64, 65, 96, 97, 128	12.75, -12.90, 14.00, -13.15, 13.50, -12.40, 13.25, 11.35	-5.34	5.35

3.2 Using The Developed Test Statistic

Series: A Simulated data N=512, $\alpha=5\%$, and 10% where U=1.96, and 1.28

Table 3.7: Wavelet analysis of parametric method

Resolutions (No of Obsns)	Lev.	Location (L) of AOs	AOs Values	Location (L) of U Values	U Values
9 (512)		1, 256, 257, 512	43, -44, 41, 47	1, 256, 257, 512	4.61, -4.78, 4.40, 5.04
8 (256)		1, 128, 129, 256	30.35, 31.66, 28.94, -32.68	1, 128, 129, 256	3.43, 3.58, 3.27 -3.74
7 (128)		1, 64, 65, 128	21.41, -21.89, 20.41, 23.61	1, 64, 65, 128	2.56, 2.71, 2.43, 2.83
6 (64)		1, 32, 33, 64	16.43, 15.45, 15.72, -16.73	1, 32, 33, 64	2.01, 1.89, 1.78, -2.19

Series: B N=1024, $\alpha=5\%$, and 10% where U= 1.96, and 1.28

Table 3.8: Wavelet analysis of parametric method

Resolutions (No of Obsns)	Lev.	Location (L) of AOs	AOs Values	Location (L) of U Values	U Values
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10 (1024)	1, 512, 513,1024	32,41,40,-37	1, 512, 513, 1024	5.10, 6.54, 6.38,-5.92
9 (512)	1, 256, 257,512	22.57,-28.89, 28.23, 26.26	1, 256, 257, 512	3.75, -4.86, 4.70, 4.37
8 (256)	1, 128, 129, 256	15.91 , 21.15 19.91, 17.85	1, 128, 129, 256	2.80, 3.73, 3.51, -3.21
7 (128)	1, 64, 65,128	12.54, -14.36 15.36, 13.21	1, 64, 65, 128	2.25, -2,71 2.77, 2.37
6 (64)	1, 32, 33, 64	9.50, 10.10,11.49, -9.40	1, 32, 33, 64	1,99,1.97, 2.18, -1.99

Series: C N=2048, $\alpha= 5\%$, and 10% where $U= 1.96$, and 1.28

Table 3.9: Wavelet analysis of parametric method.

Resolutions Lev. (No of Obsns)	Location (L) of AOs	AOs Values	Location (L) of U Values	U Values
11 (2048)	1, 512, 513,1024, 1025,1536, 1537,2048	45,-51, 50, -52, 48, -49,47, 46	1, 512, 513, 1074, 1075, 1536, 1537, 2048	5.48, -6.22, 6.09, -6.34, 5.84, -5.97, 5.72, 5.60
10 (1024)	1, 256, 257,512,513, 768, 769,1024	31.76,36.16,35.30,36.87,33.89,34.75, 33.18,-32.43	1, 256, 257, 512, 513, 768, 769, 1024	4.02 4.58, 4.474,67, 4.29, 4.40, 4.20, -4.17
9 (512)	1, 128, 129,256, 257, 384, 385,512	22.41 , 24.85, 24.91, -25.35, 23.91,- 23.85, 23.41, 23.65	1, 128, 129, 256,257, 384, 385, 512	3.02,-3.38, 3.36,-3.45, 3.22, -3.24, 3.15, 3.19
8 (256)	1, 64, 65, 128,129, 192, 193,256	17.13,18.16,18.52,18.19,17.46,17.84, -16.13	1, 64, 65, 128,129, 192, 193,256	2.32 2.46, 2.56,2.51, 2.46, 2.36, 2.4144 - 2.3286
7(128)	1, 32, 33, 64, 65, 96, 97,128	12.75, 12.90, 14.00, -13.15, 13.50, - 12.40, 13.25, 11.35	1,32,33,64,65,96,97,128	2.82, 2.97, 2.05, 2.98, 2.98, -2.80, 2.01, 2.99
6 (64)	1, 16, 17, 32,33	9.36, 8.92, 10.24, 9.09, 9.89, 8.56, 9.71, -8.23	1,16,17,32,33,48,49, 64	2.05, 2.28, 1.96, 2.30, 2.43, 2.22, 2.40, -2.47

3.3 Discussions on the Tables

Table 3.1: It can be seen that the four aberrant observations injected randomly were identified up to the fifth resolution at the same location using Turkey's method.

Table 3.2: Also shows that the four aberrant observations injected randomly were identified up to the fifth resolution at the same location using Modified Turkey's method.

Table: 3.3. The results obtained using 1024 observations with four aberrant observations injected shows that Turkey's method detected the aberrant observations up to the sixth resolution level at the same location.

Table: 3.4. Confirms the result obtained in table 3.3. using Modified Turkey's method.

Table: 3.5. Contain 2048 observation with eight aberrant observations injected shows that Turkey's method detected the aberrant observations up to the seventh resolution level at the same location.

Table: 3.6. Confirms the result obtained in table 3.6. using Modified Turkey's method.

Table 3.7 provides information on simulated data of 512 with four aberrant observations injected. The aberrant observations were detected at first and second resolution, seventy five percent of the third (3 out of 4) and fifty percent (2 out of 4) of fourth resolution at $\alpha=0.05$. At $\alpha=0.10$, the aberrant observations were all detected up to the fourth resolution

Table 3.8 contains analysis of simulated data of 1024 with four aberrant observations injected. These aberrant observations were detected up to the fifth resolution level at $\alpha = 0.05$ and 0.01 level of significance.

Table 3.9 provides information on the detection of eight aberrant observations injected in the simulated series of 2048 data set. It was observed that these eight aberrant observations were detected up to the seventh resolution levels in both $\alpha -$ values of 0.05 and 0.10 respectively

4.1 SUMMARY OF FINDINGS

4.1.1 The non-parametric approach

In the non-parametric setting, containing three simulated series of 512, 1024 and 2048 observations in which four (43,-44, 41, 47), four (32, 41, 40,-37) and eight (45,-51, 50,-52, 48,-49, 47, 46) anomalous observations were injected into the series respectively. Turkey's and modified Turkey's methods were able to detect all the AOs in the three series.

4.1.2 The Parametric Approach

In the parametric approach, using the developed test statistics, it was observed that these AOs were detected at same location even when the series has been compressed to the fifth resolution level in series A, B and up to the seventh resolution level in series C at $\alpha = 5\%$ and 10% level of significance. It was also observed that the more the series, the more efficient wavelet method is in detecting these aberrant observations at more resolution levels.

4.2 Conclusion

In the non-parametric method, Turkey's method detected the anomalous observations in the three data sets as well as modified Turkey's method irrespective of the increase in the multiplier

from 1,50 to 3.95. and at lower resolutions (when the data were compressed).

In the parametric method, the developed test statistic was also able to detect anomalous observations in all the three data sets, hence; it is as effective as the modified Turkey's and the Turkey's methods in the non-parametric method

4.3 Recommendations

Anomalous observations present in a data set cannot be determined a priori, it is recommended that every data set most importantly time series data be diagnosed for anomalous observations using the proposed test statistic which has been proved to be more efficient than other existing methods.

From both the parametric and non-parametric setting, it was discovered that even when data is compressed, wavelet analysis can be used to obtain the required information at same location, still preserving its properties, wavelet analysis could be used especially when the series is non-stationary and non-periodic. It is therefore recommended that wavelet analysis be used where data has to be compressed, where issue of stationary and period is not important.

4.4 Suggested Areas for Further Research.

This research work focused on aberrant observations detection in the frequency domain using wavelet analysis. After this work, some research areas for future academic work has now been opened. They are to:

- Extend the detection of anomalous observations in the frequency domain using the Non-decimated wavelet transform.
- Comparing our results in Haar wavelet analysis objectively with what may be obtained using the Non-decimated wavelet transform.

Using multiple wavelet transform for the detection and modeling of anomalous observations in time series data.

REFERENCES

- [1] Armando D. M., Gracia J. F. and Ramon M. R. (2003). A Practical Procedure to Estimate the shape Parameter in the Generalized Gaussian Distribution (ITESM Campus. Monterrey)
- [2] Daubechies, I. (1988). Orthonormal bases of compactly supported wavelet. (Communication Pure and SIAM), XLI, 909-966.
- [3] Daubechies, I. (1992). Ten lectures on wavelet. (SIAM), Philadelphia.
- [4] Daubechies, I. and Lagarias, J.C. (1992). Two-scale difference equations II: Local regularity, infinite products of matrices and fractals, (SIAM, J. Math. Ann). 23, 1031-1079.
- [5] Eckley, I.A. (2001). (Wavelet methods for Time Series and Spatial Data). Ph.D. Thesis, University of Bristol, U.K.
- [6] Eckley, I.A. and Nason, G.P. (2005). Computation of the Discrete Autocorrelation Wavelet Inner Product Matrix, (Statistics and Computing), 15, 83-92.
- [7] Graps A. (1995). In introduction to wavelets, (IEEE Computer), pages 50-61, Vol 2, issue 2, June, 1995.
- [8] Nason, G.P. (2002). Choice of wavelet smoothness, primary resolution and threshold in wavelet shrinkage, (statistics and computing), 129; 219-227.
- [9] Nason, G.P. (2006). Stationary and non-stationary time series. Madder and S. eds., Statistics in volcanology, pp. 129-142. (Geological Society of London), London.

- [10] Nason, G.P. and Sapatinas, T. (2005). Wavelet Packet Transfer Function Modeling of nonstationary time series. *Journal of Statistics and Computing*, 12, 19-229.
- [11] Neill P. (2012). A robust, non parametric methodsto identify outliers and improve final yield and quality. *Proceedings of the C.S MANTECHconference* April 23-26, 2012 Boston Massachusetta.
- [12] Percival, D. B. and Walden, A. T. (2000)wavelet method for time series Analysis, Cambridge university press, Cambridge.

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Real time Application of Robots for Smart Crop Cultivation in Rural Community Environments

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ABSTRACT

Indian agriculture, even after the Green Revolution, is not as productive as it could potentially be. It calls for a second Green Revolution – one of „precision agriculture“, where cutting-edge technology is used to maximize production with minimum input costs and resources. In this paper we present a multi-purpose agricultural robot to implement precision irrigation, fertilizer addition and de-weeding, apart from continuous monitoring of crop and soil conditions. This will involve efficient utilization of water resources, intensive plant and soil monitoring, condition based use of fertilizers and the ability to work in unstructured environments. Developed agriculture needs to find new ways to improve efficiency.

Keywords- *Precision agriculture, agricultural robots, robotic irrigation, robotic de-weeding.*

INTRODUCTION

The green revolution changed the very technology that was being applied in the Indian agricultural system. It showed great results and made India agriculturally self sufficient. But these technologies have remained untouched since then and no major improvement has been made to step up

productivity to meet the demands of the burgeoning population. The new trend for improvement in agricultural production is that of precision agriculture. Some of the major problems in Indian agriculture are raising input costs, availability of skilled labour, dwindling water resources, over usage of fertilizers and lack of proper crop monitoring. Overcoming some of these problems requires tedious manual work which due to unavailability of enough labour cannot be performed. Hence, one of the solutions could be involving automation technologies in agriculture. Agricultural automation could help farmers single headedly maintain their crops and optimize usage of resources. Here, we present an agricultural robot, capable of implementing some of the methods of precision agriculture such as precision irrigation, soil based application of fertilizers, de-weeding and crop monitoring.



Fig 1: shows that AG robots on the farm

1 PRECISION AGRICULTURE

Precision agriculture involves the adequate and optimum usage of resources based on various parameters governing crop yield. The Handbook of Precision Agriculture[1] defines Precision agriculture as a holistic and environmentally friendly strategy in which farmers can vary input use and cultivation methods – including application of seeds, fertilizers, pesticides and water, variety selection, planting, tillage, harvesting – to match varying soil and crop conditions across a field. It is a management philosophy or an approach to agriculture where critical factors that affect yield are identified, and intrinsic spatial variability is determined. It is essentially more precise farm management made possible by modern technology. The variations occurring in crop or soil properties within a field are noted, mapped and then management actions are taken as a consequence of continued assessment of the spatial variability within that field.

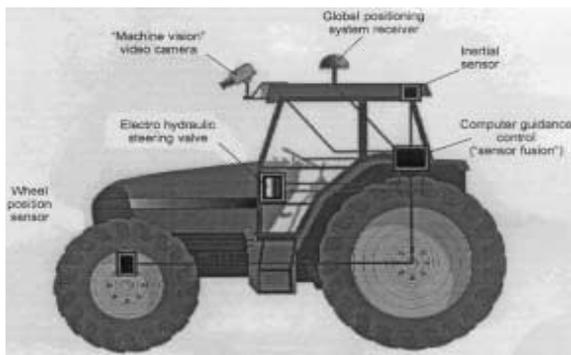


Fig 2: shows that automated harvester

Most of the methodologies of precision agriculture require tedious processes that could only be implemented using machines. De weeding, which was being done manually, is presently mostly dealt with herbicides, which reduces crop yield and degrades soil quality. A single solution to implement precision agriculture, perform tedious agricultural processes and combat the problems of weeds could enhance agricultural yield to a large extent. In this paper we present a single gantry robot capable of carrying out various precision agriculture related operations. The primary goal of the design would be to implement precision irrigation and soil monitoring on each crop entity in the robot's working envelope,

perform de weeding and self structure a cultivated field through accurate robotic crop planning. Crop planning would ensure effective use of the land for maximum yield.

2 THE GANTRY ROBOTIC SYSTEM

Most of the methodologies involving precision agriculture mostly modify the usage of pivot irrigation systems or drip irrigation systems. Perry and Pocknee [2] in their paper reported on the development of a precision pivot irrigation control systems based on GPS data of a field. But these methods haven't proved to be very effective. The most ideal solution to precision agriculture would be to build a robot that individually waters every crop in the field. Building a terrestrial robot with this ability would be impossible as it would have to maneuver itself along with a water hose. The most effective solution would be to use a gantry robot system. The gantry [Fig 1] consists of three linear drives to position the robot at any given co-ordinate in its working envelope. A typical plot of agricultural land in India is assumed to be having dimensions of 100x100m. A gantry robot would be an optimum solution for this dimension provided it has a good traversal speed. The linear drive has to be suitable for this speed. The linear drive will also have to be precise enough as only simple sensors are to be used to maintain cost effectiveness. There should be no possibility of slip or backlash in the drive. This robot, along with its fixture can be easily detached and attached to the frame on some other field, enabling sharing of a single robot by many farmers.

Gantry robotic systems used in industries are built robustly and are expensive. Their main advantage is their capability of having a large working environment. They can also be conveniently be used for precision agriculture purpose as maneuvering would not be affected by the water pipe lines. But their costs need to be reduced for feasibility in agriculture. The feasibility can be improved by modifying the linear drives for light pay loads and using cheaper material for the framework. A gantry frame would have to be set up through the length cultivated field, which would be the working envelope of the robot. Normally screw drives or timing belt drives are used in industries for precision linear drives. But these drives cannot be used for agricultural purposes as this application demands the linear drive

to be cost effective, extremely fast and applicable for large lengths. We present a cheaper and faster linear drive which would be well suited for applications with lighter payloads.

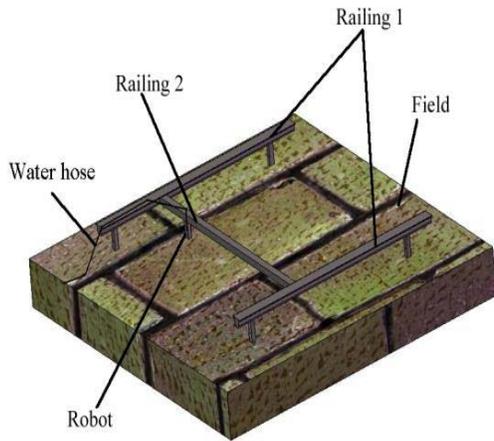


Fig 3: An aerial view of a gantry robot system on a field.

2.1 THE LINEAR DRIVES

2.1.1 HORIZONTAL MOVEMENT

The linear drives used for the horizontal displacements (X-axis and Y-axis displacement) of the gantry robot are essentially a wheel rolling on a rail. Screw drives or belt drives are normally used in an industrial gantry robot to avoid backlash and other positioning related errors. The positioning errors need to be eliminated in this system too as the robot knows its position only through the optical encoders used with the DC motors powering the linear drives. Any slip between the wheel and the rail could lead to serious positional errors. To avoid these errors, peanut shaped projections and engravings are applied on the wheel and the railing respectively [Fig 4]. These projections are made small compared to the wheel that they can be assumed to have a non curved surface. Peanut shaped mating parts are used to avoid slippage and backlash errors between the wheel and the railing. The support rollers arrest any vertical movement of the wheel. The bearing casing holds the shafts of the wheel and the support rollers. This design is aimed at reducing the slippage, and not as a power transmission device.

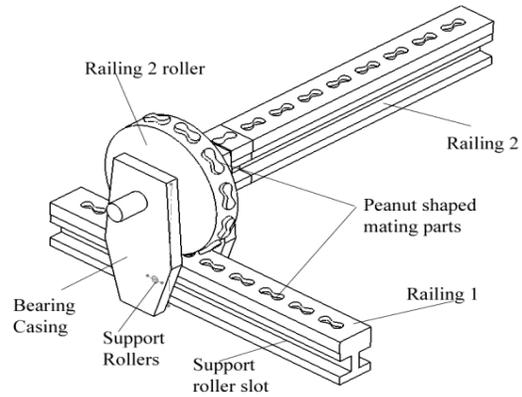


Fig 4A: linear drive used for X & Y axis movement

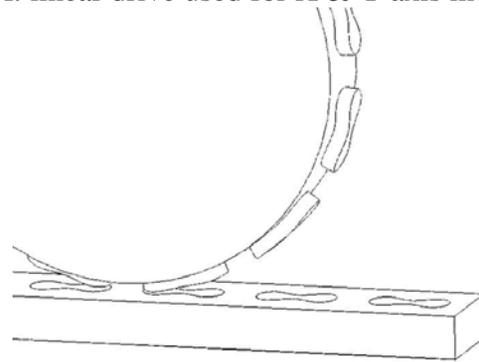


Figure 4B: Zoomed version of railing system

Mating of the profiles on the roller and the railing, The peanut shape used has several advantages. Firstly, they lock easily and tightly, but only in one fixed position. Hence, the wheel will have a constant orientation with respect to the railing. The vertical movement of the wheel is arrested by the support rollers inside the support rollers slot in the railing. Therefore, with the peanut shaped mating projections and engraving any possibility of backlash errors or slippage is avoided. Their profile being convergent contrasts that of circular teeth that are divergent. Secondly, as the beam lengths are going to be very high for this application, stress concentrations at any point on the beam should be minimal. The peanut shape induces lower stress concentration than any other shape due to its close resemblance to elliptical shapes, which create minimum stress concentration. Hence, due to these advantages, the peanut shaped mating parts can be used for the linear drives.

2.1.2 VERTICAL MOVEMENT

The vertical movement of the robot is driven by linear screw drive [Fig 5]. As the traversal length along the Z-axis would be small, screw drives can be used cost effectively. The linear screw drive system is supported on the bearing casing of the wheel moving on railing 2. The robot is provided with a fixture to mate with the screw thread. As the screw thread is rotated by a DC motor with optical encoder, the robot is forced upward or downward. A screw drive support with slots is provided for the robot to grip on to avoid rotating during the rotation of the screw thread. The clockwise or anticlockwise rotation of the screw thread determines the upward or downward movement of the robot.

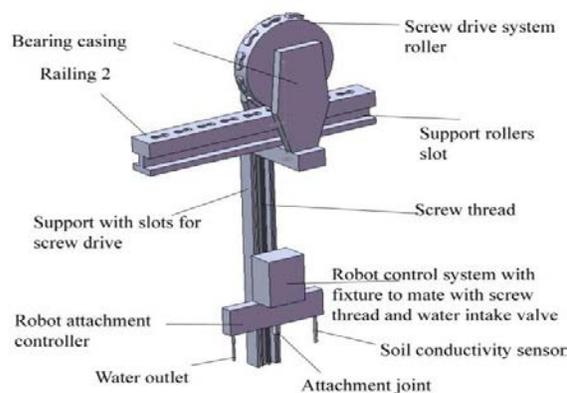


Fig 5: The vertical screw drive attached to the bearing case of the wheel moving on railing 2.

2.2 THE WATER FLOW

The robot has to be connected to an overhead water supply applying the water for the crops. A hose from the water tank is connected to the robot. The hose is supported on the framework of the gantry itself. This does not hinder the movement of the robot. The water rate is controlled by a timer which opens a valve for a definite time depending on the moisture requirements of the soil at a particular co-ordinate. Fig. 5 explains the flow and control of the water by the robot. The robot gets its positional details from the optical encoders mounted on the motor shafts of the linear drives. From the co-ordinate detail, the robot finds the moisture requirement of the soil at that co-ordinate. The water outlet solenoid valve is then opened for an appropriate time. The screw rod is enclosed in a screw drive support with slot on which the robot system grips to avoid rotating due to the rotation of the screw thread. The robot system has a water inlet valve to which the water hose is connected. It also has an attachment joint for auxiliary attachments such as the de weeding attachment.

The screw rod is enclosed in a screw drive support with slot on which the robot system grips to avoid rotating due to the rotation of the screw thread. The robot system has a water inlet valve to which the water hose is connected. It also has an attachment joint for auxiliary attachments such as the de weeding attachment

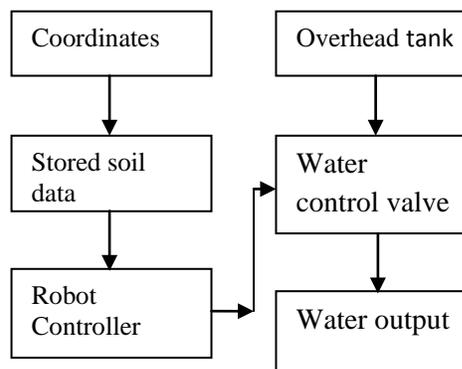


Fig 6: The block diagram of water flow in the robot system.

2.3 MOTORS AND CONTROLLERS

The linear drives have to be powered by DC motors fitted with optical encoders. Precise control of the motor would be required for exact positioning of the robot. The data from the optical encoders is to be stored in a computer to keep a constant record of the robots position. All precision agriculture related decisions of the robot depend on this coordinate data stored on the robots memory. The movement of railing 2 on railing 1 makes use of 2 DC motors, one mounted on each end of railing 2. The movement of the screw drive system on railing 2 makes use of one motor, while the screw drive system makes use of one motor. Appropriate linear drive controllers need to be used for the efficient and speedy performance of the

linear drives. Also the oscillation of the suspended robot needs to be taken care of during the traversal of the robot. Various studies on gantry robot controllers have been performed by Jones, J.F and Petterson [3] and Meressi [4]. These robot controllers are meant for industrial gantry systems and can be modified for the present system.

2.4 MATERIALS

Choosing the right material for the gantry frame forms an important task in the design of this robot. The material should be strong, light weight and inexpensive. It should also be able to withstand all weather conditions. Based on these constraints High Density Poly Ethylene would be an ideal material, although it costs more than steel. If steel is used, the long bars would sag under their own weight, which is to be avoided for smooth functioning of the robot.

2.5 PATH PLANNING

The robot should have a path planning program to minimize traverse movements. This saves energy used by the robot. The robot, before starting any operation should determine the most efficient path. For example minimizing movement on railing 1 reduces more energy as two motors are used for the robot to move on railing 1. Therefore, such optimizations should be planned by the robot.

2.6 POWER SOURCE

The robot will have to be powered by external AC supply through wiring. The AC power could be generated by diesel generator sets as power in rural areas in India is not reliable.

3 APPLICATIONS

One of the challenges of the robot would be its ability to adapt to unstructured environment. Although machine vision techniques are widespread these days, it would prove costly in an agricultural context. Therefore, through concepts such as crop planning, the robot structures the environment to suit its needs while maximizing yield.

3.1 CROP PLANNING

The robot first needs a precise measurement of the soil conditions of a farm. Soil conductivity sensors mounted on the robot measure the conductivity of the soil to determine the moisture content of the soil. As the robot traverses, conductivity sensor is inserted at constant intervals. After traversing the entire field, a map of the soil conductivities is constructed. Similar tests can be performed to map the presence of various minerals based on the crops to be cultivated. From the map, with various constraints such as presence of moisture, minerals, optimum spacing of crop etc. put together, an array map of the crops is created. The robot then traverses the entire field and marks sowing points on the field. These are points where seeds are to be sowed during the sowing season. The robot also records the position of the sowing points for future operational uses.

3.2 PRECISION IRRIGATION AND FERTILIZER ADDITION

Fig 5 explains the method adopted to apply water to the crops according to the soil requirement at that position. Thus, a large volume of water resources would be conserved by applying the optimum amount of water. Based on the map of minerals created by the robot, right amount of fertilizers could be added to the water during precision irrigation of the crop. Thus, by adding the exact amount of fertilizer required for the particular soil location, the land is not degraded and yield is maximised. Thus accurate scientific methods are being implemented directly.

3.3 CROP AND SOIL MONITORING

Various agriculture-related sensors have been developed. Phytomonitoring sensors are capable of monitoring plant growth rates. Sensors are also used to monitor insect activity on crops. The soil data is also to be refreshed frequently as soil characteristics could change seasonally. These sensors can be fixed on the robot attachment joint and can be used throughout the field. The data collected could be used for immediate action to avert any crop failures.

3.4 DE WEEDING

De weeding is a wide research topic and lots of development has taken place in this field. Terrestrial robots have been used to perform de weeding operations. Various machine vision algorithms have been developed for weed recognition. Bakker et al [5] and use a machine vision enabled robot to carry out de weeding on a sugar beet farm. Watchareerueta et al [7] have developed image processing techniques to detect weeds in lawns, which could be applied for the above system with some modifications. Weed destruction can be carried out by positioning a pulsed high voltage device on the weed [6]. Electrical discharges burn the weed, thus destroying it. The electrical discharge device along with a camera mounted on the attachment joint can be used to de weed the entire farm.

4 CONCLUSION

A gantry robot that could be manufactured at a low cost could implement numerous precision agriculture related processes on a field with very less supervision. This could help in reducing input costs and increase agricultural outputs by maximising the crop yield of a given land. Dwindling water resources are of major concern today. Agriculture should do its part to conserve water resources. By applying adequate water to the crops using the system explained above, water could be conserved to a large extent compared to the conventional irrigation system. But one major concern would be the amount of power used by the robot system. Non conventional energy systems can be implemented to solve power problems of the robot system.

REFERENCES

- [1] Ancha Srinivasan; "Handbook of Precision Agriculture" – 2006
- [2] Perry, C., Pocknee, S.; "Precision Pivot Irrigation Controls to Optimize Water Application", NESPAL, The University of Georgia, Tifton GA
- [3] Jones, J.F.; Petterson, B.J.; "Oscillation damped movement of suspended objects"; Proceedings of the IEEE International Conference on Robotics and Automation; 24-29 April 1988 Page(s):956 - 962 vol.2; 1998

[4] Meressi, "Modeling and control of a three dimensional gantry robot"; Proceedings of the 37th IEEE Conference on Decision and Control; Volume 2, Page(s):1514 - 1515 vol.2; 1998

[5] Bakker, T.; et al; "An autonomous weeding robot for organic farming"; International Conference on Field and Service Robotics. - Port Douglas, Australia; 2005 - p. 580 – 591; 2005

[6] Mizuno, A.; Tenma, T.; Yamano, N.; "Destruction of weeds by pulsed high voltage discharges"; Conference Record of the IEEE Industry Applications Society Annual Meeting, 1990., Page(s):720 - 727 vol.1; 1990

[7] Watchareeruetai, U.; Takeuchi, Y.; Matsumoto, T.; Kudo, H.; Ohnishi, N.; "Computer Vision Based Methods for Detecting Weeds in Lawns"; IEEE Conference on Cybernetics and Intelligent Systems, June 2006 Page(s):1 – 6; 2006

Collective Empowerment of Women through Self Help Groups

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Abstract: Economic empowerment is a major step towards the goal of equal participation of women in household and community, and to challenge socially unfair stereotype practices through women's Self Help Groups (SHGs). Economic empowerment of poor women could be achieved through improvement in their ability in accessing and controlling individual household economic resources and assets such as income, savings land, housing, and livestock. To sustain the economic empowerment it is crucial that the process of social empowerment should begin simultaneously by developing a sense of independence, self-confidence among women. Taking either individual and or group actions, to address social issues that are prevailing at household, community and institution levels, will improve capabilities in attaining education, sense of ownership, sense of belonging, leadership and their capacity to seek a better future. Collectively, women are enabled to address challenges and constraints and in the process achieve empowerment. This paper tries to examine the impact of SHGs collective with respect to empowerment of women based on the first-hand information.

The concept of community development is one of the important components of collective empowerment. Community development aims at generating sense of ownership among the people through increasing their ability to collectively discuss community issues, plan and work together to solve problems and collective decision making for social empowerment.

This research working paper attempts to find out the initiatives taken by SHGs to achieve individual and collective empowerment.

Individual social empowerment of members in SHGs is studied through indicators such as: awareness level, leadership, mobility, socialization, financial independence and security, understanding in family, improved living standard, recognition and equal status in family, support and involvement in decision making process.

Collective empowerment is examined through a list of indicators such as village development activities, mobilisation of schemes, social action programmes and political action programmes.

Key words: Self Help Group, Women empowerment, Scheduled caste, nonscheduled caste, Social empowerment, Economic empowerment, Political Empowerment

Introduction:

Although women form nearly half of the human capital in the country, they are still the most deprived and neglected segments of society despite the constitutional guarantee for equal rights and privileges for men and women. Women continue to be victims of a process of economic, social, cultural and political marginalization. Women are viewed as homemakers and are not encouraged to undertake professions to which men have a natural access. On the other hand, half of the world's food is produced by women working in the fields and they constitute 1/3 of the world's labor force. Although a woman does double the amount of work and contributes doubly to the economy, she is considered a burden and instances of female infanticide and foeticide bear testimony of this.

Women not only face various gaps as females, but they may also belong to another disadvantaged category. Their lack of empowerment often originates within the household or family and their empowerment needs a major transformation, especially in patriarchal societies.

The low social status of women stem from the insignificant economic status ascribed to them in the rural society resulting in their continued economic dependence on the male members of the household. Therefore, there is need for economic empowerment of women.

In particular, the scheduled caste women are totally deprived of opportunities though there are provisions and allocations in job opportunities. "The Scheduled Caste is the weakest in terms of political, economic, social and cultural resources". (Status of Scheduled Caste of Karnataka.2001). As in other states of the country, 75% of the Scheduled Caste in Karnataka are in the villages and they subsist by laboring in agricultural and allied fields. "Not only do the Scheduled Castes suffer from a lack of social

resources; they have also been denied access to both material and cultural resources. They have experienced, in addition to material deprivation, social exclusion, which is manifested in their poor access to human development.”

Several economic and other social welfare measures have been taken by the government and non-government organisations. The Government of India announced a holistic programme called Swarna Jayanti, Gram Swarozgar Yojana, which is based on group approach. The rural poor are organized into SHGs which are provided micro-credit to take up viable economic activities on their own. While most of the development programmes address themselves to alleviating the condition of poor who live below subsistence levels, women, who form the single largest disadvantaged section of gender oppression are seldom given priority in such programmes. Majority of these women come from the lowest strata of the caste/class hierarchy. Their caste affiliation restricts their mobility; their class membership limits their access to productive resource, while their gender role minimizes their economic participation. As such, they are marginalized as workers and found in situations of immense exploitation and victimization and are therefore forced to a status of invisibility and powerlessness. Despite their invisibility in the labor force and their powerlessness in the family, it is their meager but substantial income that sustain and meets the needs of the family.

Self-help Group serve as a platform for poor women to come together reflect on their status, analyse and take appropriate measures to improve their status, both at the individual and the collective level. Thus, Groups become empowered through collective action, and are enabled to address the constraints in the process. Empowerment is a multifaceted process encompassing aspects such as enhancing awareness, increasing access to resources – economic, social and political. It comprises an equally important component of mobilization and organization of women into groups, because it is these groups that form the basis for solidarity, strength and collective action. While economic empowerment often emphasize more at individual level the social empowerment impact at individual, family and community level

The research working paper on “Collective empowerment of women in Self Help Groups “intends to study the impact of SHGs collective action to empower scheduled caste and non-scheduled caste women who form subordinate category of people who have generally lacked access to education and societal structures of power.

Review of literature:

During the course of the research work, the study of several writers was referred to and it is vital that an abstract of the literature study is put to note and the following references are worth mentioning.

Karnataka Human Development Report (2005) describes that the SHG strategy, which has begun to emerge as the main vehicle of socio-economic development for women, offers multiple inputs and not just wages: like communication skills, vocational training, awareness about literacy and health, participation in community and political processes, all these are inputs that the Scheduled Caste need as they are poor, marginalized and voiceless. In addition, poverty reduction programmes must target the Scheduled Caste because so many other deprivations arise out of income poverty.

Sudha Rani, K., D. Umadevi and G. Surendra (2002) in their study titled “SHGs, Micro-Credit and Empowerment “observed that the participation in SHGs enhanced the empowerment of women in aspects like increase in self-confidence and decision-making power during the period of participation.

Gadekar, H.H. (2005) in their study “Women Empowerment Through Mahila SHG Industrial Society Ltd” found that because of the society’s efforts, women empowerment has become a reality. Members are becoming self-reliant. This visualizes the strength of women leadership is encouraged in the field of cooperatives, this will strengthen cooperative development in all walks of life.

Banerjee, G.D. (2002), in their Evaluation Study on Self-Help Group, observed that the participation of women in SHGs made a significant impact on their empowerment both in social and economic aspects. Most of the women were able to increase their income level manifold and contributed to the development of their family. It has enabled women’s participation in financial decisions, full satisfaction in performance in SHG activities, continuing girl child education and reduction in consumption of alcohol individually, contesting and winning in panchayat elections, liaising with government authorities to improve village basic infrastructure (laying of roads, getting electric connections and providing drainage, drilling of bore well and community hall construction).

Raghav Gaiha and Mani Arul Nandhi, (2007), in their article “Microfinance, Self-Help Groups and Empowerment in Maharashtra” states that various dimensions of empowerment were confirmed. Not only do SHGs benefit from the presence of networks, the former also contribute to trust, reciprocity and associational capital (e.g. through strengthening of local institutions). Domestic violence was reduced.

CS Reddy and Sandeep Manak, (2005) in their study titled Self-Help Groups: A Keystone of Microfinance in India - Women empowerment and social security, observed that the status of women has generally improved as they have developed stronger

confidence which has changed gender dynamics and their role in the household. In south India, significant improvements in fertility rates, female literacy, participation in development programmes and economic independence are evident. Women are able to fight for their rights and entitlements and have emerged as a force to be reckoned with. Further, SHGs are becoming more than just financial intermediaries, instead they have emerged into a more political and social unit of society.

Lalitha, N., and B.S. Nagarajan (2002) in study on “Functioning of the SHGs in Selected Districts of Tamil Nadu” (eds.) highlighted the facts that SHGs were people’s institutions and with their support, the women could march towards empowerment and that the groups could promote individual and group ventures of income generating activities under the effective guidance of NGOs. The study also revealed that effective leadership, group cohesiveness, savings, regular meetings, peer group pressure, linkage with other institutions and effective supervision by the NGOs were the factors which contributed to the success of the groups.

Rationale of Study:

The various problems related to women status are found frequently among women in general and scheduled caste population scheduled caste is one of the disadvantage sections in our society. There are inadequate studies that emphasise on collective empowerment of women in SHGs. Hence, the present study has been undertaken.

Objective;

To study the collective interventions of women that impacts social and economic empowerment at family, community and village level.

Research methodology:

SHGs which have been in existence for more than 3 years and with a membership of 12-20 were chosen for the subject area. Heterogeneous groups were selected where in both scheduled caste and non- scheduled caste women have taken the membership. SHGs having 1/3 of scheduled caste members were chosen. The total sample size is 28 SHGs. The study was conducted on the basis of stratified, purposive random sample technique.

Information was collected both from primary and secondary sources. To find out the dimensions of women empowerment at collective level structured questionnaires were used in focused group discussions with SHGs. In addition separate discussion was held with SHG federation members. The primary data thus collected were tabulated and analysed. Statistical tools like; Chi square test and Karl Pearson's Coefficient of Correlation have been applied. Secondary data was gathered from SHG records and annual reports of SHG facilitating agency.

Scope of Study:

The present study area is limited to the SHGs facilitated by an NGO in Mulabagilu Taluk of Kolar district. There are a total number of 325 SHGs. Only 28 Self Help Groups have been studied.

Null Hypothesis:

1. H₀: There is no significant difference in upliftment of scheduled caste members than the non-scheduled members (Non-SCs) through SHG formation and management
2. H₀: There is no significant difference in the empowerment of women in literacy level while comparing with the performance
3. H₀: There is no significant difference in taking responsibility in convening the regular meetings and deciding the agenda for the discussion in SHG meetings i.e., the staff and NGO representatives will play major role in convening the regular meetings of SHGs

Limitations of the study:

The study is mainly based on the information provided by the members through focused group discussion by using structured questionnaire and not through direct observation of SHG regular meetings.

Research Findings and Analysis:

Part I -General profile of SHGs and function

Table 1.Age of Self Help Group

Inception years of SHGs in years	Frequency	Percentage
5 to 10	5	17.86
10 to 15	9	32.14
15-20	14	50
Total	28	100

The above table shows that all SHGs covered under the study were in existence for more than five years.50 % of the SHGs were between 15 to 20 years. 32 % and 18 % was in the range of 10 to 15 years and 5 to 10 years respectively. It is shows the sustainability of SHGs

Table 2.Caste wise analysis

Observed			
Domination	SC	Non-SC	Total
0-50%	10	18	28
>50%	18	10	28
Total	28	28	56
Expected			
Domination	SC	Non SC	Total
0-50%	14	14	28
>50%	14	14	28
Total	28	28	56

Chi-Square P Value 4.57

Table Value at 1 degree of freedom and 95% confident level: 3.84

We reject H_0 because $4.57 \geq 3.84$. We have statistically significant evidence at $\alpha=0.05$ to show that H_0 is false, or that the distribution of responses is not in equal proportion. The p-value is $p < 0.005$.

The result indicates that there is a significant difference in upliftment of scheduled caste members than the non-scheduled members (Non-SCs) through SHG formation and management. The scheduled caste members get leveraged by the involvement in the SHGs with the support of non-scheduled caste members. The caste discriminations can also be addressed in the society, at large, by such a great initiatives. This study also shows that the SHG movement has visually brought equality among the population of different categories, which has to be highly appreciable. It also proves that the SHG brings social empowerment

Table .3 Education status of SHG Members

F.Dist. - One tailed - Test Between the groups

Education status of SHG members						
Illiterate	Literate	Primary	Upper Primary	High School	PUC	Degree
295	5	49	48	45	8	1
F.Dist.Test P Value 0.0355						
Table Value at 6 degree of freedom and 95% confident level: 4.2839						
We accept H_0 because $4.2839 \geq 0.0355$. We have statistically insignificant evidence at $\alpha=0.05$ to show that H_0 is true, or that the distribution of responses is equivalent between the groups (one-tailed test). The p-value is $p < 0.005$.						
There is no significant difference in the empowerment of women in literacy level while comparing with the						

performance.

The above table shows the level of school education of the SHG members. Majority (66%) were illiterate. Rest of the members had schooling up to primary (11%), upper primary (11%), high school (11%) and graduate (1 %). Only 1 % knows to read and write through informal education.

Table 4. Convening SHG meetings

Convening SHG meetings				
Representatives	Members	President	Secretary	Treasurer
1	21	7	2	0
6.2	6.2	6.2	6.2	6.2
4.36129	35.3290323	0.103226	2.845161	6.2
Chi-Square P Value 48.84				
Table Value at 4 degree of freedom and 95% confident level: 9.488				
We reject H_0 because $48.84 \geq 3.84$. We have statistically significant evidence at $\alpha=0.05$ to show that H_0 is false, or that the distribution of responses is not 0.2. The p-value is $p < 0.005$.				

The above result indicates that there is a significant difference in taking responsibility in convening the regular meetings in SHGs. Here, the members on their own, take initiatives and convene their SHG meeting without the support of any NGO staff or individuals. It shows that in SHGs which have been in existence for over 10 years have socially empowered women, which is highly appreciable.

Table .5Deciding agenda for the SHG Meeting

SHG Agenda						
Representative	Member	President	Secretary	Treasurer	Others	Total
2	25	2	0	0	1	30
5	5	5	5	5	5	30
1.8	80	1.8	5	5	3.2	96.8
Chi-Square P Value 96.8						
Table Value at 5 degree of freedom and 95% confident level: 11.070						
We reject H_0 because $96.8 \geq 11.070$. We have statistically significant evidence at $\alpha=0.05$ to show that H_0 is false, or that the distribution of responses is not 0.17. The p-value is $p < 0.005$						
There is a significant difference in the capabilities of women in framing the SHG meeting agenda themselves.						

The above result indicates that there is a significant difference in taking responsibility while deciding the agenda for the discussion in the SHG meeting. Here, the members on their own, takes initiatives, discuss the economic and social issues and analyze the causes. It shows the socially empowered women are the result of SHGs over a period of 10 years, which are highly appreciable.

Part -II

Collective Empowerment

Collective action for village development activities

Self-help groups have initiated and completed activities which can benefit one individual, a group of individuals, locality or the whole village. This has led to better participation and encouraged leadership among women leading to community recognition of SHGs. Some of the activities that were initiated are given in the table below.

Table 1. Collective action for village development activities

Village development activities		
Name of activity	Frequency	Percentage
Road making	9	32.143
Toilet	8	28.571

Public Distribution System	13	46.429
Drainage	1	3.5714
Housing	9	32.143
Drinking water	20	71.429
Others	26	92.857

It is observed from the above table that a greater percentage of 71% of SHGs took part to improve basic facilities like drinking water facility in their villages followed by ensuring access to ration cards (46%) as per the eligibility criteria and housing (32%). The general village infrastructure such as road making (32%), sanitation facilities like drainage (3%) and toilets construction (28%) were addressed. Others (92%) included Tank/lake improvement, through Jala Samvardhana yojana, and employment generation through National Rural Employment Guarantee Scheme. In some villages SHGs were able to mobilise MLA fund for village infrastructure development. They have provided labour for construction of school building, anganwadi building and Community hall. They emphasised planting of trees for environment protection, mobilised job cards for eligible poor families.

Collective action for mobilisation of government schemes

It is essential that the members realise that they have to ensure the government benefits earmarked for the poor and needy are mobilized. This can be achieved by establishing linkages with government departments and other institutions and organizations, etc.

Table 2. Collective action for mobilisation of government schemes

Mobilisation of government schemes		
Name of the scheme	Frequency	Percentage
Family pension	2	7.1429
Old-age pension	20	71.429
Widow pension	19	67.857
Ration card	26	92.857
Special assistance schemes (Women,SC,ST)	19	67.857
Housing	25	89.286
Electricity	23	82.143
Toilet	24	85.714

It is observed from the above table that the SHGs were able to access different programmes for their members who are eligible under different schemes. Availing ration card was reported to be highest (93%). Availing Housing schemes like; Indira Awas Yojana, Ashraya Yojana, Ambedkar Housing scheme Yojana, and Basava Housing was reported to be the second highest (89%) and the third highest was toilet construction (85%) through Swachh Bharat Mission and Nirmal Bharat Abhiyan. Electricity through Bhagya Jyoti was reported to be the fourth highest (82%) government benefit availed. Other social security benefits for vulnerable women included-- old age pension through Sandhya Suraksha Yojana (71%), widow pension (68%) and family pension (7%). Special assistance schemes for scheduled caste members were also mobilized (68%).

Table 3. Collective action for economic development activities

Economic empowerment initiatives				
Name of the activity	SC members	Non SC members	Frequency	Percentage
Skill building	64.28	60.71	18	64.286
Group IGP	14.28	14.28	4	14.286
Alternative savings	57.14	57.14	16	57.143
Health Insurance	67.85	67.85	19	67.857
Bank linkage			20 SHGs	71.429
Equal wages			16 SHGs	57.143

It is

observed from the above table that through SHGs 64% and 60% of scheduled caste and non-scheduled caste women have got the opportunity to develop their skills to take up and manage their agri business and livestock business including dairying more efficiently. An equal percentage i.e.14% of both scheduled and nonscheduled caste members have taken up group income generation activities like silkworm rearing. In a similar manner both scheduled and non-nonscheduled caste members (57%) have been doing savings in post office and separate individual savings bank account. Health insurance from TATA AG is taken in equal percentage by 67% of both scheduled caste and nonscheduled caste members. They have encouraged women to have health insurance under SwasthBhimaYojana and helped obtain Yashasvini cards. They have ensured mothers get a kit called as “Madilu kit” under Janani Suraksha Yojana. 57% of SHGs has demanded for equal wages. They have been able to access loans by establishing SHG bank linkages (71%).

Collective actions of SHGs to address social issues

SHGs have become aware of the need to address the social issues that are affecting girl child and /or woman. They have been able to discuss these matters in SHG meetings and initiate steps to bring changes in the social life of SHG members. Some of the issues taken up by SHGs are: girl child education, dowry prevention, prevention of violence against women, asserting property rights for women, awareness level on legal matters, woman divorce, and others

Table 4. Distribution of SHGs as per Collective actions to address social issues

Collective interventions to address Social issues		
Name of social activity	Frequency	Percentage
Girl child education	25	89.286
Prevention of violence against women (VAW)	25	89.286
Legal awareness	23	82.143
Dowry prevention	19	67.857
Women property rights	19	67.857
Woman divorce	5	17.857
Others	24	85.714

It is observed from the above table that majority of 89 % of SHGs have given importance to provide school education for their girl children. They have also influenced the community by creating awareness on the significance of girl child education. They have made efforts to prevent school dropouts after attaining puberty. They encouraged girls to study up to 10th standard and beyond. Federation members have used all the possible forums like; Federation meetings, SHG annual functions, mothers meeting of anganwadis, adolescence meetings, and other to create awareness as well as to motivate girls and women. They have encouraged men in families to prevent gender discrimination in educating their children. They have mobilised Bhagya Lakshmi scheme for girl children schooling.

It can be inferred from the above table that 89 % of SHGs have tried to abolish alcoholism which are causes of poverty and violence against women. Through the gender education and legal awareness imparted by NGO they have understood that they have right over their body and none can abuse it either by using derogatory words and or violence in the form of beating and others. They have (internalized that domestic violence is violating human rights. 89 % of SHGs have addressed such issues both at family and community level collectively.

It is can be inferred from the table that 82% of SHGs have invested time in imparting legal awareness to its members. They have imparted knowledge on Human rights, reproductive rights of women, property rights, and children rights, domestic violence and others. Legal information given them confidence to address social issues and others issues which are affecting their life. The only way these scheduled women can escape the viscous cycle of poverty, abuse and oppression is through education. Through education more scheduled caste women can come to know their basic human rights and they can then raise an even stronger voice against abuse and exploitation.

The above table reveals that 67% of SHGs have initiated efforts to create awareness on the Dowry Prohibition Act. In SHG meetings they have recognized the incidence of dowry and its violent consequences. They have been able to address dowry related issues at the level of members’ households and community. Among themselves they have decided that they will not take and give dowry. They have decided to educate their children and encourage them to seek employment so that they become economically independent.

More importantly, there is no discrimination of members on caste basis. Scheduled caste members having SHG membership are not performing their conventional jobs like; manual scavenging, toilet cleaning in houses of well off and slipper making. They have been participating in SHG related activities and social functions.

Collective actions of SHGs for Political Empowerment

Attendance at Grama Sabha indicates rising interest in local affairs, besides widening the canvas of politically empowering women resulting in to greater participation as candidates for election to local bodies. The SHGs by virtue of their doing good for SHGs and support rendered by members towards village development activities can contest for local elections or support a woman candidate by canvassing for elections.

Table 5. Distribution of SHGs as per Collective actions for political empowerment

Political participation		
Name of the political action programmes	Frequency	Percentage
Awareness on voting	28	100
Freedom to vote	28	100
Contesting in election	19	67.857
Canvassing in election	25	89.286
Designation in GP	10	35.714
Participation in GP meeting	26	92.857
Others	22	78.571

Democratic awareness is a vital step in progress and it is expected that training programmes and Federation and SHG meetings provide valuable inputs in this regard. It is observed from the above table that 100% of SHGs reported that members are aware of right to vote and vote in all elections. They have cast their vote in favor of the candidate of their own choice.

A total of 67 % SHGs have encouraged their members to contest in local elections and 89% of SHGs have canvassed in favor of the nominated women candidates from SHGs. 35 % of SHGs have reported that women candidates who won elections are not mere members but have attained responsible positions in Grama Panchayat. In 92 % of SHGs members have attended Grama Sabha meetings and have a say in decision making process.

Part - III

1. SHGs impact on Social Empowerment

Table 6. Distribution of SHGs as per Collective actions for social empowerment at individual and family level

Karl Pearson coefficient of correlation:

Self-Development					Family status					Community		
Increased awareness	Leadership	Mobility	Socialization	Financial Independence	Understanding in Family	Improved in standard of living	Equal Status	Participation in Decision making	Financial Security	Recognition	Support	Involvement
	0.37	0.69	0.81	0.62		0.11	-0.03	0.75	0.47		0.71	0.76

Cut off / standard level: +0.6

1. **Correlation between increased awareness level and leadership: +0.37**

This table indicates that the increased awareness contributed to taking leadership position to the extent of +0.37. Other criterion like ability, school education, family background etc. is forming part of leadership apart from getting awareness alone (there is no

reference to this in the table). However, it could be pointed out that getting the improved awareness would be the entry point for any leadership position in SHGs.

2. Correlation between increased awareness level and mobility: +0.69

It indicates that the increased awareness also contributed to higher mobility in the social background to the extent of +0.69; hence, it is highly correlated to the standard level. It means that the increased awareness level gives is positively related to their ability to move freely and independently in the society i.e., the ability to move between different levels in society like employment, development institutions/organizations.

3. Correlation between increased awareness level and socialization: +0.81

It indicates that the increased awareness contributed to the socialization process to the extent of +0.81; hence, it is highly correlated to the standard level can be inferred. It means that the increased awareness level has a positive impact on the process of learning to behave in a way that is acceptable to society. It gives higher leverage for the women empowerment.

4. Correlation between increased awareness level and financial independence: +0.62

It indicates that the increased awareness contributed to financial independence to the extent of +0.62; hence, it is positively correlated than the standard level. It means that the increased awareness level has a somewhat positive impact on the financial independence. It gives higher leverage for the economic empowerment of women.

Family Status:

1. Correlation between understanding in family vs. standard of living and equal status: +0.11 & -0.03

It is surprising to note that, though there is a good understanding at the family level, it did not contribute majorly to improvement in the standard of living of family and failed to provide equal status with men. A diligent effort has to be taken by the NGOs and GOIs to enhance the importance of equal status to bring women empowerment at family level.

2. Correlation between understanding in family vs. participation in decision making: +0.75

The correlation with the participation in decision making is high i.e., +0.75, which shows that women play a major role in decision making in their family. The participation in the decision making at family level is the foundation for women empowerment, which is a positive highlight of understanding in family level. Members took decisions about various important aspects of household management like expenditure on education of child, marriage of child, medical care, etc.

3. Correlation between understanding in family vs. financial security: +0.47

The correlation with the financial is moderately low i.e., +0.47, less than the standard. Hence, women can exercise their role in their family to bring financial security to a limited extent only. Men in families are supporting women to attend SHG meetings, contributing to savings, and payment of loan installments. Women get support of men in the form of children care, elderly care and household chores when they attend SHG meetings or when they travel outside villages to fulfill duties of SHG and federations.

Community level:

1. Correlation between community recognition and support: +0.71

The correlation between the community recognition and support is highly positive i.e., +0.71. Since most of the SHGs were more than 10 years old, it indicates that the existence of SHGs for more number of years builds community support and thereby it results in women empowerment at society. In the society they gain respect. Community also have rendered support by participating in campaigns organised by SHGs, to name a few, Right to food campaign, Campaign on Violence Against Women, Pension campaign, Prohibition of alcoholism, campaign to assert woman's property rights, Campaign against cutting trees,

2. Correlation between community recognition vs. involvement: +0.76

The correlation between the community recognition and involvement is highly positive i.e., +0.76. This could be because the SHGs selected for the study are almost 10 years old. SHG members have been invited to participate in committees like; School Development and Betterment Committee, Village Health and Sanitation Committee, ward sabha meetings. They are also invited to participate in national and local events and are treated with respect. It indicates that the existence of SHGs for more number of years builds involvement in the community and thereby it results in women empowerment at society.

Major findings

Development activities of SHGs which has performance above: 90%
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Sl.No	Development Activities	Performance in %
1	Awareness of voting	100
2	Freedom to voting	100
3	Participating in Gram Panchayat meeting	92.86
4	Ration card procurement	92.86
Development activities of SHGs which has performance:71%-90%		
1	Girl child education	89.3
2	Fighting against Prevention of VAW	89.2
3	Canvassing in election	89.2
4	Mobilising Housing for poor	89.2
5	Toilet facilities	25.87
6	Electricity facilities	82.1
7	Drinking water facilities	71.4
8	Bank linkages	71.42
Development activities of SHGs which has performance : 50%-70%		
1	Access to insurance; Dowry prevention; Women property rights; Contesting in elections; Widow pension; availability of special assistance schemes	67.86
2	Skill building	60-64
3	Ensuring equal wages system and alternative savings	57.14
	Development activities of SHGs which has least performance	
Development activities of SHGs which has least performance:below 50%		
1	Road making	32.14
2	Drainage facilities	3.57
3	Group Income Generation Activities (IGAs)	14.28
	Toilet construction	
All the above results show the Overall performance of SHGs in collective empowerment is 64.796%.		

Suggestions

1. Improve literacy level of women
2. Pay attention to other diversified activities for women beyond farming.
3. Emphasize financial sustainability in SHGs.
4. Encourage members to document the details in SHG independently
5. More efforts to be taken to address dowry issues
6. Greater need to take up right based issues like; equal wages, property rights, equal status
7. Skill building to provide supplementary income generation activities
8. Gender and empowerment indicators to be developed to assess the year wise progress

9. Create more employment for women
10. Remove superstitious beliefs among women
11. Greater awareness of constraints and achievements of SHGs
12. Gender sensitization programmes for men

Conclusions

This research study examines the effectiveness of women SHGs in collective empowerment. It conducted a significant analysis of various indicators such as; awareness level, leadership, mobility, socialization, financial independence and security, understanding in family, improved living standard and recognition and equal status in family, support and involvement in decision making process. Collective empowerment is examined through a list of indicators such as village development activities, mobilisation of schemes, social action programmes and political action programmes

The study found that older SHGs are emerging as social empowerment or social action groups for women. This is because SHGs are facilitated by NGO which organized women around multiple issues that helped them to expand into new spaces. The SHGs have the capacity to deal with Economic empowerment (access to savings and credit) Social empowerment (girl child education, dowry, violence against women), Individual empowerment (self-confidence, mobility, decision making, leadership) and Political empowerment (freedom to vote, contesting elections, canvassing, holding positions in local bodies)

The SHGs have enabled women to be assertive and facilitated the empowerment process. SHGs have been found to be a meaningful force in achieving collective empowerment. Poor women have gained voice through collective participation. Women are developing a sense of dignity, self-confidence which is powerful tool of empowerment.

This study concludes that, members of the older SHGs appear more confident, financially more secure, and in better control of their lives. Thus, we can conclude that SHGs are one of the means to achieve collective empowerment of women. Their increasing awareness has given them courage and enhanced their participation in discussions in aspects that affect their status at various levels--family, community and village level.

Reference:

1. Status of scheduled castes in Karnataka Karnataka Human Development Report 2005 –Chapter 9
2. Sudha Rani, K., D. Uma Devi and G. Surendra “SHGs, Micro-Credit and Empowerment”, Social Welfare, February, 2002, pp. 20-22.
3. Gadekar, H.H., “Women Empowerment through Mahila SHG Industrial Society Ltd”. The Cooperator, Vol. 43, No. 3, September 2005.
4. Banerjee, G.D., Financing Agriculture – In-house Journal of Agricultural Finance Cooperation Ltd., Evaluation Study on Self-Help Group, April-June 2002.
5. Raghav Gaiha and Mani Arul Nandhi, (2007), Microfinance, Self-Help Groups and Empowerment in Maharashtra, ASARC Working Paper 2007/15.
6. CS Reddy and Sandeep Manak, APMAS CEO, (2005), Self-Help Groups: A Keystone of Microfinance in India - Women empowerment & social security, Mahila Abhivruddhi Society, Andhra Pradesh (APMAS)
7. Lalitha, N., and B.S. Nagarajan, “Functioning of the SHGs in Selected Districts of Tamil Nadu” (eds.) Self-Help Groups in Rural development, New Delhi: Dominant Published and Distributors, 2002.

Development and Legal Basis of Sharia Banks in Indonesia

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Abstract- Indonesia is a dominant Moslem country in the world. This condition makes the Sharia Banking growing easily. As a consequence, the education and socialization processes of the Sharia banking system in this country are done intensively. These processes are expected to increase public awareness and interests to use Sharia banks. However, literatures on the development and the legal basis of Sharia banks in Indonesia have been limited. For this reason, this paper aims at discussing the development and the legal basis of Sharia banks in Indonesia. The method used to discuss is by using secondary sources advance in literature with particular concern on both national and Islamic rules and laws concerning with Sharia banking systems. This study found that the large number of Muslim population in Indonesia have not been well-informed about the development of Sharia banking systems, although National rules and laws to support the development of Sharia Banks have been many. In addition, it was also argued that the development of Sharia banks can be one solution to improve the economic development in Indonesia. However, much remain to be done by the Sharia banks to promote their financial activity to public at large in Indonesia.

Index terms- Sharia Banks, Sharia Principles, Islamic laws, economic development

I. INTRODUCTION

Bank is a very important financial institution in the economy of a country. In general, the Bank is defined as a financial institution in which the main business is collecting funds and channeling it to the community in the form of credit as well as providing services towards public transactions and circulation of money. In addition, Bank is also a financial intermediary institution generally established with the authority to accept deposits of money, lend money, and issue promissory notes or banknotes. The word Bank comes from the Italian word *Banca* which means a money changer. The word *Banca* was popular in the Renaissance era to indicate the need of bankers to sit behind the desks when they do any economic transactions.

According to the Law Number 10 Year 1998 on the Amendment of Law Number 7 of 1992 concerning Banking system, especially in the Article 1 of paragraph (2), a bank is defined as a business entity that collects funds from the public in the form of savings and distributes it to people in the form of credit and or other forms in order to improve the lives of many people. Based on this definition, the bank is a company engaged in the field of finance, meaning that banking activities are always related in the field of finance. The bank can also be considered as a social institution that provides financial services.

In terms of the banking principles, Indonesia has regulated the banking principles. These principles are regulated in the Article 2 of the Act Number 7 of 1992. In this act, it was stated that Indonesian banking when it runs its business should be based on economic democracy by using the principle of prudence. The words economic democracy refer to Pancasila and the 1945 Constitution of the Republic of Indonesia. Whilst the principle of prudence has no explanation formally. But in practice, it can be meant that business activities must be conducted or run by people who have experiences and professionalism in banking activities. For this reason, the principle of prudence is a must in running banking activities. However, in the context of the objectives of Banking in Indonesia, this was regulated in the Article 4 of the Law Number 7 Year 1992, which states that: "Indonesian banking aims to support the implementation of national development in order to improve equity, economic growth and national stability towards the improvement of the welfare of the people".

In terms of the type of Banking it is regulated in the Article 5 paragraph (1) of the Law Number 7 of 1992. In this article it was stated that banking types are divided into two. The first is the Commercial Banks as explained. The commercial Bank is specialize to carry out certain activities or give greater attention for certain activities. The meaning of "carrying out certain activities" is that the banks have objectives to conduct a long term financial activity, financing cooperative development, the development of micro, small and medium enterprises, exporting non oil and gas products, and financing housing development. The second type is the rural bank, that is, banks that are established and serve financial transactions in rural areas

The different between conventional bank and Sharia bank is that the later is managed and organized based on Islamic law. This aspect makes the Sharia bank has advantages in comparison with the conventional banking systems. Sharia bank is implemented based on justice values as outlined in the Islamic teaching. Other differences are that the decisions made are based on the *fatwa* of the National Sharia Council of the Majelis Ulama Indonesia (MUI). In addition to this council, there is another independent institution that participates in Sharia banking activities. This institution is called the Sharia Supervisory Board. This is also an independent institution which has the main function to supervise the bank in compliance to both Islamic and national laws.

This study, by using library research, aims at discussing the development and the legal basis of Sharia Bank in Indonesia. The significant reason why these issues are discussed is partly because literatures that elaborates the development of Sharia Banks in Indonesia are still limited. Also, it is because Sharia bank has not been well understood by many people in this country. However, as a background information, definition and the scope of Sharia Banking system is addressed in section 2. Section 3 highlights the development of Sharia bank and factors caused the development of Sharia bank in Indonesia. Section 4 explores the legal basis of Sharia Bank and the role of the Central bank. Finally, concluding notes are given in section 5.

II. DEFINITION AND SCOPE OF SHARIA BANK

According to Siamat Dahlam as cited by Djawahir (2012), Sharia bank is a bank that runs a banking business based on the principles of Sharia contained in the Qur'an and Hadith. Whilst Schaik cited in Djawahir (2012) defined Sharia bank as a form of modern bank based on Islamic laws. This type of bank was developed in medieval Islam. This bank is based on the concept of profit sharing for any risks as the main system and abolishing the financial system based on assumption of predetermined profit certainty. Similarly, Sudarsono cited in Lewis and Algaoud (2007) argued Islamic bank is one of the state financial institutions that provide credit and other banking services in the payments and circulation of money that operate on the basis of religious principles or Sharia principles. In addition, Perwataatmadja (Djawahir, 2012) defined Sharia bank as a bank that operates by following the principles of Sharia or Islamic laws outlined in Al - Qur'an and Hadith.

Islamic banking systems are introduced to provide halal financial services to the Muslim community. In addition to this objective, this institution is expected to contribute to the achievement of socio-economic goals of Islam. The main target of the development of Sharia banks is not only to increase economic welfare, but also to expand employment opportunities, high economic growth rates, socio-economic justice and the distribution of reasonable income and wealth, stability in the value of money, and mobilization of savings and investments for economic development.

Other important aspects of the Sharia banking principles are that this type of bank eliminated the use of interests for any kind of financial transactions in accordance with Islamic principles. This principle is purely religious that differs the Sharia bank with other conventional bank. This suggests that any payment and withdrawal of interests contradict Sharia principles. There are two kinds of individual assets recognized in Sharia. The first is the assets that combine one's creative work and natural resources. The second is the assets of which the right has been transferred from the first owner to others due to the exchange, payment, donation granted by the owner to the needy, and the inheritance to name a few.

Due to the above principles, the present of Sharia banks has given Muslims opportunity to conduct free-interest financial transactions and, therefore, *halal*. However, there are two models proposed to show how this transaction should be done. The first as supported by Shiddiqi, is based on the two-row or three-point *mudaraba* scheme. This means that any banks' revenue that are obtained from various activities are unified and then shared with the depositors and shareholders in accordance with the terms set forth in the contract. Banks are allowed to accept demand deposits that do not generate profits, but they are able to impose fees. The second model, as proposed by Khan cited in Lewis and Algaoud (2007) in that the bank's balance sheet liabilities are divided into two windows, namely, demand deposit or transaction balance and investment balances. However, both models consider the losses incurred as a result of the investment activity should be undertaken by the bank.

In one model, there is an opportunity to make interest-free investments on the individual level. Undeniably, there is disagreement about the way some (or possibly most) Islamic banks operate. Some scholars argue that not all forms of

legitimate Islamic financial agreements meet Shari'a requirements (Lewis and Algaoud, 2007). The most acceptable form of financing, they argued, is the pattern of equity participation conducted under the principles of *mudharaba* and *musharaka*. The bulk of the banking business should follow this scheme. However, most Islamic bank financing is done by using *murabaha* (mark-up) and *ijarah* (leasing) techniques. These contracts generate revenues that are previously determine, and, thus, they have the same effect as interest. This position is considered to be different from the value system in the Islamic economy.

Furthermore, some authors question the emphasis on equity-oriented transactions in Islamic banking, particularly the *mudaraba* model. The effort to change the pre-determined interest with uncertain profit does not necessarily make an Islamic transaction. This is because the excessive profit is the same as interest. One response to this criticism states that it must distinguish between profit and profiteering, and Islam prohibits excessive profit taking as it prohibits interest. Naqvi cited in Lewis and Algaoud (2007) also states that the *mudaraba* scheme is not a concept that was derived from Al Qur'an and hadith. This concept is the custom of pre-Islamic Arabs. In the past, *mudaraba* allowed elderly women and children who have capital to trade by investing their funds to traders. If this activity generates profits, they get a share of the profits, and if they loss, all losses are borne by the owner of the capital. For this reason, *mudaraba* cannot be regarded as a special concept. Nevertheless, the Prophet Muhammad is not against *mudaraba*.

III. THE DEVELOPMENT OF SHARIA BANK AND ITS CAUSES

Sharia bank has existed in Muslim countries since the 60s, beginning with the establishment of *Mit Ghamr* Local Saving Bank in Egypt. However, due to the political situation at that time, the bank was taken over by the National Bank of Egypt and Central Bank of Egypt in 1967. This was then operated on the basis of usury. In 1972, the interest-free bank system was reintroduced by the establishment of Nasser Social Bank in Egypt which subsequently led to the birth of the Islamic Development Bank (IDB) in 1975 in Jeddah which was organized by the Conference Organization Lam (OKI). The IDB then became a milestone of development as well as motivating the establishment of Islamic financial institutions in several Islamic countries and played an important role in providing the funds needed by Muslim countries for development. By the late 1970s these type of banks have sprung up in Egypt, Sudan, Gulf countries, Pakistan, Iran, Malaysia, Bangladesh and Turkey. In Indonesia the first Sharia banking emerged was Bank Muamalat which was established in 1991. The emerging of other Sharia banks in Indonesia was since 1998. This includes Bank Sharia Mandiri, Bank BNI, Bank BRI, Bank IFI, Bank Bukkopin, and Bank Danamon. In recent years, there are many foreign banks that open Sharia branches including HSBC Bank.

PT. Bank Muamalat Indonesia Tbk was established on November 1, 1991. It was initiated by the Indonesian Ulema Council (MUI) and the Government of Indonesia, and commenced its operations on May 1, 1992. With the real support of the exponents of the Association of Indonesian Muslim Intellectuals (ICMI) and some Muslim entrepreneurs,

the establishment of Bank Muamalat also received public support, as shown by the commitment to purchase shares of the Company valued at Rp 84 billion at the time of the signing of the agreement of establishment of the Company. Additional support of Rp 106 billion was also obtained from the West Java community at the meeting in Bogor Presidential Palace.

On October 27, 1994, only 2 (two) years after it was founded, Bank Muamalat has been successful in bearing the title as a Reserve Bank. This recognition further accentuates the position of the company as the first and leading Sharia Bank in Indonesia with a variety of services and products that continue to be developed. However, in the late 1990s, Indonesia was hit by a monetary crisis which devastated most of Southeast Asian economics. The National Banking Sector was rolled up by bad debts and Bank Muamalat was affected by the crisis. In an effort to strengthen its capital, Bank Muamalat have been supported by the Islamic Development Bank (IDB) based in Jeddah, Saudi Arabia. In 1999 IDB officially became one of the shareholders Bank Muamalat. Since then the development of Islamic banking system in Indonesia began to be conducted in the framework of dual-banking system, namely, Sharia banking system and conventional banking. These two types of banking systems synergistically support the mobilization of public funds more broadly to improve financing capabilities for the sectors of the economy

It should be noted that the development of Sharia bank in Indonesia is very rapid. The rapid development of Sharia banks in Indonesia is because of fatwa (religious supports) that were provided by the National Sharia Council (DSN). This institution is an independent institution. This is different as in other countries in that fatwas issued by individual scholars. In Malaysia, the organizational structure of the fatwa institution is under the State Bank of Malaysia (BNM). However, this institution is not independent. Therefore, the development of Sharia banks in Indonesia has been very rapid. This development will increase in the near future as the population of this country dominated by the Moslems.

The factors that cause the development of Islamic Banking are as follows. The first is because of potential market of Sharia banks in Indonesia is quite large especially when associated with the number of Muslims. At the moment, the number of Sharia bank users among Muslims today is still very small compared to the number of Muslims. Secondly, Muslims themselves will ultimately choose Sharia banks than conventional banks. This is because Islamic banks are guaranteed halal, while for conventional banks have no guarantee for halal. This is especially after the MUI states that the system of interest and all transactions following it are haram. Thirdly, Sharia Banks did not cause resistance for those who are not Muslims. Fourthly, Sharia banks have a competitive advantage. This can be seen from the ability of Sharia banks to provide a larger share of funds to the owner compared with conventional bank. Fifthly, Sharia Bank will not experience a negative spread because Islamic banks do not pay interest on deposits. This bank is based on profit-sharing principle. Six, Sharia banks have succeeded in mobilizing the economic potential of Sharia. Finally, through Sharia bank, jurisprudence can be applied optimally. In fact, there have been a number of market demand to review economic transaction made by the people based on Islamic law. Thus, Sharia bank seem to be a promising bank for the people of Indonesia as it is for conventional bank.

IV. LEGAL BASIS OF SHARIA BANK

The rapid development of Sharia Bank in Indonesia is because this bank, like the conventional bank, fulfill criteria that was established in the Article 33 of the 1945 National constitution. The criteria that were fulfilled by Sharia Bank are as follows. The first is that Sharia bank is structured as a joint effort based on the principle of kinship. The second is that this bank has role to increase the livelihood of the people. The third is that this bank can be used for the greatest prosperity of the people. The fourth is that this bank is organized on the basis of economic democracy with the principle of togetherness, efficiency, justice, sustainability, environmental insight, independence, and maintaining a balance of progress and national economic unity.

In addition, the Sharia bank fulfills other criteria as follows. The first is that the bank is able to accommodate the aspirations of the community and it is very appropriate for the Indonesian people who are mostly engaged in micro, small and medium enterprises activities. The second, Sharia bank prioritizes the common progress of individual progress. The third is that Sharia bank is very suitable to finance small communities and it can empower the people. Finally, this bank is assumed to be able to combine the balance between today's life and here after (ukhrawi).

Due to the above conditions, the government issued the following laws that are worth to be mentioned in relation to the development of Sharia bank. The first is the Law No. 7 of 1992. In this law the Sharia bank is positioned as commercial bank and rural bank. The government has granted permission for the existence of Islamic bank or bank based on Islam to perform any action or banking activities like a conventional bank. However, this law does not use the term Islamic Bank or Sharia Bank. It mentions that a commercial bank may provide financing for customers on the basis of profit-sharing principles in accordance with the provisions set out in government regulations (Djawahir, 2013).

In addition to the above law, there is another law number 10 Year 2008 containing the refinement and explanation of the Law Number 7 of 1992. In the articles 1 and 6 of this law, it was mentioned as follows. The first is that Sharia bank as a commercial bank has tasked to complete all business activities based on Sharia principles. The second is that Sharia bank as a rural Bank has tasked to complete all business activities based on Sharia principles. The Sharia Principle is a rule of agreement or provision which is based on Islamic law in conducting financial activities. These activities include financing based on profit sharing (*mudaraba*), financing principle based on capital participation (*musyarakah*), the sale and purchase product principle (*murabaha*), the lease principle (*ijara*), and the transfer of ownership of leased goods principles (*ijarah wa iqtina*).

Apart from the above two laws, there are other laws that worth mentioning here. The first is the Law Number 23 Year 2003. This law contains the protection of the existence of Sharia Bank. The protection is given in the form of assignment to Bank Indonesia to prepare all forms rules and facilities to support the operations of Sharia bank. Also, there is the law no. 21 of 2008. This law, however, is more specific among other regulations. This law is actually formed when Sharia bank is growing rapidly. In this law it is clearly stated the difference between conventional banks and Sharia banks. This law also explains that the operation of Sharia Bank should be based on Islamic law such as *mudaraba*, *wadi'ah*, *masyarakah*, and others.

Although the Sharia bank has been accommodated in the Indonesian banking system, the economic performance of this bank is supervised by the Bank Indonesia as the central bank. There are several regulations issued by Bank Indonesia in regulating the performance of Bank Sharia Indonesia, namely, the regulation No. 9/19 / PBI / 2007 concerning the implementation of Sharia principles in the activities of fund raising and channeling of funds and Sharia services, and the regulation No. 6/24 / PBI / 2004 concerning the commercial Bank conducting business activities or duties based on Sharia principles.

The supervision given by Bank Indonesia is to maintain the health level of Sharia bank which includes at least the capital adequacy, asset quality, liquidity, profitability, solvency, quality of management that describes financial capability, compliance with Shari'a Principles and Islamic management principles, and other related aspects to Sharia Bank business. In addition, the Sharia Bank is obligated to convey all information and explanation of its business to Bank Indonesia in accordance with the established procedure.

Bank Indonesia may assign the public accountant office or other party for and on behalf of Bank Indonesia to perform the inspection as referred to in Article 52 paragraph (2), as well as the requirements and inspection procedures set forth in paragraph (1) of the regulation of Bank Indonesia. Bank Indonesia has the authority to take action against Sharia Bank in case of difficulties that endanger their business continuity. These authorities are as follows : (a) limiting the authority of the General Meeting of Shareholders, commissioners, directors and shareholders; (b) Ask shareholders to increase capital; (c) requesting shareholders to replace members of the board of commissioners and / or board of Bank Sharia; (d) requesting the Sharia Bank to remove the bookkeeping of the disbursed funds and take into account the loss of the Sharia Bank with its maturity; (e). requesting a Sharia Bank to merge or merge with another Sharia Bank; (f) requesting a Sharia Bank to be sold to a buyer willing to take over all of its obligations; (g) requesting a Sharia Bank to hand over the management of all or any of the activities of a Sharia Bank to another party; and (h) requesting a Sharia Bank to sell part or all of the assets and / or obligations of Sharia Bank to another party.

If the Sharia Bank in conducting banking activities faces a dispute, the settlement of the Sharia Banking dispute will be solved by the court within the Religious Courts. If the parties have agreed to settle the dispute other than as referred to in paragraph (1), the dispute settlement may be made in accordance with the contents of the Agreement and in the dispute settlement it should be contradictory to the Sharia Principles / Islam. The legal basis based on such basic policy is to prove that the Sharia banking is ready to participate in implementing and assisting the economy of Indonesia. Also, it aims to show to the international community that Sharia banking can carry out economic activities both nationally and internationally, as well as to attract foreign investors.

V. CONCLUDING NOTES

Sharia bank in Indonesia grows rapidly in Indonesia. The number of Sharia banks in Indonesia currently stands at 199 Bank Sharia consisting of 12 Commercial Banks, 22 Sharia Business Units, and 165 Sharia Rural Banks. This rapid

grow has been due to many factors, including the number of Muslims and the business activities of Sharia bank are guaranteed halal. As the Sharia bank will grow faster in the future there is a need for the government to issue the laws to support the development of Sharia Banks. These government's supports will increase public confidence to Sharia Banks. Also, there is a need for Sharia banks to improve and innovate their Sharia products as well as their management system, human resources quality, services, and their operations. In addition, the image that Sharia banking is only for Muslims should also be changed immediately. These improvements are important for the Sharia Banks to compete with the conventional banks. If this is not done, it is certain that Sharia bank will not be accommodated by the majority of Muslims community in Indonesia. Thus, much remain to be done by Sharia bank as well as by the government of Indonesia.

REFERENCES

- (1) Atho Mudzhar. Esai - Esai Sejarah Sosial Hukum Islam. (Yogyakarta : Pustaka Pelajar), 2014.
- (2) A.Riawan Amin." Perbankan Sharia. Sebagai Solusi Perekonomian Nasional". Pidato Penganugerahan Gelar Doktor Honoris Causa, dalam Perbankan Sharia. UIN Syarif Hidayatullah Jakarta. 2009.
- (3) Djawahir Hejaziey. Perbankan Sharia ditinjau dari Aspek Hukum dan Politik (Bandung : Fajar Media), 2013.
- (4) Maria Farida Indrati S. Ilmu Perundang-Undangan. jilid 1. (Jogjakarta : Penerbit Kanisius). 2007.
- (5) Ma'Ruf Amin. Prospek CeraH Perbankan Islam. (Jakarta : LeKAS), 2007
- (6) Mervyn K. Lewis & Latifa M. Algaoud. Perbankan Sharia. Prinsip, Praktik, dan Prospek. (Jakarta : Ikrar MandiriABADI), 2007.
- (7) Miriam Budiardjo. Dasar – dasar Ilmu Politik. (Jakarta : Gramedia Pustaka), 1977.
- (8) Undang-Undang Dasar Negara Republik Indonesia Tahun 1945;
- (9) Undang-Undang Republik Indonesia Nomor 7 Tahun 1992 Tentang Perbankan (Lembaran Negara Republik Indonesia Tahun 1992 Nomor 31, Tambahan Lembaran Negara Republik Indonesia Nomor 3472)
- (11) Undang-Undang Republik Indonesia Nomor 10 Tahun 1998 Tentang Perubahan Atas Undang-Undang Nomor 7 Tahun 1992 Tentang Perbankan (Lembaran Negara Republik Indonesia Tahun 1998 Nomor 182, Tambahan Lembaran Negara Republik Indonesia Nomor 3790)
- (12) Undang-Undang Republik Indonesia Nomor 6 Tahun 2009 Tentang Penetapan Peraturan Pemerintah Pengganti Undang-Undang Nomor 2 Tahun 2008 Tentang Perubahan Kedua atas Undang-Undang Republik Indonesia Nomor 23 Tahun 1999 Tentang Bank Indonesia
- (13) Undang-Undang Republik Indonesia Nomor 3 Tahun 2004 Tentang Perubahan Atas Undang-Undang Republik Indonesia Nomor 23 Tahun 1999 Tentang Bank Indonesia
- (14) Undang-Undang Republik Indonesia Nomor 21 Tahun 2008 Tentang Perbankan Sharia.
- (15) Undang-Undang Republik Indonesia Nomor 21 Tahun 2011 Tentang Otoritas Jasa Keuangan
www.bankmuamalat.co.id/profil-bank-muamalat
www.bi.go.id
www.ojk.go.id
www.peraturan.go.id

The Role of the Teacher Mentor in the Development of Pedagogical Content Knowledge (PCK) of the Information and Communication Technology (ICT) Trainee Teachers

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Abstract - This research aims to study the role of the teacher mentor in the development of Pedagogical Content Knowledge (PCK) of the Information and Communication Technology (ICT) trainee teachers. A total of 109 trainee teachers from the Degree in Information Technology Education (AT20) Sultan Idris Education University (UPSI) who have completed their 14 weeks teaching practice program were the respondents. This quantitative research used the questionnaire with a validity value of Alpha Cronbach 0.966. The research focussed on four PCK elements: i) communication; ii) knowledge about students and learning; iii) curriculum knowledge; and iv) knowledge on teaching strategy. The research found that all four elements are good. The mean of PCK communication element is 3.05, knowledge about student and learning is 3.25, curriculum knowledge is 2.94, and teaching strategy knowledge is 3.21. The percentage of mentoring proses rated by the trainee teacher is low (44%). A total of 56% of trainee teachers are not satisfied with the mentoring received which is within the range of 20% to 50% only. Further detailed research is needed to measure the role of teacher mentor in developing the PCK of the ICT trainee teachers.

Index Terms: Mentoring and Supervision, Teaching Practice Program, Pedagogical Content Knowledge

I. INTRODUCTION

ICT is one of the subjects offered to secondary school students for form four and five in Malaysia as a preliminary disclosure in knowing and moving towards higher-level computer science (Sulaiman, 2012). While in higher education, ICT is a program offered by public and private institutions of higher learning to students interested in learning and learning about the subject.

Quality of teaching is influenced by education and training followed by teacher education program (Rice, 2003), to distinguish between trained and untrained teachers. Therefore, in college training, PCK needs to be mastered in order for the college profession to be guaranteed (Norasliza&Zaleha, 2008). Therefore, teacher education institutions have introduced teaching training programs as one of the key elements in teaching practice programs.

Teaching exercises are one of the fundamental components to be trained by each trainee's teacher including trainees who attend the education program at Sultan Idris Education University (UPSI). According to MegatAman (2010), such programs are practical exercises for trainee teachers practicing all the theories and methods that have been learned and applied knowledge, methods and teaching skills in real situations that are in the classroom and school.

Pedagogical Content Knowledge

The Pedagogical Content Knowledge (PCK) was introduced by Lee Shulman (1986) focusing on teacher education research to expand and enhance new knowledge that teachers need to master the combined pedagogical knowledge with content knowledge. This knowledge is what distinguishes the quality of teaching each teacher. Shulman (1987) also pointed out that PCK is an important knowledge and as a basic knowledge of teaching:

"The key to distinguishing the knowledge base of teaching lies at the intersection of content and pedagogy, in the capacity of a teacher to transform the content knowledge he or she possesses into forms that are pedagogically powerful and yet adaptive to the variations in ability and background presented by the students" (pg. 15)"

Scheffler (1973) emphasized that institutions that handle teacher education should be aware that the provision of teachers not only has the skills in implementing procedures such as educational management skills but should take seriously the knowledge of what they are teaching or known as content knowledge.

According to Shulman (1987), the basics of PCK construction are the blend of content knowledge and pedagogical knowledge as shown in Figure 1.

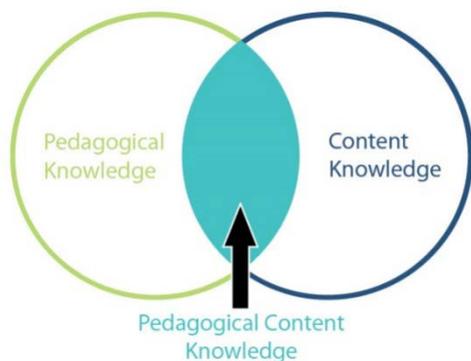


Figure 1: Pedagogical Content Knowledge Framework (Shulman, 1986)

The PCK contains some of the core knowledge that teachers need to have; (i) knowledge of content, (ii) general pedagogical knowledge, (iii) curriculum knowledge, (iv) pedagogical content knowledge, (v) knowledge of students and characteristics of students, (vi) knowledge about the context of education and (vii) knowledge of educational goals.

According to Roehrig (2004), PCK is divided into four knowledge, namely (i) teacher knowledge about concept understanding by students, (ii) curriculum knowledge, (iii) knowledge of teaching strategy and (iv) knowledge of needs and teaching use.

Grossman (1990) intends to introduce PCK to (i) knowledge about pupils and learning, (ii) curriculum knowledge and (iii) knowledge of teaching strategies. Shulman (1986) and Grossman (1990) also point out that the new teachers' PCK has not yet been built until they are blending the content knowledge and pedagogical knowledge into new knowledge namely Pedagogical Content Knowledge.

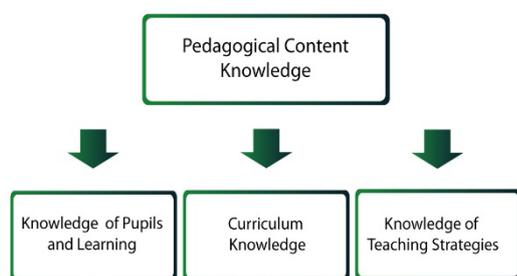


Figure 2: Formulation of Pedagogical Content Knowledge (Grossman, 1990)

Whether Shulman (1986, 1987), Grossman (1990) and Roehrig (2004) emphasize that all the knowledge that forms the PCK should be implemented simultaneously and used dynamically. Teachers should also be able to integrate knowledge vertically that have a deep understanding of the relationship between knowledge and knowledge related topics and broadly linking between pedagogical knowledge and content knowledge (Sulaiman, 2012).

Sulaman (2010) who studied PCK ICT trainee teachers found that ICT trainees teachers failed to integrate syntactic knowledge and substantive knowledge that shaped pedagogical knowledge because of isolated syntactical knowledge with substantive knowledge. This will cause the trainee teacher not to understand the development of PCK and fail to integrate separate knowledge and not unite the knowledge received during the course of study and will not be used simultaneously in teaching at school.

Substantive knowledge is the most important part of a discipline that covers the subject's facts and concepts. It also refers to the framework used to compile all the concepts and facts of the subject. While syntactic knowledge exists, methods involve the acceptance of new knowledge through several trial and endorsement procedures.

Teaching Practice Program

The teaching practice program is one of the fundamental components that every trainee teacher has to undergo an education program. This program depends largely on the mentoring and supervision of teaching. In the case of UPSI ICT trainee teachers, mentor is asked to perform at least four coaching sessions. Mentor is appointed from ICT and ICTL teacher in the school where the trainee teacher is placed. Teaching guides in the context of teaching practice need to be seen from a wider scope, not only as a field of trainees practicing all the theories but also the most useful medium for them to learn how to teach in real situations the school environment.

According to Rohaza (2010) teaching practice is one of the important components to equip the trainee teacher's knowledge before they are appointed teachers. This means that all the pedagogical knowledge and practices learned will be applied first within the prescribed period before they are absorbed as actual teachers. According to Abdul Malek (1999), his research on the relationships created by the mentor led to the development of professionalism and personal development, encouraging, building collaboration and inculcating the confidence of trainees' teachers to explore pedagogical knowledge and skills as well as teaching experience in more depth.

Ball and Feiman-Nemser (1988), Feiman-Nemser and Parker (1990) and Geddis (1993) are among researchers who found that among the problems of learning difficulty in learning from the teacher of the trainer is less ability to diagnose the difficulty of learning, pre-concept and conceptual misconception.

According to Frasson (2010) in his study, mentor as supervisors are required to play a role in supporting new teachers (mentee) included in the assessment as described in the consultative document in Sweden. The findings also found that mutual trust between mentor and new teachers was important as most new teachers objected to asking experienced partners to avoid losing their dignity or being uncompensated (Dinham 1992; Rust 1994).

Mentoring and Supervision

According to Al Ramaiah (1999) supervision is defined as an effort to encourage, coordinate, and guide the teacher in terms

of teaching so that teachers are more able to perform all the functions related to teaching. Jamaluddin et al., (2006) emphasize the role played by mentor in teaching practice program was huge and important because of their strong influence on trainee teachers. According to Jamaluddin, in the teaching practice session of the trainers, supervision will be made by the lecturers and teachers in the school. The supervision and mentoring provided will help trainee teachers prepare for the teacher's educational goals.

According to Hasnford et al., (2004), mentor play an important role in assisting trainee teachers in developing the practical skills, competencies and knowledge needed to be practiced in the classroom. At the same time, mentor plays a role in supervising trainee teachers in the classroom as well as forming the professionalism of teaching.

II. OBJECTIVE

This study attempts to study the role of mentor in assisting ICT trainee teachers to develop PCK. Two sub objectives have been outlined by researchers as a guide to achieving the main objectives are:

- i. Knowing the level of PCK of ICT trainee teachers
- ii. Knowing the level of mentoring and supervision from the perspective of ICT trainee during the Teaching Training program

III. RESEARCH QUESTIONS

Questions for this study are:

- i. What is the level of PCK of ICT trainee teachers for practice training programs?
- ii. What is the level of mentoring and supervision from the perspective of ICT trainee teachers during the Teaching Training program?

IV. PROBLEM STATEMENT

Recent studies have found that teachers who are less prepared to face problems in teaching often consider they inexperienced and do not have adequate training (Buell et al., 1999; Cains & Brown 1996; Martin et al. In the context of teaching profession, Experience and training of teachers are two different issues. Experience is empirical knowledge such as the experience of undergoing teaching training while the teacher training is more theoretical. They need each other to make a teacher reach the level of competency claimed. Therefore, Goodwin (1999) defining teacher training and teaching experience as one of the key basics of effective teaching.

Quality education comes from teaching and learning. Furthermore, the quality that is determined by the mastery of Pedagogical Content Knowledge (PCK) of a teacher and the level of knowledge and skills possessed at the entrance to the classroom of the results of the teacher education program that participates mainly involves the actual school environment (Shulman, 1986; Grossman, 1990; 1999, Darling-Hammond, 2000). In addition, according to Rice (2003), the success of this teacher's teaching was influenced by the education and training that followed during a teacher education program. In this context, the real environment is a teaching practice program

that becomes the mandatory course of every student who attends a teaching program.

Hence there must be a difference between trained and untrained teachers. The role of trained teachers should be far from being able to deliver information from books to students. Therefore, in the training of teachers, various knowledge and skills must be mastered by the trainee so that the profession of the college is guaranteed (Norasliza & Zaleha, 2008). The education system in Malaysia is based on the National Education Philosophy which emphasizes that capable human beings in all respects require mentoring and education from professionals. To look at the credibility and capabilities of trainee teachers in teaching, the teacher education institution has introduced teaching practice program as one of the key elements in teacher education program. Therefore, to produce quality instructors is very important in the study conducted to see how far the program teacher education is administered to develop the PCK of the trainee teachers.

V. ANALYSIS AND DISCUSSION

This study is a descriptive case study with quantitative methods. The respondents of this study were trainee teachers in the Bachelor of Information Technology (ISMP-AT20) who had participated in the teaching practice program. They consist of 109 people as respondents of the study using purposive sampling with the required characteristics are in the final year AT20 (ISMP-Information Technology) who have undergone teaching practice program including their readiness and consent to be involved in the study.

The research instrument is a set of questionnaires developed by researchers based on the construction of PCK prepared by Sulaiman (2010). The construction of PCK (Sulaiman, 2010) which has the Kappa Coefficient Value (Cohen Coefficient Coefficient) is 0.92. Its construction is based on a questionnaire formulation in the form of a four-point scale likert. The questionnaire consists of five sections as in table 1.

Table 1: Item of questionnaire

Section	Item
A: Demographic	General Information
B: Communication	6
C: Knowledge about students and learning	9
D: Curriculum Knowledge	15
E: Knowledge on Teaching Strategies	32
Total	62

The data collected and analyzed using descriptive statistics by searching the mean using the Statistical Package for Social Science (SPSS) software version 20.0. The questionnaires used are four-point likert scale which means the following and the findings are described in form descriptive and table. Further explanation on four-point likert scale is shown in Table 2.

- 1 = Strongly disagree
- 2 = Do not agree
- 3 = Agree
- 4 = Strongly Agree

Table 2: Levels of Respondents Assessment Based on Mean

Assessment Level	Mean
Very contributing	3.6 – 4.0
Contributing	3.0 – 3.5
Not contributing	1.6 – 2.9
Very not contributing	1.0 – 1.5

The rating level of the respondents based on the mean of the four points of the likert scale score is "Very Contributing" = 3.6 - 4.0, "Contributing" = 3.0 - 3.5, "Not Contributing" = 1.6 - 2.9 and "Very Not Contributing" - 1.5.

Section A: Demographics

A total of 109 respondents, 103 (94.5%) get subject related to their study are an Information and Communication Technology (ICT) and Information and Communication Technology Literacy (ICTL). The rest are Trade (1), Visual Art Education (1), History (1), Civic (1) and Mathematics (1). If viewed from the point of view of the subject and the relevance to the formation of PCK, knowledge of students and learning also teaching strategies has no problem. However, it affects the formation of the curriculum's knowledge of the trainee teacher.

The frequency of mentoring and supervision by mentor is very satisfying. The lowest frequency is twice and the highest is eight times. Grade obtained is also very good that is 82.6% gets grade A (A +, A and A-) and 17.4% gets grade B (B + and B).

Section B: Communication

The study found that the respondents were comfortable with their mentor. Similarly, with the item '*They are uncomfortable if I ask too much for help*', mean is 1.53 which means that the mean is very not contributing and is not accepted by the respondent. Where the mentor is comfortable if the trainee teacher refers to it. On the other hand, the '*Good relationship with the mentor determines the actual grade of teaching practice (LM)*' that is 2.90 indicates that the respondents disagree with the good relationship with the mentor may affect the LM grade. If viewed at a mean assessment level, it is at a not contributing level. This means good relationship with the teacher does not affect the grade of teaching practice program.

Section C: Knowledge of Students and Learning

It is found that mean of knowledge students and learning is 3.25 and the standard deviation is 0.667. The level of knowledge students and learning is contributing to the development of PCK. Trainee teacher get good mentoring in aspects of knowledge about students especially their needs for ICT / ICTL learning with mean 3.39. Although understanding and conceptual misconceptions in ICT / ICTL are lowest 3.12, they are still in the evaluation stage that contributes to the PCK development of trainee teacher.

Section D: Curriculum Knowledge

The overall mean for curriculum knowledge section is 2.94 and the standard deviation is 0.553. Although 94.5% have received ICT subjects it does not show good construction.

They are still weak in mastering the syllabus description (HSP) of ICT. Assessment based on the mean of being not contributors which means the teaching practice program does not contribute to the curriculum knowledge development of ICT trainee teacher. Curriculum knowledge is very important to the development of PCK to trainee teacher. If viewed at the assessment level, the trainee teacher still needs mentoring and supervision to strengthen their curriculum knowledge.

Section E: Knowledge of Teaching Strategies

Knowledge of Teaching Strategies, the overall mean is 3.21 and the standard deviation of 0.693 is at the level of contributing to the construction of PCK. The 32 item indicates '*Method to implement school-based assessments (PBS)*' is still a problem with the lowest mean of the 32 items that is 2.74 which does not contribute to the development PCK of trainee teacher. Here, the trainee teachers are less likely to receive good exposure and mentoring from mentor teacher about the PBS. However, the trainee teachers are very satisfied with the mentoring of the diversity of teaching materials revealed to them with mean 3.44 which is at the level of contributing to the construction.

Teachers should play their part in ensuring that trainee teachers get trained training because teaching training program can shape their personality as teachers in a real environment.

Section F: Assessment Level of Mentoring

Assessment Level of mentoring, the researcher sees the percentage given by the trainee teacher for the mentoring and supervision they have received. Percentage range between 20% to 90%. 56% are 61 ICT trainee's teachers set a range of mentoring ranging from 20% to 50%. While, 44% that is 48 ICT trainee teacher set a range of mentoring and supervision ranges from 60% to 90%. It is at a low level of Mentoring and supervision assessment. Researchers see how frequent Mentoring and supervision do not contribute significantly to the percentage of evaluations for the formation of PCK of ICT trainers. The problem is what is being discussed during the mentoring and supervision session. And if we look at the PCK assessment level of the ICT trainee teacher, it is still at a positive level.

VI. RESULTS

Section A: Demographics

Table 3 shows the number and percentage of respondents involved in the study.

Table 3: Gender

Gender	Number	Percent (%)
Man	33	30.3
Woman	76	69.7
Total	109	100

The subjects taught during the teacher practice program can be seen in Table 4. This subject is determined by the school administration.

Table 4: Subjects

Subjects	Number	Percent (%)
ICT	51	46.8
ICTL	52	47.7
Trade	1	.9
Networking	1	.9
Visual Art Educatio	1	.9
History	1	.9
Civic	1	.9
Mathematics	1	.9
Total	109	100

Table 5 shows the frequency of mentoring and supervision by mentor recorded by researchers.

Table 5: Frequency of Mentoring and Supervision

Supervision Frequency	Number	Percent (%)
2	4	3.7
3	27	24.8
4	51	46.8
5	15	13.8
6	7	6.4
8	4	3.7
Missing	1	.9
Total	109	100

Table 6 shows the grade obtained for the teaching practice program.

Table 6: Teacher Practice Grade

Grade	Number	Percent (%)
A+	3	2.8
A	51	46.8
A-	36	33.0
B+	17	15.6
B	1	.9
Missing	1	.9
Total	109	100

Section B: Communication

A total of six items were submitted to the respondent. Mean for part B is Communication between trainee teacher and mentor within three. The lowest is 1.53 which is 'They are uncomfortable if I ask too much for help' while the highest is 3.57 is 'Comfortably communicate with them'. See Table 7.

Table 7: Communication

Communication Item	Mean	Standard Deviation
1. Comfortably communicate with them	3.57	.629
2. Very often discuss to them	3.39	.651
3. My mentor was very friendly	3.56	.617

4. They are uncomfortable if I ask too much for help	1.53	.729
5. Good relationship with the mentor determines the actual grade of teaching practice (LM)	2.90	.971
6. They believe in my ability to teach ICT	3.32	.622
N = 109		

Section C: Knowledge of Students and Learning

Table 8 shows nine items in Knowledge of Students and Learning. Mean within three. The lowest mean is related to the 'Misconceptions of ICT concept by students' were 3.12 and highest 3.39 'Students' needs to learn ICT / ICTL'.

Table 8: Knowledge of Students and Learning

Knowledge of Students and Learning Item	Mean	Standard Deviation
1. Student learning style	3.32	.665
2. Ability communicate students	3.34	.658
3. Existing knowledge of student	3.31	.676
4. Students' ability to learn	3.24	.668
5. Difficult topics to be taught	3.15	.743
6. The causes of the difficulties of learning ICT / ICTL students	3.19	.631
7. The concepts of ICT are always misunderstood	3.15	.705
8. Misconceptions of ICT concept by students	3.12	.663
9. Students' needs to learn ICT / ICTL	3.39	.592
N = 109		

Section D: Curriculum Knowledge

Table 9 shows 15 items of Curriculum Knowledge. Overall mean is 2.94. The lowest are related to the 'Differences in the nature of ICT/ICTL subjects with other subjects' is 2.27 and the highest 3.33 'Good object writing' and 'Moral values in ICT/ICTL teaching'.

Table 9: Curriculum Knowledge

Curriculum Knowledge Item	Mean	Standard Deviation
1. The goal of teaching ICT	3.12	.593
2. The relationship between National Education Philosophy (FPK) with ICT teaching	3.13	.595
3. The contents of the lesson contained in the syllabus (HSP)	2.77	.527

4. Information contained in syllabus (HSP)	2.44	.464	9. The use of skill-based teaching approaches	3.32	.651
5. The suitability of the contents of the lesson in the ICT curriculum	3.25	.566	10. Use of task-based teaching approaches	3.28	.610
6. Change the subject title sequence which is suitable for my students	3.31	.556	11. Use of self-directed learning approaches	3.09	.660
7. Area of ICT/ICTL lesson content	3.29	.598	12. Use of self-accessed learning approach	3.01	.619
8. Depth of contents of ICT/ICTL lessons	2.28	.433	13. Use of self-assessed learning strategies	3.04	.652
9. The teaching methods proposed in syllabus (HSP)	3.17	.621	14. Use of teaching strategies is in line with the level of difficulty in the subject matter	3.08	.598
10. The contents of each lesson are taught	2.45	.466	15. Teaching strategy selection is based on the level of difficulty in the content of the lesson	3.28	.668
11. Differences in the nature of ICT/ICTL subjects with other subjects	2.27	.432	16. Method to overcome the difficulty of learning a student	3.27	.718
12. Knowledge dominated by students	3.18	.611	17. Method to modify teaching strategies when teaching if necessary	3.32	.679
13. Good object writing	3.33	.639	18. Use of group learning methods based on lesson content needs	3.39	.693
14. The depth and breadth of learning outcomes that need to be assessed	2.79	.530	19. Method to keep students focused on teaching and learning	3.26	.738
15. Moral values in ICT/ICTL teaching	3.33	.667	20. Method to evaluate the learning progress of each student	3.31	.604
N = 109					

Section E: Knowledge of Teaching Strategies

A total of 32 items were submitted to respondents related to the Knowledge of Teaching Strategy. Mean for this part in the range of three. The lowest mean is 2.74 which are '*Method to implement school-based assessments (PBS)*' while the highest is 3.44 which is '*Use of various materials that fit the lesson*'. See Table 10.

Table 10: Knowledge of Teaching Strategies

Knowledge of Teaching Strategies Item	Mean	Standard Deviation			
1. Time distribution is appropriate for teaching	3.39	.593	23. Method to overcome the problem of teaching comes from computer software	3.17	.756
2. Length of teaching time to achieve an objective	3.12	.720	24. Method to overcome teaching problems is caused by computer hardware	3.23	.753
3. The choice of teaching materials that facilitates the learning process	3.36	.674	25. Method to maximize the use of teaching time	3.25	.709
4. Use of various materials that fit the lesson	3.44	.686	26. Use of e-learning materials effectively	3.14	.775
5. Planning of teaching activities corresponds to the contents of the lesson	3.39	.667	27. Method to make reflection, identify problems and overcome them	3.13	.771
6. Misconceptions of ICT concepts of students before learning	3.11	.674	28. The construction of good e-learning materials for teaching	3.19	.739
7. Use of existing knowledge of the students in teaching	3.27	.662	29. Method to find and select the appropriate e-learning material	3.17	.731
8. Use of information-based teaching approaches	3.30	.601	30. Method to give students the opportunity to practice practical skills	3.25	.641

31. Method to maintain learning momentum through teaching arrangement	3.17	.660
32. Application of pure values in teaching and learning	3.41	.670
<hr/>		
N = 109		

Section F: Assessment Level of Mentoring

Table 11 shows the percentage level of assessment by the trainee teacher on the mentoring and supervision process received by mentor in ensuring the improvement and development of the PCK during the teaching practice at the school.

Table 11: Assessment Level of Mentoring

Percentage Range	Number	Percent (%)
20.00	4	3.7
30.00	4	3.7
40.00	22	20.2
50.00	31	28.7
60.00	34	31.9
70.00	8	7.4
80.00	5	3.7
90.00	1	.9
Total	109	100

VII. CONCLUSIONS

The teaching practice program is a good platform to ensure that students pursuing studies in the teaching program have sufficient knowledge of the students and the learning, curriculum and teaching strategies of those experienced in the school environment. In this aspect, they are experienced teachers or more precisely the mentor who will guide the trainee teacher throughout the teaching practice program.

The percentage of mentoring assessment level is still low although there is a PCK formation in the trainee teacher. From the percentage statistics, the researcher found that further research should be carried out to clarify in more detail the role of the actual teacher in ensuring the mentoring and supervision especially in improving and developing PCK. Additionally, further studies need to look at the factors that contribute to the formation of the PCK. This is because the level of evaluation based on mean is at a positive level.

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REFERENCES

[1] Al Ramaiah. (1999). *Kepimpinan Pendidikan, Cabaran Masa Kini. Petaling Jaya: IBS Buku Sdn Bhd. Anderson.*

[2] Ball, D.L. & Feiman-Nemser, S. (1988) Using textbooks and teachers’ guides: a dilemma for beginning teachers and teacher educators, *Curriculum Inquiry*, 18(4), pp. 401–423.

[3] Buell, M., Hallam, R., Gamel-McCormick, M. & Scheer, S. (1999). A survey of general and special inservice needs concerning inclusion. *International Journal of Disability, Development and Education* 46: 143-156.

[4] Cains, R.A. & Brown, C.R. (1996). Newly qualified teachers: A comparative analysis of the perceptions held by B.Ed. and PGCE-trained primary teachers of their training routes. *Educational Psychology* 16: 257-270.

[5] Carlsen, W. S. (1999). Domain of teacher knowledge. Dalam J. Gess-Newsome, & N. G. Lederman (Eds.). *Examining Pedagogical Content Knowledge* (Pg. 133-144). Dordrecht: Kluwer Academic.

[6] Cohen, J. (1960), A coefficient of agreement for nominal scales, *Educational and Psychological Measurement* 20(1), 37-46.

[7] Darling-Hammond, L. & Bransford, J. (2005). Preparing Teacher for a Changing World. In Sulaiman Sarkawi. (2010). *Pengertian Kandungan Pedagogi Guru Pelatih Program Teknologi Maklumat Universiti Pendidikan Sultan Idris*. Thesis Doctor of Philosophy UPSI. Unpublished.

[8] Darling-Hammond, L. (2000). Teacher Quality and Student Achievement: A Review of State Policy Evidence. *Education Policy Analysis Archives*, 8, (1), <http://epaa.asu.edu/ojs/article/view/392/515>.

[9] Feiman-Nemser, S. & Parker, M. B. (1990). Making subject matter part of the conversation in learning to teach, *Journal of Teacher Education*, 41(3), 32-43.

[10] Geddis, A.N. (1993) Transforming subject-matter knowledge: the role of pedagogical content knowledge in learning to reflect on teaching, *International Journal of Science Education*, 15(6), 673–683.

[11] Grossman, P. L. (1990). The Making of a Teacher: Teacher Knowledge and Teacher Education. New York: Teachers College Press. In Sulaiman Sarkawi. (2012). *Pembinaan Piawai Pengetahuan Pedagogi Kandungan Guru ICT di Malaysia*. Thesis Doctor of Philosophy UPSI. Unpublished.

[12] Grossman, P.L. (1989). Learning to teach without teacher education. *Teachers College Record*. 91, 191-207.

[13] Jamaluddin Ramli, Ahmad Johari Sibes, Abdul Rahim Hamdandan Muainah Ismail. (2006). *Bimbingan Guru Pembimbing Terhadap Guru Pelatih Dalam Latihan Mengajar*. Faculty of Education, Universiti Teknologi Malaysia.

[14] Megat Aman Zahiri Megat Zakaria & Nor Kamsiah Kamar ul Jaeh. (2010). *Persepsi Guru Pelatih Terhadap Proses Penyeliaan dan Bimbingan yang diberikan oleh Penyelia Pembimbing bagi Program Latihan Mengajar Universiti Teknologi Malaysia*. Faculty of Education, Universiti Teknologi Malaysia.

[15] Mohamad Najib Abdul Ghafar (1999). *Penyelidikan Pendidikan*. Skudai: Universiti Teknologi Malaysia.

- [16] Norasliza Hassan &Zaleha Ismail. (2008). PengetahuanPedagogiKandungan Guru PelatihMatematikSekolahMenengah.Faculty of Education, UniversitiTeknologi Malaysia.
- [17] Rice, J. K. (2003). Teacher quality: Understanding the effectiveness of teacher attributes. Washington, DC: *Economic Policy Institute*.
- [18] Roehrig, G. H. &Luft, J. A. (2004). Constraints experienced by beginning secondary science teachers in implementing scientific inquiry lessons. *International Journal of Science Education*, 26(1), 3-24.
- [19] RohazaChe Rose. (2010). *MasalahLatihanMengajardalamKalanganPelatihUniversitiTeknologi Malaysia*.UniversitiTeknologi Malaysia.
- [20] Scheffler, I. (1965). The conditions of knowledge.InSulaimanSarkawi.(2010). *PengetahuanKandunganPedagogi Guru Pelatih Program TeknologiMaklumatUniversitiPendidikan Sultan Idris*.Thesis Doctor of Philosophy UPSI.Unpublished.
- [21] Shulman, L.S. (1986). Those who understand: knowledge growth in teaching. *Educational Reseacher*.
- [22] Shulman, L.S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-21.
- [23] SulaimanSarkawi. (2010). *PengetahuanKandunganPedagogi Guru Pelatih Program TeknologiMaklumatUniversitiPendidikan Sultan Idris*.Thesis Doctor of Philosophy UPSI.Unpublished.
- [24] SulaimanSarkawi. (2011). *PengetahuanTentangPelajardanPembelajarandalamkalanGuru PelatihTeknologiMaklumat*.Journal of Educational Technology Malaysia. 1(4), 31-41
- [25] SulaimanSarkawi (2011).*PembinaanPiawaiPengetahuanPedagogiKandungan Guru ICT di Malaysia*. UniversitiPendidikan Sultan Idris.Unpublished.
- [26] S,Sarkawi, NM,Salleh, M, Ibrahim. (2012). Development of Pedagogical Content Knowledge Standard for Malaysian ICT Teachers (Pg. 5177-5184).*International Proceeding - 6th.International Technology, Education and Development Conference*. 5-7 March 2012. Valencia, Spain.
- [27] Teaching Training Unit. (2012). *LaporanPenyeliaanLatihanMengajar*.UniversitiPendidikan Sultan Idris.

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Internal Branding-A Conceptual Review of related concepts

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Abstract- Internal branding is thought to be a moderately new approach which help organizations to concentrate on the organizational vision and values by on the whole passing on and focusing on one reasonable brand message in order to improve the corporate brand identity to all partners. Internal branding positively affects attitudinal and behavioral parts of employees. The adequacy of internal branding relies on upon a comprehension of the internal and in addition the external condition of the organization. The purpose behind review is to give a better understand of internal branding concept and to inspect the dimension of internal branding in the area of marketing and human resources. Researchers followed literature Review as the main methodology to review the existing knowledge to build conceptual content to support for the proposed research directions. In view of the discussion, it proposes the future research bearings in accordance with the empirical knowledge gaps. The review can help future research to contribute to existing knowledge whilst organizations are benefited with the insights shared on internal branding practices.

Index Terms- Internal Branding, Brand Commitment, Brand performance, Human Resources, Marketing

I. INTRODUCTION

Today, human resources as the best upper hand of associations in the third millennium years are the wellspring of major industrial development and monetary advancement of nations, and specific regard for their positive part in branding is an obvious need. Accordingly, employees as the main clients are the most capable and most critical calculates fortifying or debilitating the brand and satisfying the commitment that is given to clients concerning the brand since they are in steady association with clients and different employees (Ghorbani, Samiei Nasr & Amoozesh, 2015). In today's exceedingly focused situation, associations see brand from alternate points of view. Branding was initially used to separate just tangible products, however now it is utilized to separate individuals, places and firms as well. A brand is the disguised total of all impressions gotten by customers bringing about a particular position in their mind depends on saw passionate and utilitarian advantages. Branding as a showcasing wonder is really the way toward talking the estimation of association's service or item to buyers. It includes the making of psychological structures that assist the intended interest group with organizing their knowledge concerning a specific item/association. Branding, be that as it may, is not just a chance to shape client's recognitions as for the organization, it is additionally a chance to shape employees discernments too. The brand should dependably convey value and the value must be characterized regarding the buyer, which may be the internal customer or an external customer. Indeed, as per Jacobs (2003), a brand speaks to the relationship an organization has with its employees the same amount of as it speaks to the relationship that it has with its clients. Along these lines the idea of employer branding started.

Meanwhile, McLaverty, McQuillan&Oddie (2007) offered the accompanying definition for internal branding, which by exploring the literature survey of the subject, one might say that it is a standout amongst the most far reaching meanings of internal branding. Internal branding is an arrangement of vital procedures that organize the staff and give them the privilege to make a decent affair for the client in a manageable way.

These procedures incorporate (yet not restricted to) internal communications, training support, Leadership activities, recognition and reward programs, recruitment activities and survival elements. Expanding rivalry in administration parts and in businesses, for example, hoteling, insurance, banking, protection et cetera is completely open. Unquestionably, in such conditions, holding the clients and expanding their dependability turn out to be more troublesome step by step. Internal branding as another way to deal with making client steadfastness has been examined through the channel of employees. Effective execution of internal branding can make a scaffold amongst technique and its usage, and the principle segment of this extension are the staff. Henceforth, Aaker (2004) depicts employees as a basic segment of an organization's image, particularly for service organizations, where the nearness of amiable, ready, steadfast and proficient staff and furthermore purchasers devotion will be respected.

In the brand performance of a service association, the part of employees at all the levels has higher ramifications. The accomplishment of a service brand is nearly connected with the behavior of the employees since they speak to the brand in the collaboration with the client. The brand-related behavior of employees which is the result of brand knowledge is fundamental to make a steadier and special brand correspondence in the service sector (Henkel et al., 2007). This goes past being pleasant and accommodating to the clients in the service experiences. With regards to services, since the customer frequently see no difference amongst the individual conveying the service and the association a deficient staff execution regularly brings about crevices between customer desires and the brand promise. To empower employees to convey the guaranteed customer desires they need further knowledge about the brand value, trust it and follow up on it in consistence with the qualities (Punjaisri, et al., 2009), (Punjaisri& Wilson, 2011). However the initial step is to illuminate and make employees comprehend the brand value and the following stage is to make them act as per them (Burmam&Zeplin, 2005).

Because of its overlapping existence, a lack of basic theory for Internal Branding inside and between controls of Marketing and HRM appears to upset its affirmation. Aurand et al., (2005) analyzes the effective advancement of the internal branding convention might be as reliant on HR activities as on those created in the marketing division. Despite very much reported internal branding, there gives off an impression of being opportunity to get better among HR divisions as far as effectively conveying the corporate branding message. Since HR experts who are accountable for internal communications normally does not have the promoting aptitudes, a large number of the standards of purchaser publishing to internal communication that empower employees to "live" the vision of the brand also lack in planning, creating and executing successful internal branding rehearses (Simi ,2014). The greater part of the examination has focused on the employees point of view of internal branding there is less concentrate on the employee's perspective of different internal branding inputs and their results which should be contemplated for organizational ramifications (Alshuaibi&Shamsudin, 2016). Adjusting Marketing and HR capacities is not a simple errand as they are not coordinated and at times both the divisions don't talk, internal branding offers solution for this issue by blending best of marketing and HR hones. The effect of internal branding on brand identification, brand commitment and brand performance has been inquired about in different context (Dissanayake & Neel & Jinadasa, 2017.). Therefore this paper addresses to review the literature and different area of internal branding by addressing to following mentioned objectives

- To review empirical arguments and insights on internal branding.
- To examine the dimensions of internal branding in the areas of marketing and human resource perspective.

Taken after by the given foundation, researchers have sorted out the paper content with targets, procedure alongside theoretical surveys on the said topics under particular segments to give clear discussions and finally it has given a conclusion before displaying the suggestions for future reviews and practices.

Methodology

Through a thorough review of the past reviews on internal branding the crevices and gaps in the internal branding idea and its key hugeness has been checked. In light of the bits of knowledge from a few research chips away at internal branding, this review has received a thorough theory expanding on internal branding (Burman, et. al., 2009, King & Grace, 2009, Papasolomou&Vrontis, 2006) Further, special focused has been made to review the antecedents and consequence of the concept of internal branding and its behavioral connections with different brand related concepts. It has organized the empirical contents validate the concept of internal branding as one of the needed concept to be further examined with different contexts.

11. LITREATURE REVIEW

Internal branding depends on the basic idea of being employee centered. Lloyd (2002) contends employer branding is “total of an organization's endeavors to convey to existing and imminent staff that it is an alluring work environment”. Literature is starting broadly with a discussion of the concept of Internal branding, followed by an insight within the dimensions of internal branding, antecedents and consequences. The different perspective of internal branding included in this section.

Internal Branding

Internal branding (IB) is a subset of internal marketing which concentrates on the improvement, fortification, and maintenance of the brand. This idea risen in 1970 by Berry et al. In 1976 it was suggested that employees are the same as internal clients who ought to be happy with the organization. This idea has developed more than three decades to wind up plainly a multi-dimensional idea. While a few scientists, for example, Chang (2009), and Punjaisri& Wilson (2007) trust that internal marketing is operational through internal communication, others, for example, Nahavandi (2008), and Gazen (2007) trust that training is the most essential dimension. Moreover, internal marketing exploration is the most essential dimension (Porricelli et al., 2014.). King and Grease (2008) contend that internal brand management is more imperative than “internal communication with the brand” and trust that a far reaching system of intellectual and passionate preparing is fundamental for the acknowledgment of this demand (Porricelli, 2013, p. 15). Accentuation on internal brand in recent marketing, needs to take part in practices that consent to the brand (Helm, Renk, & Mishra, 2016). Internal brand management works as a potential device in acquiring competitive advantages.It, through the production of a solid brand, makes it troublesome for the contenders to debilitate and duplicate the brand's position (as far as client unwaveringness, market share and premium). Albeit proficient advertisers are the fundamental players in making and keeping up strong brands, the defenders of internal brand management trust that employees, paying little respect to their various leveled part or performance in the organization, assume an imperative part in the making of upper hand through branding. Albeit every employee has a different level of commitment in “brand life”, the commitment of each of them in the development of a strong brand is verifiable (Burmman,et.al., 2009, p. 265).Burmman&Zeplin (2005) contend that internal brand management comprises of three levels. The main level is human recourses management which depends on the brand and accentuates individual character of the brand through enrollment and advancement of

the employees. Truth be told, this alludes to the hierarchical socialization of employees through introduction, education, and social and instructive projects to guarantee comprehension of brand identity. The following influence is to strong the brand among employees through the making of awareness and internal communication. The last use is the brand leadership which is empowered at all hierarchical levels and alludes to the employees who live with the brand. Burmann&Zeplin (2005) assert that playing with these influences, internal brand management made brand communication thus of which brand citizenship behavior was made. Burmann, et.al. (2009) recommended another rendition of internal brand management in which three influences have been anticipated: brand identity, brand communication and brand leadership (Porricelli, 2013, p. 15).

Internal branding assumes an urgent part in the fruitful usage of business technique. These days organization's most capable methods for conveying a characterized brand experience is just through the support and intermediation of its workers and by viably conveying on the brand promise. This is the main way that business procedure can effectively be executed, empowering strategies for success to be accomplished. Or, then again simply say - disregard internal branding and you are probably going to taking in question your business. Given that brand has moved towards being a client encounter idea, the capacity of employees to convey that experience has turned out to be progressively remarkable. The significance of the part of employees in service and service related businesses is unchanging

HR Construct of Internal Branding

Employees are viewed as a critical component in the brand management, since they speak to the brand in the connection with the client. HR office needs to make the employees understand that they are adding to brand's present accomplishments by demonstrating to them how their parts and obligations help the brand in prevailing in its central goal. Brands that don't make the employees feel that the brand's accomplishments are their own particular don't make employees commitment. It improves the conveyance of the brand promise to live up to client's image desires by means of different communication implies (Drake et al., 2005 and Punjaisri et. al., 2009). This requires connecting with the employees. Internal branding is the way toward drawing in employees in the branding procedure, which empowers them to all the more effectively speak to the brand's qualities to outside crowd (Keller, 2013). Building an internal brand is the most critical part of any organization in the period of worldwide rivalry. In this manner it is important to acquire employee responsibility and make a connected with workforce. As indicated by Wallace et.al (2014), the employee's state of mind and behavior must speak to organization's image, value and culture. Internal branding empowers the employees to know the estimations of the brand, to build up an uplifting demeanor towards the qualities and to build up the abilities to convey on the estimations of the brand (Punjaisri et.al. 2007). Internal brand management encourages the procedures which help the representatives in "living the brand" of the association.

Internal Branding -Antecedents

Knox and Freeman (2006) directed an observational review to gauge the parts of manager brand image amid employee enrollment. The managerial ramifications of building up a more reliable manager brand image in the enlistment market are talked about by them. As per Hersey and Blanchard (1996), values mirror the rights and wrongs in associations. This was additionally upheld by another review which demonstrated that incongruence between individual esteems and those of the organization can prompt employee doubt, bring down execution and profitability and decreased nature of yield (Harshman& Harshman,1999). As per Peterson's (2004) hierarchical model of employees' commitment, the worker turnover aims, worker persistence, work fulfillment and objectives are affected by the employee organizational connections, for example, employee manager relationship, person organization fit and person job fit, collaboration with companions and organizational support. In their latest meta-investigation, found that P-O fit has strong

connections with employment fulfillment and organizational commitment and a more direct relationship with intention to quit. Pappasolomou & Vrontis (2006) have bolstered that internal branding utilizing internal communication and training upgrades employee's unwaveringness. As per Zucker (2002), internal communication ought to be the primary purpose of center in internal branding programs. These reviews demonstrate that employees are the significant connection amongst organization and clients. The employee's convictions about the company's way of life influence the legitimacy of self-determination choices (Cable and Judge, 1996) and influence their post-section performance (Schein, 1985). These reviews have set up how hierarchical culture speaks to the essential suspicions and qualities learned by the individuals from the organization, passed on to newcomers, and confirm by the courses in which individuals carry on in the working environment.

The arrangement of satisfactory performance input is critical for the making of a profitable situation in which employees can accomplish their own and organizational goals (Furnham, 2002). This is clarified by management support and state of mind alongside leadership. Tosti and Stotz (2001) clarified in their exploration that management mentality is worried with the degree and nature of obvious bolster given by management to the internal branding program. Punjaisri et al. (2009) have demonstrated that the coordination of HR and marketing is the key for effectively executing internal branding and inducing positive results, for example, employees brand image brand commitment, brand loyalty and brand related behaviors.

Internal Branding –Consequences

The current investigation of Punjaisri and Wilson (2007) delineated the interceding impact of the states of mind on the connection between internal branding's apparatuses and employees brand performance. Punjaisri et al. (2009) has directed research to comprehend the results of internal branding on employees brand supporting practices. They have highlighted the significance of an integrative internal branding structure enveloping capacities, for example, HR and marketing. Boyd and Sutherland (2006) led four distinctive observational reviews in associations where employees recognized "living the brand". They demonstrated an employee branding model, which concurring them, is a self-fortifying cycle which highlighted the significance for organizations to urge their staff to "live the brand" so as to acquire employee brand commitment.

Burmann and Zeplin (2005) contended that internal branding causes a mutual comprehension of a brand over an association and a viable internal branding effort initiate's employees brand commitment. Employee engagement is an imperative apparatus for the maintenance of ability. Numerous experts, for example, Baumruk (2004) and Ferguson (2007) have demonstrated the connection between work environment variables and engagement. Explore associations, for example, Gallup (2006) and Hay Group (2002) have done research in the region of engagement. The foresaid review denotes that human assets have a strong concentrate on individuals have exhibited a noteworthy effect on upgrades in employee fulfillment and performance. It is a region where thorough scholastic research is required. A review by Ind (2007) clarified that when an organization has a strong philosophy and qualities, representatives will probably take part to the organization's advantage.

Incubate and Schultz (2001) perceive the essential part that organizational culture may play in producing a picture to outside partners. This paper has depicted corporate marking as a corporate device whose effective application relies on taking care of the setting in which it is utilized. A model to help directors examine setting as far as the interaction between vital vision, organizational culture and corporate picture was additionally presented. Organ (1997) has clarified organizational citizenship that contributes in a roundabout way to the association through the support of the organization's social framework. It has been of expanding enthusiasm to both researchers and managers and has shown the employee behavior. Aaker (2004) has led many reviews on the ideas of brand equity and brand identity which demonstrated that brand equity is in the heart of branding research.

CMA (Canadian Marketing Association) Branding and Strategic Planning Council led three sequential studies comprising of a progression of research activities to concentrate the prescribed procedures for internal branding. The principal activity was an online

study with 475 respondents crosswise over businesses that analyzed how associations view and execute Internal Branding hones. The outcomes were in this way distributed by the CMA in 2006. They did additionally studies to set up the same in 2007 and 2008. The writing has contended for the impact of internal branding on employees brand supporting behaviors. This was inquired about by de Chernatony et.al (2001; 2006). As per their review, internal branding could shape employee's behavior is to a great extent in view of the presumption that when employee comprehend and are committed on the brand values innate in the brand promise, they will perform in ways that satisfy client's brand desires. As indicated by Zeithaml and Gremler (2006), to guarantee that their employees can convey the brand promise, the organization needs to participate in any exercises that guide their employees in their capacity to convey on brand promise, for example, training motivating, rewarding, recruiting, fulfilling and providing equipment and innovation.

Techniques and Tools of Internal Branding

Internal Communications: otherwise called Employee Communication – is at its most fundamental, encouraging vital associations and discussions inside your organization. This communication happens between pioneers, managers and employees or distributed, from pioneer to-pioneer or employee to-employee, for instance.

Training Support: Helps, gadgets, hardware, and services given to encourage productive operation and upkeep of processor framework.

Leadership Practices: It is a leadership behavior or that you rehearse deliberately consistently. Here are a few criteria for a powerful leadership practice.

Reward and Recognition: In spite of the fact that these terms are regularly utilized conversely, reward and recognition frameworks ought to be considered independently. Employee compensate frameworks allude to projects set up by an organization to reward performance and motivate representatives on individual or potentially bunch levels. They are ordinarily viewed as isolated from compensation however might be financial in nature or generally have a cost to the organization. While already considered the area of huge organizations, independent ventures have likewise started utilizing them as an apparatus to bait best employee in an aggressive occupation advertise and also to build employee performance.

As noted, despite the fact that employee recognition projects are regularly joined with reward programs they hold an alternate reason inside and out. They are expected to give mental prizes: a monetary advantage. Albeit numerous components of outlining and keeping up reward and recognition frameworks are the same, it is valuable to remember this distinction, particularly for entrepreneurs inspired by propelling staffs while minimizing expenses.

Recruitment Practices: The way toward finding and contracting the best-qualified candidate (from inside or outside of an association) for an employment opportunity, in a convenient and savvy way. The enrollment procedure incorporates dissecting the necessities of an occupation, pulling in employees to that occupation, screening and choosing candidates, contracting, and coordinating the new employee to the organization.

Sustainability Factors: Supportability has turned into a huge issue in the famous press, corporate meeting rooms, political fields and the scholarly community. As indicated by the OECD's definition, maintainability signifies “connecting the monetary, social and ecological targets of social orders balanced” and “about the results of today's exercises which address the difficulty of reasonable improvement and require that the procedure through which choices are come to is educated by the full scope of conceivable outcomes,

and is responsible to the general population” Sustainability demonstrates both difficulties and open doors for associations and it can beat financial weights and fit the future needs of the earth.

Effect of internal Branding and Brand Commitment

Sense of duty regarding the association mirrors employees' inclusion and impedance with the organization's objectives and their enthusiasm to proceed with their works in the association. Organizational commitment can be characterized as one's feeling of having a place with the organization and their awareness of other's expectations towards the organization's objectives. It additionally implies giving the social framework one's vitality and fidelity (Ng and Feldman, 2011). In connection to the attributes of employees, Podsakoff et al. (2000) contend that the investigation of organizational commitment is notable in the territory of organizational citizenship behavior. On account of corporate brand, brand commitment (BC) is synonymous with organizational commitment (Porricelli et al., 2014, p. 746) Brand commitment is a key component in organizational accomplishment of numerous enterprises, for example, tourism and hotel industry (Ahn, Hyun, and Kim, 2016, p. 332). What is imperative in this exploration is the idea of employees' commitment regarding the organization's brand. Brand commitment has been characterized as the mental and passionate association with the brand. Truth be told, brand commitment is the powerful urge of the organization's employees to ensure that brand. Creating a commitment to a brand, one knows the brand as his/her identity and nature and experiences all the push to ensure the brand (Punjaisri, Wilson, and Evanschitzky, 2009). Burmann and Zeplin (2005) characterize brand commitment as the mental connection of employees to the brand, the inclination of employees for the brand, and endeavor to accomplish the objectives and techniques of the brand. The formation of the idea of brand commitment is a critical component in fortifying and accomplishment of internal brand (Ahn et al., 2016, p. 332).

Brand Performance

Brand performance alludes to how fruitful a brand is in the market. It means to quantify the vital accomplishments of a brand. Subsequently, monetary measures are unseemly for this develop. Brand awareness, brand identity brand loyalty, brand citizenship behavior were proposed as critical performance of a brand Chaudhuri (2002) Punjaisri and Wilson (2011) Since brand awareness and loyalty have been talked about in the above research. There is a positive and significant connection between the internal branding and brand citizenship behavior. These outcomes are predictable with the discoveries of Hadizadeh Moghadam et al. (2012) and Zulfiqar Nasab and Zulfiqar Nasab (2013) contemplated the connection between the internal branding and brand performance in their research.

111. CONCLUSION

The idea of internal branding is very much acknowledged in the service sector. The research finds internal branding is presently basic for all forefront employees occupied with service sector. To apply Internal Branding a few instruments and strategies must be connected, for example, Internal Communication, Training and Support, Leadership Practices, Rewards and Recognition, Recruitment Practices and Sustainability Factors so that Internal Branding is useful in conveying the brand guarantee to the clients (Varunand Indu and Ashish, 2015).

Internal branding is contended to be instrumental in impacting employees' states of mind and forming their practices to be lined up with a brand, by making employees' comprehension of brand values and connecting with them in living brand reality (Kotter and Heskett, 1992). Living the brand or item is show in brand supporting mentalities and behavior. When one disguises the brand value he/she will have the capacity to convey the brand guarantee and experience to the outside partners adequately (Cushen, 2009). In this

specific circumstance, internal branding is an intense instrument for attitudinal and behavioral adjustment in the organizations essential for the brand survival and brand sustainability over the long haul (Burmam&Zeplin, 2005). Meanwhile, the empirical gaps have been highlighted referring to services sectors including financial services as a context to be examined how branding related stimulus influence brand evaluations including brand trust (Dissanayake, 2015; Dissanayake& Ismail, 2015). Thus, services sector is a highlighted notion to be surveyed with branding perspectives.

As employees are a definitive brand ambassadors and brand advocates, the HRM practices ought to be adjusted and facilitated well with the marketing exercises to advance brand supporting practices that are vital to brand value conveyance to outside constituents (Burmam and Zeplin, 2005). In this paper, we recommended a few practices we accept are vital in disguising the brand value suggestions among employees. While the practices are not thorough, we trust that a decent HRM framework gives a workplace and a work condition that is helpful for the advancement, support, and working of brand practices through different works on, starting with the enlisting endeavors. At the point when the best possible framework is set up, it is, in this way, feasible for the inside partners, i.e. the employees to live the brand and turn into the brand.

Future benefit and supportability of present day organizations rely on upon intellectual capital of the organization and its capacity to co-make with employees. It is thusly correlated that internal branding marking be verbalized with vision, mission, and key objectives that convert into practices and gauges of behavior. Specialist prescribes that future reviews ought to focus on

Investigating key viewpoints and measurements of internal branding in assembling firms and organizations.

- Operationalizing internal branding measurements in connection to performance management
- Encouraging correspondence and discourse amongst HR and Marketing.
- Future research ought to concentrate on behavioral parts of internal branding.
- Focused research ought to be done with HR experts, Marketing expert and Branding specialists.
- The bits of knowledge of the writing survey and case rehearses said in this paper could be additionally contemplated in future investigates to see how arranging internal branding in both all sectors in worldwide settings ought to be overseen by highlighting branding related angles as all-encompassing perspective somewhat constraining to a practical specialty.

Further this review can be a reminder to numerous various sectors who have restricted mindfulness on the colossal capability of internal branding on brand behaviors and maintaining its upper hand. Thus, future research works are encouraged to investigate the concept of internal branding alongside the related concepts referring to empirical gaps claimed in different study contexts.

IV. REFERENCES

- [1] Aaker, D.A (2004), Leveraging the corporate brand, *Californian Management Review*, Vol. 46 No. 3.
- [2] Ahn, Y. J., Hyun, S. S., & Kim, I. (2016). City residents' perception of MICE city brand orientation and their brand citizenship behavior: A case study of Busan, South Korea. *Asia Pacific Journal of Tourism Research*, 21(3), 1-26.
- [3] Alushuaibi A.S.I. and Shamusudin F.M. (2016). The Role of Human Resource Management Practices in Enhancing Internal Branding, *the European proceeding Of Social and Behavioral Science*.
- [4] Aurand T. W., Gorchels L. and Bishop T. R., (2005) Human resource management's role in internal branding, an opportunity for cross- functional brand message Synergy, *Journal of Product Brand Management*, 14(3), 163-169
- [5] Baumruk, R. (2004) the missing link: the role of employee engagement in business success. *Workspan*, Vol 47.p. 48-52.
- [6] Boyd G. and Sutherland M. (2006) Obtaining employee commitment to living the brand of the organisation. *South African Journal of Business Management*. Vol. 37.
- [7] Burmann, C. and Zeplin, S. (2005) Building brand commitment: A behavioral approach to internal brand management. *Journal of Brand Management*. Vol. 12, No. 4. p. 279-300.

- [8] Burman, C., Zeplin, S and Riley, N (2009), Key Determinants of Brand Management Success: An exploratory empirical analysis, *Journal of Brand Management*, vol.16, pp.264-284
- [9] Cable, D.M., Judge, T.A. (1996). Person-organization fit, job choice decisions and organizational entry. *Organizational Behavior and Human Decision Processes*. Vol. 67. p. 294-311.
- [10] Cushen, J. (2009). Branding employees. *Qualitative Research in Accounting & Management*, 6(1/2), 102-114.
- [11] de Chernatony, L. (2000) Developing corporate brands through considering internal and external stakeholders. *Corporate Reputation Review*. 3 (3). p. 268-274.
- [12] Dissanayake, D.M.R., Wastantha, H.L.N. and Jinadasa, M.P.K. (2017). The Role of Organizational Creativity towards Innovations: A Conceptual Review on Services Sector Research Directions, *Journal of Social Sciences – Sri Lanka*, Faculty of Social Sciences, University of Kelaniya, Sri Lanka. 09 (01): 12-19.
- [13]Dissanayake,D.M.R. &Ismail,N. (2015). Relationship between Celebrity Endorsement and Brand Attitude: With Reference to Financial Services Sector Brands in Sri Lanka, *Conference Proceedingsof International Conference on Business & Information (ICBI)*, 1-22.
- [14] Dissanayake,D.M.R. (2015). Factors Determine the Customer-Celebrity Relationship towards Perceived Celebrity Endorsement: Propositions to Hypothesize Future Studies in Sri Lankan Service Sector, *Sri Lanka Journal of Marketing*, Vol11, and Issue 2, 22-35.
- [15]Furnham, A. (2002) Work in 2020 Prognostications about the world of work 20 years into the millennium. *Journal of Managerial Psychology*. 15. p. 242-50.
- [16] HadizadehMoghadam, A., Jamali, Sh. &Rezaei, M. (2012). "The impact of internal branding and brand citizenship behavior in the hotel industry", Volume 16, Issue 3, Pages 203-223.
- [17] Hersey, Paul and Kenneth H. Blanchard, and Dewey E. Johnson, (1996). *Management of Organizational Behavior: Utilizing Human Resources*, 7th ed. (Upper Saddle River, N.J.: Prentice Hall, p. 188-223.
- [18] Helm, S. V., Renk, U., & Mishra, A. (2016). Exploring the impact of employees' self-concept, brand identification and brand pride on brand citizenship behaviors. *European Journal of Marketing*, 50(1/2), 58-77.
- [19] Henkel, S., Tomczak, T., Heitmann, M., and Herrmann, A. (2007) Managing brand consistent employee behavior: relevance and managerial control of behavioral Branding, *Journal of product and brand management*, Vol. 16, issue 4/5, pp 310-320
- [20] Jacobs, R. (2003) Turn employees into brand ambassadors. *Bank Marketing*. 35(3): 22-6.
- [21] Keller, K. (2013). *Strategic brand management* (2nd Ed.). New York, NY: Pearson Higher Ed.
- [22] Knox S.D., Freeman C. (2006) Measuring and Managing Employer Brand Image in the Service Industry. *Journal of Marketing Management*, 22 (7). p. 695-716.
- [23] Kotter, J., &Heskett, J. (1992). *Corporate culture and performance*. New York, NY: The Free Press.
- [24] King, C and Grace, D (2009), Employee based brand equity: a third perspective, *Service Marketing Quarterly*, Vol.30, pp.122-147
- [25] MacLavery N., McQuillan P. and Oddie, (2007) Internal Branding Best Practices Study, Canadian Marketing Association
- [26] Mahmood Ghorbani;Mahmood Samiei Nasr;Mojtaba Amoozesh. (2015). The impact of internal branding on employees brand promise (Case Study: Samen credit. *GMP Review*, V18(5).
- [27] Ng, T. W. H., & Feldman, D. C. (2011). Affective organizational commitment and citizenship behavior: Linear and nonlinear moderating effects of organizational Tenure. *Journal of Vocational Behavior*, 79(2), 528-537
- [28] Pappasolomou, I and Vrontis, D (2006), using internal marketing to ignite the corporate brand: the case of the UK retail bank industry, *Journal of Brand Management*, Vol.14 (1/2) pp.177
- [29]Pappasolomou, I. &Vrontis, D. (2006) Building corporate branding through internal marketing: the case of the UK retail bank industry. *Journal of Product & Brand Management*. 15(1):37-4.
- [30]Peterson, S. (2004) toward a theoretical model of employee turnover: A human resource development perspective. *Human Resource Development Review*, 3(3), 209-227.
- [31] Podsakoff et al. (2000). Organizational citizenship behaviours: A critical review of the theoretical and empirical literature and suggestions for future research. *Journal of Management*, 26 (3),513-563
- [32] Punjaisri, K., H. Evanschitzky and A. Wilson (2009b) internal branding: an enabler of employee's brand supporting behaviors. *Journal of Service Management*. 20(2). p. 209- 26.
- [33] Punjaisri, K. and A. Wilson (2007) The Role of internal branding in the delivery of employee brand promise. *Journal of Brand Management*.
- [34] Punjaisri K. and Wilson A.(2011), Internal branding process: key mechanisms, outcome and moderating factors, *European Journal of Marketing*, 45(9-10), 1521-1537

- [35] Punjaisri, K (2007), The Role of Internal Branding in the Delivery of Employee Brand Promise, *Journal of Brand Management*, vol.15, no. 1, pp. 57-70
- [36] Porricelli, M. S. (2013). *The antecedents and consequences of brand citizenship behavior* (Doctoral dissertation, UMI 3552688). H. Wayne Huizenga School of Business and Entrepreneurship Nova Southeastern University.
- [37] Porricelli, M. S., Yurova, Y., Abratt, R., & Bendixen, M. (2014). Antecedents of brand citizenship behavior in retailing. *Journal of Retailing and Consumer Services*, 21(5), 745-752.
- [38] Simi J.(2014)Strategic Perspective of Internal Branding: A Critical Review.*European Journal of Business and Management*, Vol.6, No.34,
- [39] Tosti, D.T. and Stotz, R.D. (2001) Building your brand from the inside out. *Marketing Management*. Vol. 10, No. 2. p. 27-33.
- [40] Varun K, Indu B and Ashish K. (2015)Internal Branding: A Review of Indian Hotel Industry,*Advances In Management*, Vol. 8 (11)
- [41] Wallace, E., de Chernatony, L. & Buil, I. (2014). Building bank brands: How leadership behavior influences employee commitment. *Journal of Business Research*, 66(2), 165-171.
- [42]Zucker, R. (2002) More than a Name Change - Internal Branding at Pearl. *Strategic Communication Management*. Vol. 6. No. 4. p. 4-7.
- [43] Zeithaml, V., Bitner, M. J., and Dwayne Gremler (2000) *Service Marketing: Integrating Customer Focus across the Firm*. 6th ed, New York, NY: Irwin McGraw-Hill Publishing.
- [44] ZolfagharNasab, M. & ZolfagharNasab, M. (2013), "Studying the relationship between the internal branding with brand performance", International Management Conference, challenges and solutions.

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Assessment of Karnal Bunt Disease of Wheat in Different Districts of South Western Punjab

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Abstract

The present studies has been done on investigation of Karnal bunt in wheat produced in South Western Punjab. To know the status of wheat seed, 340 wheat samples were collected from 17 different grain markets belongs to 9 districts of Punjab. The major five Varieties of wheat i.e. HD 2967, HD 3086, HD 2733, PBW 502 and PBW 725 were collected from selected area. The results shows Karnal Bunt disease infection was ranged from 0 to 14.2% in south western Punjab. The most susceptible wheat varieties were HD 2967 and HD 3086, showing 5.0% and 14.2% of infestation respectively. The minimum incidence of Karnal Bunt was observed on the varieties PBW 725 (0.81% infection) and HD 2733 (2.41% infection). Whereas PBW 502 was Karnal Bunt free. It was also found that Karnal Bunt was least in Abohar district whereas Fazilka district was totally disease-free.

Index-Terms: Karnal Bunt, wheat, Grain market, Varieties

I. INTRODUCTION

Wheat is one of the foundation crops of India's agriculture. India occupies third position in the world in production of wheat (Singhet *et al.*, 2012). Whereas in India, Punjab is the major wheat producing state. Which contributed 60% of wheat every year (Sharma *et al.* 2004). The quality of wheat is decreased by many fungal disease. One of the fungal disease of wheat is Karnal Bunt (KB) caused by *Neovossia indica* (Mitra, 1931). The Karnal Bunt disease was first reported from Karnal district of Haryana (India) in 1930s (Singh *et al.*, 1989). This disease is widely found in all the wheat growing areas in North India, Northern Pakistan, Southern Nepal and Mexico (Duran, 1972).

Although it is considered as a minor disease but due to varietal reshuffle, intensive cultivation and high input technology factors are responsible for becoming it as a major production constraint. Total losses in India during severe epidemics have been around 0.3 to 0.5 per cent with incidence as high as 89 per cent in some fields (Joshi *et al.*, 1983). Karnal Bunt of wheat also known as 'partial bunt' causes reduction in yield and quality of grain, but due to strict quarantine and tolerance limit put to zero level by some countries has proved a major setback in capturing the international wheat market (Agarwal *et al.*, 1993; Singh, 2005).

This fungus is both seed and soil borne and can retain up to four years (Krishna and Singh 1983; Vocke *et al.*, 2002). It affects the grains partially where some tissues of the grain remain normal and some converted into a mass of bunt spores. These spores fall to the ground when the glumes spread apart. Generally the infection spreads to the tissue along the groove of the grain, but the endosperm material lying along the groove of the grain remains uninfected. Except in very severe cases, the embryo is not destroyed. This leads to reduction in ears as well as number of spikelets (Ehsan-ul-Haq *et al.*, 2002). Wheat plants are more susceptible when spikes emerge, but infestation can take place throughout anthesis (Warham, 1984). This pathogen not only reduces the weight of seeds but also

causes deterioration of flour quality due to production of trimethylamine (Singh *et al.*, 1993). Therefore after knowing its seriousness an effort is made to highlight the status of Karnal Bunt in different grain markets of South Western Punjab.

II. MATERIALS AND METHODS

Sample collection

In order to observe frequency of seed abnormality, 17 grain markets were visited. Twenty samples of wheat grain, measuring about 500gm to 1Kg of seed of 5 wheat varieties; HD 2967, HD 3086, HD2733, PBW 502, PBW 725, were taken at an interval of 3 months for observation from selected grain markets. The collection of seeds was done in thick brown paper bags, randomly, from 4-5 places of each unclean heap belonging to different farmers and brought to the laboratory for further sampling.

Dry inspection of seeds

500-1000 g of different varieties of wheat seeds were collected. Each variety was examined by visual inspection under the stereoscopic binocular microscope for normal and abnormal seeds. Normal seeds were those with smooth coat, light brown to butter colour without discolouration or fungal propagates.

Abnormal seeds were those with malformed seed shapes, wrinkled seed coats, discolouration or those with fungal propagates. Four replicate samples having 100 seeds per variety were examined and further abnormal grains counted were done in laboratory. Average percent of KB infection from each district was calculated from the total no. of grains used for analyzed of KB infection. The whole sample was poured in the tray (having white sheet or bottom) to look for the infected grain.

Calculation: Percent frequency of KB infected samples = $n/N \times 100$

Where n = number of seeds in one sample showing bunted grains and N = the total number of seeds in one sample $\times 100$

III. RESULTS AND DISCUSSION

A total of 17 grain markets have been surveyed in 2016-17 from 9 districts of Punjab. The total 340 samples were collected, which was further examined in laboratory (Table 1).

Table 1. Details of different grain markets of Punjab from where samples of wheat were collected

Districts	Total samples	Grain markets
Abohar	40	AboharMandi, Balluna
Barnala	20	BarnalaMandi
Bathinda	80	TalwandiSabo, Kotshamir/KotFatta, Pithu (RampuraPhul),

		Badhiwala(RampuraPhul)
Faridkot	40	FaridkotMandi, Kabuli Wala
Fazilka	20	FazilkaMandi
Ferozpur	40	FerozpurMandi, Jalalabad
Mansa	20	Sardulgarh
Moga	40	Dharamkot, Bhinder Kala
Muktsar	40	MuktsarMandi, MahanBhaddar

The present studies on the status of Karnal Bunt in different districts of south western Punjab revealed that the disease Karnal Bunt was least in Abohardistrict whereas Fazilkadistrict wastotally disease - free. Out of 17 grain market, 14 grain markets was identified with least KB (95% and above). One grain market was come under 91-95% KB- free area. Whereas only one grain market i.e. Kabuli Wala (Faridkot district) was come under 86-90 % KB – free area (Table 2).

Table 2. Status of Karnal Bunt (KB)- free in different grain markets of Punjab in 2017

Districts	% of KB- Free grain markets		
	86-90%	91-95%	95 % and above
Abohar	-	-	Abohar, Balluna
Bathinda	Pithu (RampuraPhul)	Badhiwala(RampuraPhul)	Kotshamir, TalwandiSabo
Barnala	-	-	Barnala
Faridkot	Kabuli Wala	-	Faridkot
Fazilka	-	-	FazilkaMandi
Ferozpur	-	-	Ferozpur, Zaalalabad
Moga	-	-	Dharamkot, Bhinder Kala
Muktsar	-	-	Muktsar Mandi, MahanBhaddar
Mansa	-	-	Mansa Mandi

The Karnal Bunt infected sample was maximum reported in Bathinda district(14.2%) and no infestation was reported from Abohar and Fazilka district (Table 3).

Table 3. Percentage of Karnal Bunt (KB) – infested samples in different districts of Punjab in 2016-2017

Districts	KB(%)
Abhoar	-
Barnala	0-0.75
Bathinda	0-14.2
Faridkot	0.53-10.71
Fazilka	-
Ferozpur	0-0.65
Mansa	2.35

Moga	0.5-5
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Five Varieties i.e. HD 2967, HD 3086, HD2733, PBW 502 and PBW 725 was consider for knowing the status of seed diseases studies. In these Varieties HD 2967 and HD 3086 was predominant during 2016-17, therefore more samples drawn from it. Study of incidence of normal and abnormal wheat seeds from dry inspection of seeds showed that there is maximum cut seeds found in variety HD2967 in Badhiala (54.6%) and minimum with variety HD3086 in Kotshmir (2.48%) of Bathinda district. Maximum entirely discoloured seeds was found in variety HD2967 in MahanBhaddar (7.5%) of Muktsar district and minimum with variety HD2733 in Talwandi Sabo (0.6%) of Bathinda district. The maximum Karnal Bunt seed found in variety HD3086 in Pithu (RampuraPhul) (14.2%) of Bathinda district and Karnal Bunt free areas were Abohar, Kotshmir of Bathinda district, Fazilka, Jalalabad of Ferozpur district and MuktsarMandi.

The percentage range of normal seeds (Fig.1) was 10.9 – 87.5%. Range of abnormal seeds which includes: cut seeds (Fig. 2), entirely discoloured seeds (Fig. 3), Karnal Bunt disease infested seeds (Fig. 4) were 2.48-54.6%, 0.6 – 7.5% and 0 – 12.5% respectively. There is maximum abnormality mean range in cut seed (28.54%) and least in Karnal Bunt (6.25%), vary according to area and variety (Table 4). The dry inspection of seeds revealed a higher incidence of cut and discoloured than normal seeds. According to Tyagi and Olugbemi (1980); Sisterna and Sarandon (2010) the grain discoloration was the results of fungal infection of wheat heads under humid conditions. They also reported that the grain weathering manifests as discoloration, rough appearance, shriveling and loss of texture or reduced in grain size.

Table 4. Incidence of normal and abnormal wheat seeds in sample collected from different grain market of Punjab

DISTRICT	AREA	VARIETY	NORMAL SEEDS (%)	CUT SEEDS (%)	ENTIRELY DISCOLOURED SEEDS (%)	KB (%)
Abohar	Balluna	HD 2967	62.9	13.58	1.69	-
	Abohar	HD2967	83.5	3	2	-
Moga	Dharamkot	HD 2967	36.38	34.5	4.5	5
	Bhinderkala	HD 2967	13.5	43	4	0.5
Bathinda	Talwandi Sabo	HD 2733	69	15.52	0.6	2.41
	Kotshmir/ KotFatta	HD 3086	87.5	2.48	0.77	-
	Badhiwala (Rampuraphul) Pithu (RampuraPhul)	HD 2967	10.9	54.6	3.90	4.68
		HD 3086	30.35	19.64	1.78	14.2
Barnala	BarnalaMandi	HD 2967	53.92	26.5	0.75	0.75
		HD 2733	60.6	21.75	1.75	-
Fazilka	FazilkaMandi	HD 2967	72.38	11.5	1	-
Ferozpur	FerozpurMandi	HD 2967	33.9	-	3.92	0.65
	Jalalabad	PBW 502	86.2	4.80	2.99	-
Faridkot	FaridkotMandi	HD 3086	39.36	17.28	4.52	0.53

	Kabuliwala	HD 3086	20	32.14	-	10.71
Mansa	Sardulgarh	HD 2967	18.6	36.18	7	2.33
Muktsar	MuktsarMandi	HD 2967	44	31.19	3.03	-
		HD 2967	28.75	40	3.33	0.83
	MahanBhaddar	HD 2967	20.62	48.12	7.5	3.12
		PBW 725	35.2	27.86	-	0.81
Percentage Range			10.9– 87.5%.	2.48-54.6%	0.6 – 7.5%	0– 12.5%



Fig.1:Normal seeds of wheat



Fig.2: Cut seeds of wheat



Fig.3: Discoloured seeds of wheat



Fig.4: KarnalBunt infected wheat seeds

However as the disease is highly dependent on the climatic factors during the crop season, year to year variations in the disease are likely to occur. Many authors in previous years reported KB from different region of India. They also reported the variations in disease development is related to varietal susceptibility and the environmental conditions prevalent in different years at vulnerable stage of wheat growth (Joshi, 1978,1988; Bedi and Dhiman, 1982; Singh *et al.*, 1986; Aujlaet *al.*, 1986, 1987; Sharma *et al.*,1998). This information will be significant for the trader who are involve in wheat marketing.

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REFERENCES

- V. K. Agarwal, S.S. Chahal and S. B. Mathur, "Karnalbunt. In: *Seed borne diseases and seed health testing of wheat*," (Eds.Mathur, S.B. and Confer, B.M.), Danish Govt. Institute of Seed Pathology for Developing Countries, Denmark, 1993, pp. 31-43.
- S.S. Aujla, S.Indu and I.Sharma, "New host records of *Neovossiaindica*",vol. 40,*In Phytopathol*, 1987, pp. 437.
- S. S. Aujla, I. Sharma, K. S. Gill and A. S. Grewal, "Prevalence of Karnal bunt in Punjab as influenced by varietal susceptibility and meteorological factors", vol.1, *PI DisRes*, 1986, pp.51-55.
- P. S. Bedi and J. S. Dhiman," All about Karnal bunt of wheat", vol.8, *Seeds and Farms*, 1982, pp. 9-16.
- R.Duran," Further aspects of teliospore germination in North American smut fungi II", vol. 50, *Canadian J. Bot.*, 1972, pp. 2569-73.
- Ehsan-ul-haq, Atiq-ur-rehmanrattu and Javediqbalmirza, "Prevalence of Karnal Bunt of Wheat in NWFP (Pakistan)".Crop Diseases Research Institute,Murree-Pakistan,vol.4(1), *IJAB*,2002, pp.150-152.
- L. M. Joshi, "Wheat disease survey and control measures", *Infarming*, 1978,pp. 19-21.
- L. M. Joshi, "Plant Pathological problems as exemplified by Karnal bunt of wheat",vol. 17, *In J of Mycol and Pl Path.*, 1988, pp. XI – XXI.
- L. M. Joshi, D. V. Singh, K. D. Srivastava and R. D. Wilcoxson, "Karnal bunt- A minor disease that is now a new threat to wheat", vol. 43,*Bot Rev*, 1983, pp. 309-338.
- A. Krishna, and R.A. Singh, "Longevity of teliospores of *Neovossiaindica*causing Karnal bunt of wheat", vol. 13, *Indian J. Mycol. Pl. Pathol.*, 1983, pp.97-8.
- M. Mitra, "A new bunt on wheat in India", vol. 18, *Ann of App Biol.*, 1931, pp.178-179.
- I. Sharma, G. S. Nanda, P. K. Kalotyand A. S.Grewal," Prevalence of Karnal bunt of wheat in Punjab", vol. 26, *Seed Res*, 1998, pp. 155-160.
- I. Sharma, G. S. Nanda, H. Singh and R. C. Sharma, "Status of Karnal bunt disease of wheat in Punjab (1994-2004)", vol. 57, *IndPhytopathol*, 2004, pp.435-9.
- B. Singh, C. S. Kalha , V. K. Razdan , A.Vaidand S. K. Singh, "Status of Karnal bunt of wheat in Jammu division (J&K)", vol.5(2),*International Journal of Plant Protection*, 2012, PP. 375-377.
- D. V. R. Singh, J. K. Agarwal, B. R. Shrestha, Thapa and H. J. Dubin,"First report of *Tilletia indica* on wheat in Nepal (disease note)", vol.73, *Pl Dis*, 1989, pp. 273.
- D.V. Singh, "Karnal bunt of wheat: A global perspective", vol. 58, *Indian Phytopathol.*, 2005, pp. 1-9.
- D. V. Singh, L. M. Joshi andK. D. Srivastava, "Varietal susceptibility and spread of Karnal bunt of wheat in India", vol. 5, *Rachis Barley and Wheat Newsletter*, 1986, pp.40-42.
- B. B. Singh, S. S. Aujla, and I. Sharma," Integrated management of wheat Karnalbunt", vol. 39, *Int. J. Pest Manage.*, 1993, pp. 431-434.
- M. Sisterna and S. Sarandon, "Wheat grain discoloration in Argentina: Current Status", vol. 3 (Special issue 1), *The Americas Journal of Plant Science and Biotechnology*, 2010, pp. 54-64.
- P. D. Tyagi and L. B. Olugbemi, "Rain-fed wheat in Nigeria as influenced by fungal pathogens and adverse weather conditions", vol. 91, *Samaru Miscellaneous paper*, 1980, pp. 1 – 15.
- G. Vocke, E.W. Allen and J. M. Price, "Economic Analysis of Ending the Issuance ofKarnal Bunt Phytosanitary Wheat Export Certificates", *Wheat Yearbook/WHS-2002*. USDA Economic Research Service, 2002, pp. 1-13.
- E.J. Warham, "A comparison of inoculation methods for Karnalbunt*Neovossiaindica*", vol. 74, *Phytopathol*, 1984, pp. 856-7.

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Pattern of thyroid disorders in people from central Nepal: A Hospital based study

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Abstract- Metabolic disorders including thyroid dysfunction is increasing problem throughout the world. We aim to observe the pattern of thyroid disorder among people attending one of the hospitals in the central development region of Nepal. An observational study was conducted among 290 individuals who attended the Medical unit of Shree Puspanjali Hospital Pvt. Ltd, Bharatpur-10, Nepal between May 2016 and August 2016. Socio-demographic characteristics, clinical characteristics and laboratory data (from thyroid function test) were collected. Data were analyzed using IBM-SPSS 20.0 and descriptive and inferential analysis was performed. Of the 290 individuals, 215 (74.23%) had thyroid disorders among which hypothyroidism was the most common disorder (187, 87.0%) followed by hyperthyroidism (24, 11.2%) and subclinical hypothyroidism (4, 1.9%). Majorities (261, 90%) of the participants were female and so were those with thyroid disorders (196, 91.2%). The mean age of the participating individuals was 45.9 ± 1.3 years. Hypertension (49, 16.9%) was the commonest co-morbid condition among the participants (30, 10.3%) but diabetes ($p=0.004$) and dyslipidemia ($p=0.002$) were significantly associated with thyroid disorder. In conclusion, hypothyroidism was the most common thyroid disorders and female were at the most vulnerable group. This is a single hospital based study; therefore, it is not sufficient to generalize the thyroid disorder in whole population.

Index Terms- Nepal, Pattern, Thyroid disorders

I. INTRODUCTION

Thyroid disorders are the second most common endocrine disorders in the world.[1] Thyroid gland secretes free tri-iodo thyrosine (fT3) and free thyroxine (fT4) hormones which regulates metabolic rate, growth and development. These two hormones are under the control of thyroid stimulating hormone (TSH), which is produced by anterior pituitary gland and stimulate hormone production of thyroid gland.[2] The spectrum of thyroid disorders includes underactive hypothyroidism, subclinical hypothyroidism, overactive hyperthyroidism and subclinical hyperthyroidism. Their clinical manifestations vary considerably from area to area and determined principally by availability of iodine in the diet. In iodine-replete areas, most people with thyroid disorders have autoimmune disease, ranging through primary atrophic hypothyroidism, Hashimoto's thyroiditis, to hyperthyroidism caused by Graves' disease.[3] About 20 million people are affected by thyroid disorder in

United State of America.[4] Nepalese are considered as a high risk populations for prevalence of iodine deficiency disorder.[5] Several studies in different parts of Nepal showed wide variation in prevalence of the thyroid dysfunctions [6-9]. This study was design to observe the pattern of thyroid disorder among people attending one of the private hospitals in the central development region of Nepal.

II. METHODS

This study was conducted at the Medicine unit of Shree Puspanjali Hospital Pvt. Ltd, Bharatpur, Nepal. Ethical approval of this study was obtained from the same hospital with written informed consent from each participant. We observed the pattern of thyroid disorders among 290 individuals of all age groups and with or without previous history of thyroid disorder by performing their thyroid function test between May 2016 and August 2016. Socio-demographic characteristics [age, gender, religion, diet habit (Vegetarian or non-vegetarian), alcohol intake (Yes/No) and smoking (Yes/No)], clinical characteristics [family history of thyroid disorder (Yes/No), past history of thyroid disorder (Yes/No), duration of thyroid disorder (in years), duration of medication (in years) and currently used medications] and laboratory finding [serum level of thyroid stimulation hormone (TSH), thyroxine (fT4) and triiodothyronine (fT3)] were collected. Serum level of fT3, fT4 and TSH were estimated by Chemiluminescence Immunoassay (CLIA) method at National Reference Laboratory (Bharatpur Division). The serum level of fT3 (2.3-4.2 pg/mL), fT4 (0.78-2.19 ng/dL) and TSH (0.46-4.68 μ IU/mL) were used as a reference range for this study. Thyroid function was considered normal (Euthyroidism) when the participant had all the three hormones within the reference range. Abnormal thyroid function was further categorized as hyperthyroidism (increased FT3 and FT4 but low TSH), subclinical hyperthyroid (normal FT3 and FT4 but low TSH), hypothyroidism (decreased FT3 and FT4 but increased TSH) and subclinical hypothyroidism (normal FT3 and FT4 but elevated TSH). Data were analyzed using IBM-SPSS 20.0 (IBM Corporation, Armonk, NY, USA). The t- test and Chi- square test were used for statistical analysis. A p-value < 0.05 was considered statistically significant for all statistical tests unless otherwise stated.

III. RESULT

Out of 290 participants, female were predominate (261, 90%). The mean±S.D age of the participants was 45.9±1.3 years (Table 1).

Table 1: Socio-demographic characteristics of the participants (n=290).

Characteristic	Frequency	Percentage
Age (in years)		
<15	3	1
16-35	57	19.7
36-55	171	59
56-75	55	19
≥75	4	1.4
Mean age ± SD (years)	45.9 ± 1.3	
Gender		
Male	29	10.0
Female	261	90.0

Religion		
Hindu	284	97.9
Muslim	1	0.3
Christian	3	1.0
Buddhist	2	0.7
Diet		
Vegetarian	50	17.2
Non-vegetarian	240	82.8
Alcohol intake		
Yes	8	2.8
No	282	97.2
Smoking		
Yes	4	1.4
No	286	98.6

Overall, 215 (74.13%) participants were suffering from thyroid disorder and hypothyroidism was the most common (187, 64.48%). Twenty four participants (8.27%) were suffering from hyperthyroidism and only four (1.37%) were suffering from subclinical hypothyroidism (Figure 1).

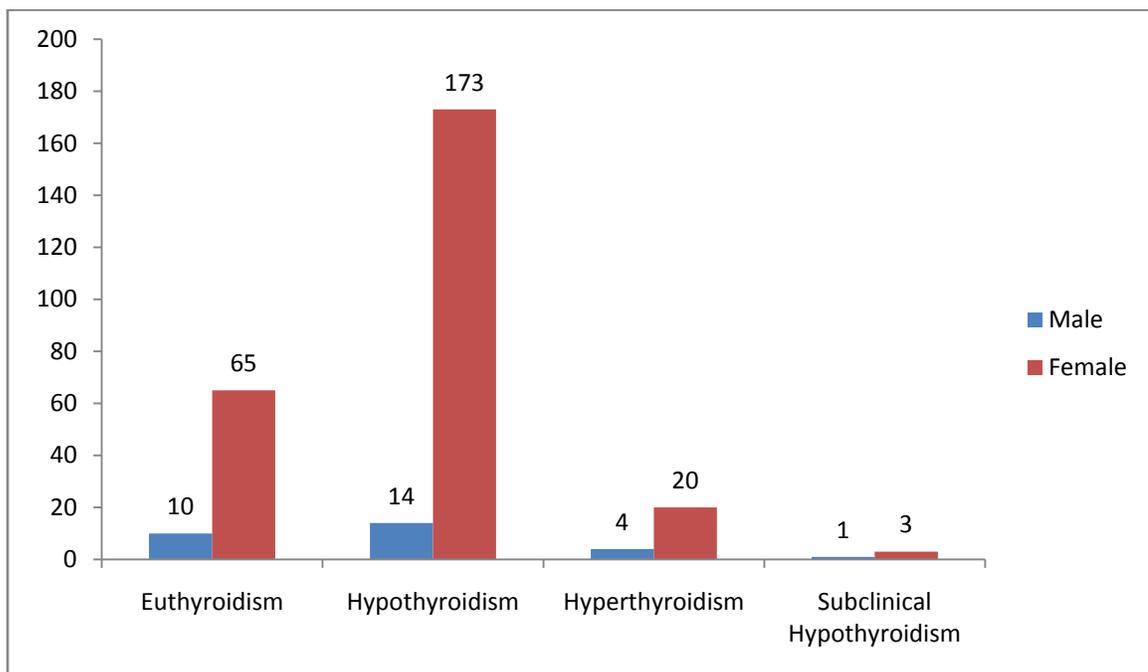


Figure 1: Final diagnosis of the thyroid disorder in the study participants.

The mean±SD serum level of fT3, fT4 and TSH were 3.91±1pg/ml, 2.42±1.08ng/dl and 7±1.2667µIU/ml respectively. Thirty two (11%) participants had family history of thyroid disorder and 176 (60.70%) had past history of thyroid disorders. Among the patients having thyroid disorders (n=174), 153 (87.90%) were on levothyroxine therapy, 17 (9.80%) were on carbimazole and four participants (2.3%) were on propylthiouracil. (Table 2). There was significant difference (p =0.001) between serum level of fT4 and gender (Table 3).

Table 2: Clinical characteristics of the participants (n=290)

Characteristic	Frequency	Percentage
Family history of thyroid disorder		
Yes	32	11.0
No	258	89.0
Past History of thyroid disorder		
Yes	176	60.7
No	114	39.3
If yes, Duration of thyroid disorder (n=176)		

<1 year	56	31.8
1-5 years	92	52.3
5-10 years	23	13.1
≥10 years	5	2.8
Duration of medication (n=174)		
<1 year	59	33.9
1-5 years	87	50.0
≥ 5 year	28	16.1
Currently used medication (n=174)		
Levothyroxine	153	87.9
Carbimazole	17	9.8
Propyl thiouracil	4	2.3

fT3(pg/ml)	3.62±3.19	2.84±.57	0.001
fT4(pg/ml)	1.49±.75	2.52±11.43	0.631
TSH(μIU/ml)	11.46±29.32	7.58±15.47	0.253

Out of 75 participants with normal thyroid hormone level, 13 (17.3%) participants were suffering from hypertension and 14(18.6%) were suffering from diabetes mellitus. Similarly, in hyperthyroid cases (n=24), two (8.3%) of them had hypertension and two (8.3%) had dyslipidemia. Most of the patients who were categorized to have hypothyroidism (n=187) had multiple co-morbidities, of which 34(18.2%) had hypertension, 14(7.5%) had diabetes mellitus and six (3.2%) had anemia (Figure 2). The abnormal thyroid function test was associated with concurrent occurrence of diabetes mellitus (p=0.004) and dyslipidemia (p=0.002) as co-morbid conditions. However, there were no significant correlations between thyroid disorders and other chronic illness namely hypertension, anemia and family history of thyroid disorder.

Table 3: Comparison of serum thyroid hormones with respect to gender (n=290).

Thyroid hormones	Male Mean±SD	Female Mean±SD	P-value
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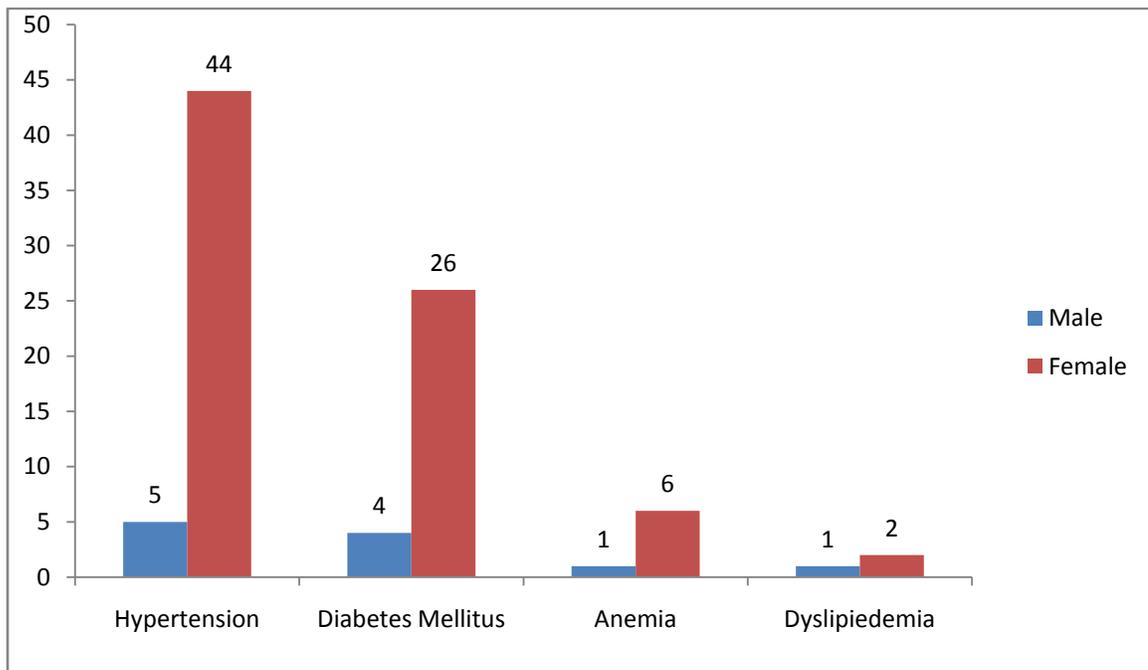


Figure 2: Associated co-morbidities in the patients with thyroid disorders.

IV. DISCUSSION

Thyroid dysfunction is the growing issue for the global health problem. Insufficient iodine in the diet is the main cause for thyroid disorder in most of the Himalayan region.[6] However, a study in south India by Usha et al among iodine sufficient adults showed that considerable proportion of individuals suffered from autoimmune thyroid disorder.[10] In our study, the proportion of females having thyroid disorder was high (196, 67.58%). Others studies also reported similar results. [7,11-13] Despite all age groups suffering from thyroid dysfunction, a significant number of cases were observed in the

age groups of 36-55 years in our study. Similar results were reported by others studies. [7,8, 12-13].

The finding of studies depends upon the methodology used for the study, age groups, ethnic group, geographical distribution and diet pattern. In our study, among all the thyroid disorders, hypothyroidism was the most common (87.0%), followed by hyperthyroidism (11.2%) and subclinical hypothyroidism (1.9%). However, a study conducted by Aryal et al in Dhulikhel Hospital reported hypothyroidism in 8% of individuals, followed by subclinical hypothyroidism in 8%, subclinical hyperthyroidism in 6% and hyperthyroidism in 3% of individuals.[9] Another study from eastern Nepal reported hypothyroidism in 17.19 % and hyperthyroidism in 13.68% of individuals.[14] Studies have

shown that hypothyroidism tends to be increased with increase in age and is more common in women [15,16] and this trend was also noted in our study. The mean fT3 level in this study was significantly different in males and females ($p=0.001$) suggesting that the mean level of fT3 hormone was higher in males in comparison to females. But, there was no statistical difference in level of fT4 and TSH.

In contrast, a study by Yadav et al reported significant difference in level of fT3 and fT4 hormones with respect to gender. [17] Our study also showed significant association ($p=0.004$) between diabetes and dyslipidemia as co-morbidities condition with hypothyroidism. A study by Risal et al also showed that there was significant correlation of raised total cholesterol in patients having hypothyroidism. [18] However, there is no statistical association with hypertension and anemia.

V. LIMITATIONS

Our study was single hospital based and the sample size was relatively small. Therefore, it is difficult to predict pattern of thyroid disorder in general population. Other parameters like total T3, T4, thyroglobulin, anti-thyroperoxidase, anti-thyroglobulin, TSH receptor antibodies were not included in this study to rule out thyroid disorders

VI. CONCLUSION

Middle age groups were highly affected by thyroid dysfunctions and it was predominant in female. Hypothyroidism was the commonest thyroid disorders. Although this study was done on single private hospital and in a small population size, it revealed baseline information on pattern of thyroid disorders which can be used as reference for further studies.

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REFERENCES

- [1] Heuck CC, Kallner A, Kanagasabapathy AS, Riesen W. Diagnosis and monitoring of the disease of the thyroid. WHO. Document 2000; 8-9.
- [2] Larsen PR, Davies TF, Hay ID. The thyroid. In: Williams Wilson JD, Foster DW, Kronenberg HM, editors. Williams Text Book of Endocrinology. 9th ed. Philadelphia: Saunders; 1988; 389-416.
- [3] Mark P.J. Vanderpump. Epidemiology of thyroid disease and swelling. In: John A.H. Wass. Editors. Oxford Textbook of Endocrinology and Diabetes. 2nd edn. Oxford University Press:2011. 10.1093/med/9780199235292.003.307410

- [4] US Census Bureau, Population Estimates. <https://www.census.gov/data/2004.html>
- [5] Gelal B, Aryal M, Das BKL, et al. Assessment of iodine deficiency status among school age children of Nepal by urinary iodine assay. *South Asian J Trop Med Public Health* 2009; 40: 538-43.
- [6] Baral N, Ramprasad C, Lamsal M, Koner BC, Koirala S. Assay of iodine deficiency status in three ecological regions of Nepal by a microdigestion method. *South East Asian J Trop Med Public Health* .1999; 30: 527-31. PMID:10774663
- [7] Mahato RV, Nepal AK, Gelal B, Poudel B, Yadav BK, Lamsal M. Spectrum of thyroid dysfunction in patients visiting Kantipur hospital, thmandu, Nepal. *Mymensingh Med J* 2013;2:164-69.
- [8] Pradip Kumar S, Baijayanti B, Soma G, Thyroid stimulating hormone measurement as the confirmatory diagnosis of hypothyroidism: A study from a tertiary care teaching hospital Kolkata. *Indian J Community Med* 7;32:139-40.
- [9] Aryal M, Gywali P, Rajbhandari N, Aryal P, Pandeya DR. A prevalence of thyroid dysfunction in Kathmandu University Hospital, Nepal. *edical Research* 2010; 21: 411-15.
- [10] Usha Menon V, Sundaram KR, Unnikrishnan AG, Jayakumar RV, Nair V, Kumar H. High prevalence of undetected thyroid disorders in an iodine sufficient adult south Indian population. *J Indian Med Assoc* 2009; 72-77. PMID:19585813
- [11] Jimmy Antony, T. M. Celine, Michale Chacko. Spectrum of thyroid disorders: A retrospective study at a medical college hospital. *Thyroid arch and Practice*. 2014;11:55-59.
- [12] Maqsood A, Shakir MM, Shahid R, Ali A. Spectrum of thyroid gland disorders in Karachi -DDRRL experience. *Med Forum Mon* 2012; 23: 12-15.
- [13] Ikem R, Adebayo J, Soyoye D, Buroloajo, Ugwu E, Kolawole B. Spectrum of thyroid disorders in Obafemi Awolowo University teaching hospital complex. *Endocrine* 2010;21:366-69.
- [14] Baral N, Lamsal M and Koner BC. Thyroid dysfunction in eastern Nepal. *South Asian J. Trop. Med. Public Health*.2002;33: 638-41.
- [15] Wang C, Crapo LM. The epidemiology of thyroid disease and implications for screening. *Endocrinol Metab Clin North Am*. 1997;26(1):189-218. DOI: 10.1016/S0889-8529(05)70240-1
- [16] Vanderpump MP and Tunbridge WM. Epidemiology and prevention of clinical and subclinical hypothyroidism. *Thyroid*. 2002;12: 839-47. DOI:10.1089/105072502761016458
- [17] Yadav NK, Thanpari C, Shrestwa MK, Mittal RK, Koner BC. Assessment of Thyroid Disorder in FarWestern Part of Nepal: A Hospital Based Study. *Bangladesh Journal of Medical Science*.2012;11: DOI: 10.3329/bjms.v11i4.12601
- [18] Risal P, Maharjan BR, Koirala R, et al . Variation of total serum cholesterol among the patient with thyroid dysfunction. *Kathmandu Univ Med J*. 2010;8: 265-68.

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Food Hygiene Conditions and Microbial Contamination of Minimally Processed Fruits in Central Ward, Nairobi County

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Abstract: Minimally processed fruits (MPF) vended as street foods, despite numerous benefits, can cause food-borne illnesses due to poor hygiene practices and unsanitary conditions. This study sought to assess food hygiene condition in minimally processed fruit vending businesses in Nairobi Central Ward.

The method used was cross sectional with analytical component through convenient sampling of 76 street food vending environment (FVs). Observational checklist prepared using codex food hygiene and safety principles captured data. Inferential statistics established variable relationships at 95% confidence interval. Food Hygiene Condition (FHC) was ranked according to Bloom cut off points on calculated percentage scores.

Results show that the vending places were washable and cleanable but the environmental surrounding was not very clean as 68% of the stalls had garbage and waste nearby. Most (75%) of the FVs had no houseflies, 89% had adequate water, and 30% had drainage system. Therefore, FHC was generally poor in 57.9% of the cases. Fruit salad samples had the highest bacterial load (\log_{10} 4.65cfu/g) and coliforms (\log_{10} 0.78cfu/g) while pineapples (mean \log_{10} 3.50cfu/g) had the highest mould and yeast count. Hence fruit salad samples were highly contaminated while pineapple and pawpaw samples were least contaminated. However there was no significant association between FHC and microbial contamination of MPF.

In conclusion FHC were poor and MPF were not microbiologically safe. Periodic hygiene training and policy on ready-to-eat food vending should be implemented.

Index Terms- minimally processed fruits, food hygiene condition, street food vendors, microbial contamination

I. BACKGROUND

Fruits are an extraordinary dietary source of nutrients, micronutrients, vitamins (especially C) and fiber for humans [1]. They are vital for health and wellbeing; and reduce the risk of several diseases and their consumption has become a global priority. Minimally processed refrigerated (MPR) fruits and vegetables are slightly modified fruits and vegetables that retain characteristics of freshness during expanded shelf-life [2]. Increasing demand for ready-to-eat fresh-cut fruits due to the paucity of time cost efficiency and increasing demand for low-caloric food products with fresh-like characteristics has caused an expansion of the market for minimally processed products [1]. However, because of the specific forms of preparation, they are highly perishable and associated with new food epidemiological and microbiological safety problems [3]. Food safety is a major concern with street foods. People working in industries and other

institutions are more likely to get food safety training as compared to street food vendors and are also more likely to be well educated [4]. The main aim of the training is to minimize food poisoning and improve the food safety among all food handlers [5]. Food safety courses and training can be used to curb the food-borne diseases among food and fruit vendors by learning various sustainable and proper methods they can employ in order to maintain a hygienic environment [6,7]. Most fruit and food vendors have undergone training but less than half made use of the knowledge learnt [8]. However, improper food handling has in the past increased with increase in the number of fruit vendors trained [5]. In Northern Nigeria, physical factors such as equipment used, furniture used in the vending area and the environment itself, coupled with poor hygiene practices during production and washing of fruits with contaminated water are all sources of contamination. Personal grooming, washing of hands and medical check-up are important preventive measures of contamination [4]. Food preparation premises should be purposely built in areas that are free from dust or smoke, away from heaps of garbage, and the surfaces should be made of material that is easy to clean and free from cracks or crevices so that microorganisms cannot easily grow and multiply [4, 9]. Street food vending is common in the Central ward of Nairobi County in the form of mobile vendors who hawk, or by stationary vendors set up in stalls, market places and public bus stations [10]. Poor hygiene practices therefore, coupled with low standards of environmental and personal hygiene, improper handling of food, improper storage occur with street foods raising health concerns such as food-borne illnesses [11]. Due to increased demand; and unlimited and unregulated growth, there has been a severe strain on city resources such as water, sewage systems, and interference with city plans through congestion and littering, and the street food vendors are usually unlicensed blocking vehicle and pedestrian traffic [4, 10]. This raises concern with respect to their potential for serious food poisoning outbreaks and exposure of the sliced fruits to flies, dust and other disease causing agents [12]. Intentional or inadvertent contamination of fruits puts the consumer at the risk of suffering food-borne illnesses [4].

II. METHOD

The study was analytical in design conducted in the Central ward, Nairobi Metropolis. The study randomly observed 76 fruit vending environment. Data was collected using observation checklist. Quality control measures were employed including pre-test, validity and reliability checks. The research permit was obtained from the National Commission for Science, Technology and Innovation and Kenyatta University. Collected

data was cross-checked for completeness and any missing entries updated. Data from observation checklists was analysed into descriptive statistics and non-parametric tests for possible associations using Statistical Package for the Social Sciences (SPSS) version 21. Findings were presented in the form of text, charts, graphs and tables.

III. RESULTS AND DISCUSSION

Food Hygiene Condition

The main means of vending were stalls (52.6%) and carts (38.2%) mostly on average condition (78.9%). The vending places were made of iron sheets (55.3%) hence they were washable and cleanable but the environmental surrounding was not very clean as 68% of the stalls had garbage and waste nearby. Most (75%) of the street fruit vending places had no houseflies, 89% had adequate water supply for washing fruits, while drainage system was only observed in 30% of the vending places visited. This raises concern with respect to their potential for serious food poisoning outbreaks and exposure of the sliced

fruits to flies, dust and other disease causing agents. Similar findings were made in Kibera which showed that 72% of informal outlets had garbage heaps near their vending places [4]. Inadequate refuse disposal facilities lead to the accumulation of refuse at food vending sites which leads to an increased pest population and resulted in an increased risk of food contamination [13]. Street foods are sometimes stored at improper temperatures and sold from vending sites which include kiosks, make-shift accommodation, and push carts as well as other temporary structures [14]. They are prepared at very dirty surroundings with waste water and garbage disposed nearby, providing nutrient and breeding ground for rodents and vermin [15]. Similarly in a study in Sudan, in most cases running water was not available at vending sites, washing of hands and crockery were done in bowls or buckets and sometimes without soap and the vending sites had flies [16]. Similar findings were also made in Benin city [17] and Owerri, Nigeria [18] where there were sufficient water but few waste bins and the vending environment had flies and rats/cockroaches [17].

Table 1 : Hygiene profile of the vending environment

Hygiene profile	Category	Frequency	Percent (% N = 76)
	Cart	29	38.2
	Wheelbarrow	7	9.2
Vending setting	Stall	40	52.6
Status of vending place	Good condition	5	6.6
	Average condition	60	78.9
	Bad condition	11	14.5
Nature of construction material	Wood	31	40.8
	Iron Sheets	42	55.3
	Sacs	3	3.9
Building structure washable and surfaces cleanable	Yes	72	94.7
	No	4	5.3
Stalls distance from garbage	Garbage and waste near	52	68.4
	Garbage and waste far	24	31.6
Houseflies and other pests present in stalls	Yes	19	25
	No	57	75
Availability of water for washing fruits	Yes	71	93.4
	No	5	6.6
Adequacy of water for washing fruits	Yes	68	89.5
	No	8	10.5
Presence of drainage	Yes	23	30.3
	No	53	69.7

A score of “1” was assigned for the presence of relevant item while a score of “0” was assigned for its absence. The total score was converted to 100 percent. Using Bloom cut off points, more than half (57.9%) of the vending environments were in a poor state, 34.2% had fair hygiene vending environment while 7.9% were categorized as having good environmental conditions.

The observation of poor sanitary condition in the majority of the food vending sites was contrary to findings of studies conducted in Owerri, Nigeria [18], Accra, Ghana [19], and Benin [17] where the majority of the food premises were observed to be tidy, with the use of waste bin and the presence of on-site water source for sanitary purposes. This finding was similar to a study

in Ethiopia which found that 21.3% of the establishments had good sanitary conditions [20]. This finding is, however, similar with what was reported in an earlier study in Nairobi where it was observed that about 85.0% of the vendors prepared their food in unhygienic condition [10]

Figure 1 : Hygiene condition score

Fruit salad samples yielded the highest bacterial load levels (mean log₁₀ 4.65cfu/g) and coliforms count (mean log₁₀ 0.78cfu/g) while pineapples (mean log₁₀ 3.50cfu/g) had the highest mould and yeast count. This showed that fruit salad samples were highly contaminated while pineapple and pawpaw samples were least contaminated. This high contamination might be emanating from food handling during handling, processing or vending [21]. This was similar to studies in Bangladesh [22, 23] and Ghana [24, 19] which found presence of unacceptable levels of Salmonella spp., Escherichia coli and other coliforms in street fruits which constituted a potential microbial hazard to human health. Similar findings were also found in Kibera [4] and Industrial Area [7] where E. coli and coliform present in street foods were of a level of concern.

Table 2 : Microbial contamination of the minimally processed fruits(cfu/g)

	Bacteria count	Coliforms count	Mould & Yeast count
Fruit salad	4.56	0.78	2.27
Water melon	3.63	0.72	2.00
Pawpaw	1.99	0.72	1.05
Pineapple	1.44	0.72	3.50

In all the fruits, level of contamination was not significantly associated with the hygiene condition of the vending environment. Lack of basic infrastructure, absence of potable water, lack of proper storage facility and unsuitable environments for food operations can contribute to poor microbial quality of foods [20]. Unhygienic environment are breeding place for houseflies and other disease causing microbes thus plays an integral role in preventing food from being contaminated hence the need for food vendors to operate within a clean environment. Contrary findings were made in Ghana which found that poor environmental condition continues to be a constant factor contributing to food contamination [25].

Table 3 : Food Hygiene Conditions and Microbial Contamination

Fruit	Bacteria	Coliform	Moulds and Yeast
	r -0.214	-0.072	0.162
Fruit salad	p 0.645	0.878	0.728
	r -0.286	-0.414	-0.162
Water melon	p 0.535	0.355	0.728

	r	-0.291	-0.036	-0.709
Pawpaw	p	0.527	0.939	0.074
	r	-0.371	-0.408	-0.429
Pineapple	p	0.413	0.364	0.337

* r - Spearman correlation; p – p - value

IV. CONCLUSIONS

Hygiene condition of the vending environment poor and although fruit vendors tried to maintain proper standards of hygiene, some environmental factors such as poor structures, poor waste disposal systems, pollution by vehicles passing by and garbage dumps and litter near them could not be controlled. Minimally processed fruits were not microbiologically safe as levels of up to 10.5 cfu/g were seen in the fruit samples. Coliform counts in the fruits suggest contamination of the fruit samples by fecal material possibly from poor personal hygiene by vendors, water used for washing, the poor vending environment, or a combination of all these factors. Also, the hygiene condition of the vending environment did not determine the microbial status of the fruits.

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Competing interests

All authors declare that: there are no significant competing financial, professional or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

Authors’ contributions

Authors made substantial contributions to conception and design, and/or acquisition of data, and/or analysis and interpretation of data.

REFERENCES

[1] P. J. Simitu, "Consumption and conservation of drylands’ indigenous fruit trees for rural livelihood improvement in Mwingi District, Kenya," Masters Thesis 2011.
 [2] M. A. McCarthy and R. H. Matthews, "Nutritional Quality of Fruits and Vegetables Subject to Minimal Processes.," Springer US, vol. 313-326, 1994.
 [3] F. Artés, P. A. Gómez, and F. Artés-Hernández, "Physical, Physiological and Microbial Deterioration of Minimally Fresh Processed Fruits and Vegetables," Food Science and Technology International, vol. 13, no. 3, pp. 177-188, 2007.
 [4] A. W. Monica, "Food safety and hygiene practices in the informal outlets (a case study of food kiosks in Kibera slums, Nairobi,," Kenyatta University, Nairobi, Thesis 2011.

- [5] H. Kassa, G. Silverman, and K. Baroudi, "Effect of a manager training and certification program on Food Safety and Hygiene in Food service operation," *Environmental health insight*, pp. 13-20, 2010.
- [6] E. Walker, C. Prichard, and S. Forsythe, "Food handling knowledge in small business," *Food control*, pp. 339-343, 2003.
- [7] M.G. Gitahi, J. Wangoh, and P.M.K. Njage, "Microbial Safety of Street Foods in Industrial Area, Nairobi," *Research Journal of Microbiology*, vol. 7, pp. 297-308, 2012.
- [8] A. Nurudeen, A. Lawal, and S. Ajayi, "A survey of hygienic and sanitary practices of street vendors in the central state of Northern Nigeria," *Journal of public health and epidemiology*, pp. 174-181, 2014.
- [9] Food and Agriculture Organization; World Health Organization, *Food Hygiene Basic Texts*. Rome: Codex Alimentarius Commission, 2009.
- [10] K. Muinde and E. Kuria, "Hygienic and Sanitary Practices of Vendors of Street Foods in Nairobi, Kenya," *African Journal of Food Agriculture and Nutritional Development*, vol. 5, no. 1, 2005.
- [11] J. G. Kariuki, "Food handling practices and the prevalence of food borne pathogens among food handlers in Embu municipality, Kenya," *Kenyatta University, Nairobi, Masters Thesis* 2012.
- [12] S. W. Kamunyori, "A Growing Space for Dialogue: the Case of Street Vending in Nairobi's Central Business District," *Massachusetts Institute of Technology*, 2007.
- [13] M. D. Khairuzzaman, Fatema Moni Chowdhury, Sharmin Zaman, Arafat Al Mamun, and Latiful Bari, "Food Safety Challenges towards Safe, Healthy, and Nutritious Street Foods in Bangladesh," *International Journal of Food Science*, vol. 2014, pp. 1-9, 2014.
- [14] Food and Agricultural Organization, "FAO Food and Nutrition Paper," *Food and Agricultural Organization, Jakarta, Indonesia, Report of an FAO expert consultation* 1990.
- [15] Nicolas Barro et al., "Hygienic status assessment of dish washing waters, utensils, hands and pieces of money from street food processing sites in Ouagadougou (Burkina Faso)," *African Journal of Biotechnology*, vol. 5, no. 11, pp. 1107-1112, 2006.
- [16] M. A. Abdalla, S. E. Suliman, and A. O. Bakhiet, "Food safety knowledge and practices of street food vendors in Atbara City (Naher Elneel State Sudan)," *African Journal of Biotechnology*, vol. 8, no. 24, pp. 6967-6971, 2009.
- [17] P. W. Okojie and E. C. Isah, "Sanitary Conditions of Food Vending Sites and Food Handling Practices of Street Food Vendors in Benin City, Nigeria: Implication for Food Hygiene and Safety," *Journal of Environmental and Public Health*, vol. 2014, no. 2014, pp. 1-6, 2014.
- [18] Comfort O. Chukuezi, "Food safety knowledge and practices of street food vendors in Owerri, Nigeria," *Studies in Sociology of Science*, vol. 1, no. 1, pp. 50-57, 2010.
- [19] Patience Mensah, Dorothy Yeboah-Manu, Kwaku Owusu-Darko, and Anthony Ablordey, "Street foods in Accra, Ghana: how safe are they?," *Bulletin of the World Health Organization*, vol. 80, no. 7, pp. 546-554, 2002.
- [20] Mulugeta Kibret and Bayeh Abera, "The Sanitary Conditions of Food Service Establishments and Food Safety Knowledge and Practices of Food Handlers in Bahir Dar Town," *Ethiopian Journal of Health Sciences*, vol. 22, no. 1, pp. 27-35, 2012.
- [21] M Abadias, J Usall, Anguera M, C Solsona, and I Viñas, "Microbiological quality of fresh, minimally-processed fruit and vegetables, and sprouts from retail establishments," *International Journal of Food Microbiology*, vol. 123, no. 1-2, pp. 121-129, 2008.
- [22] Z. Tabashsum et al., "Prevalence of Foodborne Pathogens and Spoilage Microorganisms and Their Drug Resistant Status in Different Street Foods of Dhaka city," *Agriculture Food and Analytical Bacteriology*, vol. 3, no. 4, pp. 281-292, 2013.
- [23] Mohammad Ali, M. R. Khan, and Mihir Lal Saha, "Antibiotic resistant patterns of bacterial isolates from ready-to-eat (RTE) street vended fresh vegetables and fruits in Dhaka City," *Bangladesh Journal of Scientific Research*, vol. 24, no. 2, pp. 127-134, 2011.
- [24] F. Amponsah-Doku et al., "Bacterial contamination of lettuce and associated risk factors at production sites, markets and street food restaurants in urban and peri-urban Kumasi, Ghana," *Scientific Research and Essays*, vol. 5, no. 2, pp. 217-223, 2010.
- [25] Boateng Acheampong Emmanuel, "Assessment of food hygiene practices by street food vendors and microbial quality of selected foods sold: A study at Dunkwa-On-Offin, Upper Denkyira East municipality of the Central Region," *Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, Master's Thesis* 2014.

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Does Organizational Learning Lead to Competitive Advantage?

An Evaluation of State Corporations in Kenya

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Abstract-Despite the theoretical underpinning that organizational learning is positively associated with competitive advantage, empirical support for the relationship between organizational learning and competitive advantage is not adequate in strategic management literature. The relative absence of such research does not motivate leaders, managers and employees to adopt learning initiatives. This study examined the role of organizational learning in achieving competitive advantage of State Corporations in Kenya with a focus on organization's learning culture, learning processes, systems thinking and their role in achieving competitive advantage of state corporations. The study assessed the mediating role of rate in the relationship between the independent variables and competitive advantage. The study employed a descriptive, cross-sectional designs utilizing both quantitative and qualitative methods to gather data from 198 staff from 35 state corporations comprising of senior managers, middle manager and non-management staff. Regression analysis and structural equation modeling were used to make inference on the associations dependent, mediating and independent variables SPSS Version 22 and AMOS version 21. Qualitative was analyzed using ATLAS.ti. Results from both simple and multiple linear regression revealed that each of independent variables was positively and significantly associated with competitive advantage. Rate of learning partially mediated the relationship between learning process and competitive and systems thinking and competitive advantage. These results imply that managers need to implement strategies that will increase the rate of learning with the organization by focusing on concrete learning processes, learning culture and systems thinking practices. Both formal and informal learning processes that maximize utilization-focused knowledge acquisition and sharing approach are encouraged. To ensure staff or fully engaged in the learning process, organizations need to invest in building capacity of new and existing employees and partners to encourage reflective practices within the organization. Longitudinal studies can help strengthen similar future studies.

Index Terms- Organizational Learning, Learning Processes, Culture, Competitive Advantage

I. INTRODUCTION

Organizational learning is largely theorized for its role in improving performance and competitiveness of organizations. Senge (1990) argued that the speed of

organizational learning may become the only sustainable source of competitive advantage in the future. Garvin, Edmondson, & Gino, (2008) concurred by noting that higher rate of learning is positively associated with competitive advantage. In essence, a learning organization purposefully designs and constructs its structure, culture and strategy to enhance and maximize the potential for organizational learning to take place (Dodgson, 1993; Fang et al., 2010). Learning organizations are seen to adapt to unpredictable environments more quickly than their competitors. "how difficult the learning process is, even with built-in intent (Kransdorff, 2006)". Organizational Learning efforts are no longer merely an option but rather a core necessity for organizations anywhere in the world, if they have to compete successfully (Singh and Kant, 2008).

Empirical studies have demonstrated the significant role that learning plays in fostering performance in various industries and sectors. For example, the public sector (Ferguson et al., 2013), non-governmental organizations (Corfield et al., 2013), banking industry, (Oluikpe, 2012), small- to medium-sized enterprises, (Durst and Edvardsson, 2012), manufacturing organizations (Birasnav and Rangnekar, 2010), and human service and professional services firms (Palte et al., 2011); and life insurance business (Huang et al., 2011). These studies have clearly shown that learning is an important determinant of organizational success measured by superior performance and competitive advantage.

Despite the clarity and consensus that organizational learning leads to competitive advantage, adoption of learning practices are still low among organizations, particularly for state corporations. This low adoption is partly blamed on inadequacies in past research which have not sufficiently furnish managers with concrete prescriptions on how to become a learning organization, have targeted the partial audience by focusing only chief executives and excluded departmental managers and non-managerial staff. for the Kenyan context, state corporations have been left out of most research even though they are tasked to drive economic growth in highly dynamic and unpredictable environments, that requires them to compete. So, this study is aimed to contribute to the literature by examining the relationship between organization learning and competitive advantage. It will build on the work of other authors, (Garvin et al., 2008; P. Senge, Art, & Roberts, 2001; P. M. Senge, 1990), by exploring the mechanism through which organizational learning

variables (organizational culture, learning processes and systems thinking) to influence competitiveness of state corporations. The study will address the following research questions:

- a) Does learning culture effect competitive advantage of state corporations?
- b) What is the effectiveness of learning processes in fostering competitive advantage of state corporations?
- c) What is the effect of systems thinking on competitive advantage of state corporations?
- d) Does rate of learning mediate the relationship between organizational learning and competitive advantage of state corporations?

This study has the following structure: Section 2 presents literature reviewed and research hypotheses. Section 3 contains research methodology to test hypotheses and sets results of data analyses. Section 4 brings together the implications, limitations, and directions for future research.

II. LITERATURE REVIEW

2.1. Theoretical Review

2.1.1. Competitive Advantage

The rationale for state corporations to seek and gain competitive advantage is deeply rooted in the dynamic and challenging environment under which they operated. State corporations are facing fierce competition from each and facing fierce competition from vibrant and innovation-minded private and civil society organizations (Buheji, n.d.). A highly educated and quality driven public continues to demand more efficient and effective goods and services from all business actors in equal measure. The legal and political environment has become less favorable to state corporations as they no longer operate as monopolies and the compete under relatively the same laws as the private sector. Furthermore, the perception or corruption has worsened among public institutions during the past decade making it more difficult for state corporations to assure the public of quality services and fair cost. For example, in 2016 Kenya was ranked 139 out of 168 indicating a high perception of bribery within the country. These corruption perception indices further erode public trust thus further complicating efforts to grow their market share. These circumstances have triggered state corporations to actively engage in the search of competitive advantage to guarantee their survival and success in the market place.

In pursuit of competitive advantage, researchers offer useful theoretical suggestions. The resource-based view theory of competitive advantage posits that firms are bundles of resources and capabilities and that a firm can gain competitive advantage based on its unique set of resources (Barney, 1991). Those resources are valuable, rare, perfectly inimitable and non-substitutable and a firm's potential for competitive advantage also requires a firm be organized to exploit its resources and capabilities (Barney, 2007). The fact that resources must enable the creation of value and must also resist the duplicative efforts of competitors suggests that firms are bundles of resources and

capabilities. In conditions of open competition, rival firms will seek to imitate, acquire or try to substitute for the resources that are a source of advantage. Organizations facing uncertain, changing or ambiguous market conditions similar to those experienced by state corporations need to be able to learn. Theories posit that organizational learning can help firms amass and use these kinds of resources and capabilities. For example, Karash (2002) identified the organizational learning concept as a resource-oriented approach that is based on the ability of the organization to turn standard resources that are available to all into competences that are unique and non-imitable by competitors.

2.1.2. Organizational Learning

The concept of OL is a well-researched topic in a range of academic disciplines from economics, management science, psychology and sociology to anthropology (Easterby-Smith and Lyles, 2011). Senge, (2006) describes organizational learning as 'the changing of organizational behavior' which occurs through a collective learning process. Organizational learning as a unique resource that is critical in today's dynamic and discontinuous environment of change and a crucial determinant of competitive advantage (Garvin, Edmondson, & Gino, 2008). Organizational learning emphasizes the development and application of new knowledge that has the potential to change employees' behavior which is ultimately tipped to strengthen the organization's competitive position. A learning organization uses management philosophy based on knowledge and understanding, as opposed to fear, for the complexity of the real world. Therefore, organizational learning has the potential to promote a sense of empowerment in the workforce that motivates them for a continuous learning (Bryson et al., 2006).

For learning to be fully entrenched in the organization, it has to happen at various levels. Argyris and Schön, (1978) notes that organizations learn through individuals acting as agents for them and individuals' learning activities, which in turn are facilitated or inhibited by an ecological system of factors. Gareth Morgan, (1986) points out that organizations cannot, themselves, learn; it is the individuals within them who learn. Evidently, there is more to a learning organization than simply a collection of individuals who are learning. Swieringa and Wierdsma (1992) define organizational learning as 'the changing of organizational behavior' which occurs through a collective learning process. They note that individual learning is a necessary but not a sufficient condition for organizational learning. Learning organizations are organized in such a way that learning is a prominent feature at a number of different levels: individual learning; team or work group learning; cross-functional learning; operational organizational learning; and strategic organizational learning (Britton, 1998).

Organizational learning in organizations can happen at various levels. Single loop learning focuses on fixing errors in the current system while double loop learning which goes a level here to question the policies and procedure rather than focusing only on error correction (Linz & Resch, 2010; Witherspoon, 2014). Single-loop learning involves detecting and correcting "errors" so that the organization can continue to achieve its present

policies or objectives in more efficient ways. In single-loop learning, outcomes are measured against organizational norms and expectations. According to Senge, (1990), Single-loop learning focuses on doing things in the right way without necessarily questioning whether they are the right things to be done. It explores more productive ways, doing it cheaper, using alternative methods or approaches for the same objectives. On the other hand, double loop learning not only requires changes in the rules and procedures of the organization but may also question the underlying assumptions and principles that form the basis of the rules and procedures. The implications of double loop learning are possibly far-reaching and may even lead to what has been called triple loop learning which involves challenging the organization's principles and assumptions, requiring an open and often robust exchange of views (Peeters & Robinson, 2015).

2.1.3. Relationship Between Organizational Learning and Competitive Advantage

The effect of organizational learning on performance was initially demonstrated by the learning curve model from an industrial organization's economics perspective. Barney, (2007) argued that in some circumstances, firms with the greater experience in manufacturing a product or service will attain lowest costs in an industry and, thus, will acquire a cost-based advantage. Beyond manufacturing sector, the learning curve-cost advantage association can be associated with many business functions, from purchasing raw materials through distribution and service. The Boston Consulting Group (BCG, 1970) estimated learning curves for over 20 industries and demonstrated how firms can take cost advantage by having more operating experience. Although the industrial organization economics perspective demonstrates the importance of organizational learning to a firm's gaining a cost advantage, the model has been criticized for being silent on the mechanisms by which experience leads to cost advantage and why some firms learn better than others.

Strategic management literature discusses the link between organizational learning and competitive advantage from the resource-based view (RBV) of the firm. The RBV posits that organizations can gain sustained competitive advantage through amassing and using strategic resources and capabilities, which are valuable, rare, difficult to imitate and non-substitutable (Barney, 1991). And a firm's potential for competitive advantage also requires a firm be organized to exploit its resources and capabilities (Barney, 2007). On the one hand, organizational learning is believed to be able to help firms amass and use these kinds of resources and capabilities. For example, Karash (2002) identified the organizational learning concept as a resource-oriented approach that is based on the ability of the organization to turn standard resources that are available to all into competences that are unique and cannot be easily copied by competitors (Karash, 2002). On the other hand, recent literature suggests that organizational learning is an idiosyncratic and complex capability, which is difficult to imitate, replicate and transfer and which constitutes a source of competitive advantage

(Prahalad and Hamel, 1990; Grant, 1996; Simonin, 1997; Lei et al., 1999).

Although organizational learning is widely accepted as an essential element to successfully compete in a marketplace, various factors hinder organizations from building a learning organization. Senge (2006), identifies three barriers including; the lever, which refers to the inability of organizations to understand the complexity and thus unable to target specific points within the system that would bring tremendous benefits; learning disability, which comprises of seven learning disabilities among individuals within organizations that hinder them from learning thus impacting the rate and quality of organizational learning and; prisoners of our thinking, which is fueled by lack of knowledge. Garvin et al. (2008) further identified what they considered as barriers to learning in organizations including the fact that managers do not know the steps for building a learning organization, they lack tools to assess whether their teams are learning or how that learning is benefiting the company. Zhou, Hu, & Shi, (2015) further noted that the components of organizational learning in the literature are still descriptive due to the multi-dimensional nature of the construct.

To address the aforementioned barriers, authors, both from a strategic management perspective and from an organizational theory perspective, stress different characteristics of organizational learning, for example, open communications by Philips (2003), risk taking by Appelbaum and Reichart (1998) and Richardson (1995), support and recognition for learning by Bennett and O'Brien (1994), team learning by Anderson (1997) and Senge (1990a) and knowledge management by Loermans (2002) and Selen (2000). Argote (2011), however, conceived organizational learning as having three sub-processes: creating, retaining and transferring knowledge. Some empirical studies provide support for the relationship between organizational learning and firm performance (Day, 1994; Slater and Narver, 1995). Ellinger et al. (2002) suggests a positive association between learning organization practices and objective firm financial performance.

Senge, (2006), He points out five key competencies or 'disciplines' that he suggests all leaders must have to build and lead a learning organization. These competencies are personal mastery, mental models, shared vision, team learning and systems thinking. Personal mastery is to do with 'self-awareness' and is based on the premise that organizations grow because the people in the organizations are themselves growing. It assumes that individuals must learn for organizations to learn and it is reflected in one's drive towards continuous improvement by learning. Mental models look at the process and outcome of surfacing deep-seated beliefs, values, and assumptions that determine the way people think and act. Garvin et al., (2008) proposed three foundational blocks for building a learning organization. These are a supportive learning environment, concrete learning processes, and leadership that reinforces learning. A supportive learning environment gives organizations an opportunity reflecting in the action and encourages thoughtful review of the organization's processes (Akhtar, Ahmed, & Mujtaba, 2013). Concrete learning processes ensure that a team

or company has formal processes for generating, collecting, interpreting, and disseminating information. Organizational learning is also considered to positively effect by the performance of organizations. For example, transformational leadership has been found to directly influenced organizational learning and knowledge management (Noruzi et al. 2013).

2.2. Empirical Studies on OL and Competitive Advantage

Researchers have invested the past decade in determining whether and how organizational learning affects performance and competitiveness of organizations. This research focused on the theorized variables of learning culture, learning processes and systems thinking. For example, the public sector (Ferguson et al., 2013), non-governmental organizations (Corfield et al., 2013), banking industry, (Oluikpe, 2012), small- to medium-sized enterprises, (Durst and Edvardsson, 2012), manufacturing organizations (Birasnav and Rangnekar, 2010), and human service and professional services firms (Palte et al., 2011); and life insurance business (Huang et al., 2011). This section reviews the works of these researchers.

2.3. Culture and Competitive Advantage

2.3.1. Effect of Organizational Culture and Competitive Advantage

Many scholars have paid attention to the role played by culture in relation to corporate performance. Gorden&DiTomaso (1992) found that the strength of the organizational culture can predict the corporate performance. Dension& Mishra (1995) found that different cultural characteristics have different impact on the organizational performance, leading to the conclusion that cultural differences can lead to competitive advantage. This conclusion was also reached by Chan (2004). Attempts have also been made at looking for specific cultural attributes that influence learning and competitive advantage of organizations. (Garvin et al., 2008), identified psychological safety, appreciation of differences, and openness to new ideas as essential components of a supportive learning environment. Weihong, Caitao, & Dan, (2008) study showed that openness of the organizational culture had a significant impact on the enterprise sustainable competitive advantage. Culture is seen as a source of competitiveness due to its difficulty to imitate or duplicate (Fitzgerald, 1988; Mueller, 1996). This results from its inherent tacit nature, complexity and specificity (Reed and DeFillippi, 1990). Bwegyeme&Munene, (2015) study reinforced the importance of culture in influencing organization outcomes including problem-solving and performance. Mikkelsen et al. (2000) argued that a positive learning climate reduces job stress, and also had a direct and positive impact on job satisfaction and employee commitment. Theorists and researchers seem to agree that a culture which promotes open communication practices, prioritizes and promotes staff empowerment, supports supporting staff development and promotes team learning is likely to lead to competitive advantage. However, the evidence has not targeted state corporations in particular those in developing countries partly due to their perceived non-competitive nature. The study predicts that a learning culture will have a positive and significant effect on their performance of state corporations in Kenya.

H₀₁: There exists no relationship between learning culture and the competitive advantage of state corporations in Kenya

H_{a1}: There exists a relationship between learning culture and the competitive advantage of state corporations in Kenya

2.3.2. Effect of Learning Processes and Competitive Advantage

A learning organization is cultivated through a series of concrete steps and widely distributed activities, (Sokhanvar, Matthews, &Yarlagadda, 2014). Theorists have made efforts at explicating the learning processes essential to influencing learning and attaining competitive advantage. Garvin et al., (2008) consider learning processes to involve the generation, collection, interpretation, and dissemination of information. Learning processes include experimentation to develop and test new products and services; intelligence gathering to keep track of competitive, customer, and technological trends; disciplined analysis and interpretation to identify and solve problems; and education and training to develop both new and established employees. USAID, (2016) presented a more comprehensive model, collaborating learning and adapting (CLA) model, which considers learning processes to include knowledge management, institutional memory and decision making. According the CLA model, KM processes include the process of acquiring knowledge internally and externally, distilling the knowledge and sharing knowledge internally and externally. Institutional memory includes the processes of accessing institutional knowledge, and managing of staff transitions. Decision-making included the awareness of decision-making processes, autonomy to make decisions and appropriate stakeholder involvement in decision making processes.

Empirical studies have been conducted and shown results in support of theory. Learning processes ensure that an organization and employees continually create, acquire, and transfer knowledge and use it to adapt to the ever-changing internal and external environment.To achieve maximum impact, Garvin, (2008) suggests that knowledge should be shared in systematic and clearly defined ways among individuals, groups, or whole organizations. Knowledge can move laterally or vertically within a firm. By implementing knowledge management processes as part of daily business activities, organizations can confidently compete and sustain in the competitive markets (Daud and Yusuf, 2008).Sangari, Hosnavi, & Zahedi, (2015)results also showed that knowledge management processes have a significant impact on supply chain performance. Considering the theoretical underpinning and the empirical support, the study predicts that learning processes will have a positive effect on competitive advantage of state corporations.

H₀₂: There is no relationship between learning processes and competitive advantage of state corporations in Kenya.

H_{a2}: There is a relationship between learning processes and competitive advantage of state corporations in Kenya.

2.3.3. Systems Thinking and Competitive Advantage

Senge (2006) made his contribution to organizational learning theory through his concept of Systems Thinking, which is viewed

as an ability to discover structural causes of behavior and it is necessary for sustaining generative learning which is a foundation for people’s creativity. Systems Thinking focuses on interrelationships between parts of an organization and emphasizes the importance of recognizing the effects of one level of learning on another. It shows the interrelated patterns within a business and enables people to see the whole organization instead of focusing only on the parts. Using a more holistic perspective, systems thinking helps people to solve problems with a context of a larger scenario instead of fixing the problem as a discrete activity. According to Prugsamatz, (2010), Systems thinking provides a means of understanding systems at a deeper level in order to see the paths available to bring about changes more effectively. A systems thinker is able to understand the interrelationship of activities happening inside the organization

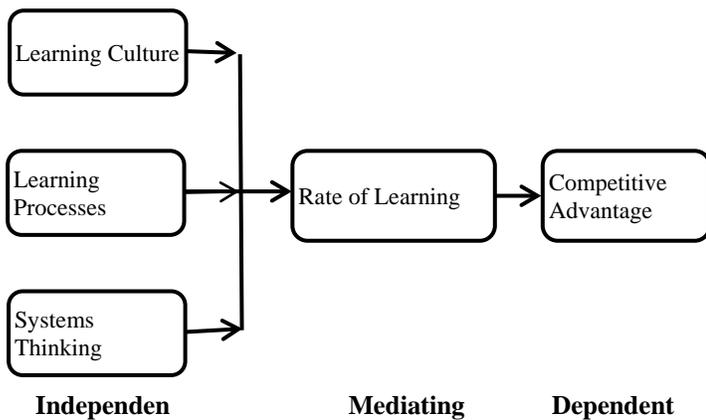


Figure 1: Conceptual Model of The Study
(Akhtar et al., 2013).

Empirical results show that systems thinking tends to have a positive effect of performance and competitiveness of petroleum industry firms (Akhtar et al., 2013). systems thinking can be taught, and as such, it should become a requirement for all employees to acquire for better coping with constant changes (Cooper, 2005). Systems thinking produces major impacts on organizational learning and change (Fullan, 2004). In fact, Kumar et al. (2005, p. 267) emphasizes that an individual must utilize systems thinking to become a decision-maker. Some organizations provide systems thinking training for their staff to improve the quality of their performance (Martin, 2005; Seligman, 2005). Kim, Akbar, Tzokas, & Al-Dajani, (2013) Found that systems thinking had a positive effect in the absorptive capacity (ACAP) of high-tech small and medium-sized enterprises from South Korea which and an overall impact on firm performance. They found that firms outperforming others in their ACAP also showed a clear element of systems thinking, which was strongly associated with ACAP. Even though studies have alluded to its importance while discussing the organizational competencies necessary for competitiveness, systems thinking has not received significant attention. This study will assess the role of systems thinking in achieving competitive advantage.

H₀₃: There is no relationship between systems thinking and competitive advantage of state corporations in Kenya.

H_{a3}: There is a relationship between systems thinking and competitive advantage of state corporations in Kenya.

2.3.4. Mediating Effect of Rate of Learning

Organizational learning is essential in today’s dynamic and discontinuous environment of change. Organizational learning has gained prominence among researchers as a crucial determinant of performance and the only true sustained competitive advantage that an organization can have, (Linz & Resch, 2010; Salmador&Florin, 2012). A learning organization is seen to be an organization, which is ‘skilled at creating, acquiring, and transferring knowledge, and at modifying behavior to reflect new knowledge and insights.’ Learning happens when errors are detected and corrected, and practices changed within the organization, (Peeters& Robinson, 2015; Witherspoon, 2014). The rate of learning refers to the frequency at which the organization is taking decisions to align to reflect new knowledge and insights. Single-loop learning involves detecting and correcting “errors” so that an organization can carry on or achieve its present policies or objectives in more efficient ways. This study will look at behavior modification at two levels: Single loop learning, which occurs when the mismatch gets corrected by altering behavior or actions and double loop learning, which happens when the organizations change their underlying values and adopts new actions, (Mitchell et al., 2012). Single loop is about efficiency and answers the question, are we doing things right? In single-loop learning, outcomes are measured against organizational norms and expectations (Peeters& Robinson, 2015). The overwhelming amount of learning is single-loop because organizations are designed to identify and correct errors, (Witherspoon, 2014). On the other hand, double loop is concerned with effectiveness and answers the question, are we doing the right things? Rate of learning is predicted to be higher among organizations that have entrenched a strong learning culture. The rate at which organizations apply both single-loop and double-loop learning are expected positively to mediate the relationship between the combined effect of the independent variables and competitive advantage, (Peeters& Robinson, 2015).

Even though empirical studies have had limited focus in assessing the rate of learning in organizations, various authors have conducted useful studies in laying the foundation. Most research has focused on the determinants of learning performance. Sorenson (2003) found that interdependence engendered by vertical integration slowed the rate of learning in firms in stable environments and speeded learning in volatile environments. Lieberman (1984) found that investment in Research and Development increased the rate of learning among firms in the chemical processing industry. Similarly, Sinclair, Klepper, and Cohen (2000) found that Research and Development contributed to the productivity gains observed in a chemical firm. Social capital is an important factor that affects the organizational learning performance (Wu, Ay, & Lien, 2009). Limited research has assessed the contribution of learning to competitive advantage. Based on findings from self-regulated learning research that control of learning and learning orientation

are positively related to learning performance (Boekaerts&Corno, 2005),

H₀₅: There is no mediating role of rate of learning competitive advantage of state corporations in Kenya.

H_{a5}: There is a mediating role of rate of learning on competitive advantage of state corporations in Kenya.

Following the literature reviewed and the propositions by theoretical models, the study’s conceptual framework proposes three independent variables affecting competitive advantage through the mediation role of rate of learning.

III. RESEARCH METHODS

3.1. Research Design

The study employed a descriptive and cross-sectional research design to address the research questions. Descriptive designs help determine the way things are with the subjects by providing answers to the questions of who, what, when, where, and how associated with a particular research (Cooper & Schindler, 2008; Saunders et al., 2015). To evaluate the relationships between the intent variables and competitive advantage, the study employed a correlational design. This type of design is recommended and has been used by various authors to determine whether or not variables are correlated by studying the joint variation of the hypothesized relationships, (Džini, 2015; Reich, Gemino, & Sauer, 2014; Saunders et al., 2015).

3.2. Target Population and Sample

The study population comprised of all 139 state corporations operating in Kenya as identified by that state corporations’ advisory committee (SCAC). The SCAC is the official body mandated to advise on all matters pertaining state corporations as mandated by section 27 of the State Corporations Act, Chapter 446, (Government of Kenya, 2012, 2015). From the list of 139 state corporations, 53 fulfilled the selection criteria (operating in a competitive landscape, selling goods or services to the Kenyan public, and mandated to make profits or surplus). Sample size determination formula by Cochran (1977), and procedures for categorical data was used to calculate a sample size of 40 state corporation. Table 3.1 shows the population, sampled organizations and number of staff targeted by sector. Three staff were targeted from every state corporation including one senior manager, one middle level manager and one non-management staff.

Table 1: Population and Sample

Sector	Population	Sample	Staff
Finance	9	7	42
Tertiary Education and Training	5	4	24
Public Universities	7	5	30
Commercial and Manufacturing	32	24	144
Total	53	40	240

3.3. Data Collection Instruments

Three instruments were used to collect data from the study respondents. These included semi-structured questionnaire, qualitative interview guide, and records review were used. A semi-structured questionnaire gathered data on the dependent variable (competitive advantage), independent variables (learning culture, learning processes and systems thinking). The qualitative interview gathered in-depth information from the 16 employees on the existing leadership and management practices and their implication for organizational culture, learning performance and competitive advantage within state corporations. Corporation records including fiscal year audited reports of 2013, 2014 and 2015 and organization’s annual progress reports. These documents helped to provide additional triangulation information on profitability and sales growth as well as to assess the performance trends of the state corporations.

3.4. Statistical Measurement Models

Pearson’s correlation analysis was used to assess linear relationships between the independent variables and competitive advantage Saunders, Lewis, & Thornhill., (2015). To examining the effect of organizational learning on competitive advantage, step-wise multiple regression models which is commonly used to measure the linear relationship that exists between variables was used (Kanji, 2006). The study employed structural equation modeling (SEM) to further test the mediating effects of rate of learning in the relationship between each of the independent variables and competitive advantage. SEM included confirmatory factor analysis and a series of multiple regression to test the theory (Kothari, 2004). For the structural equation model, the study examined two level of analysis – the measurement model and the structure model using Statistical Package for Social Scientists (SPSS) and Amos.

3.5. Measures

The study drew items from different studies from the literature review to measure the constructs. Learning culture was based on items adopted from Dimensions of Learning Organizations Questionnaire (DLOQ) by Leufvén, Vitrakoti, Bergström, Ashish, & Målqvist, (2015) and Learning Organization Questionnaire by Garvin et al., (2008). Eleven items were used to measure the organizational learning culture. The items comprised of four components namely open communication practices, learning practices, staff empowerment and supporting staff development. These items were measured on a five-point likert-type scale to permit the measurement of the dependent variable at the interval scale, (Leedy and Ormrod, 2001). The study adapted scales from various researcher to design the learning processes variable (Donate & Sánchez de Pablo, 2015; Garvin et al., 2008; María Martínez-León & Martínez-García, 2011). The final scale comprised of 11 items assessing processes for generating, collecting, interpreting, and disseminating information; experimenting with new offerings; identifying and solving problems and developing employee knowledge, skills and attitude. Systems thinking refers to people’s capacity to examine a problem in the full setting of the interconnecting elements. Systems thinking was adapted from the DLOQ and the study questionnaire by, (Bess, Perkins, & McCown, 2011). Five items were used to measure systems thinking using a five-point Likert scale. The items included organization’s practices to promote

external alignment and practices to promote internal alignment. To examine the rate of learning, the study build on the work of Andreou, Louca, & Petrou, (2016), who measured learning performance by looking at the mode of diversification as an indicator of resource relatedness; internal growth versus acquisition and Witherspoon (2014) who assessed double loop and single loop learning in the various organization. Therefore, sub-variables used to measure rate of learning considered the frequency with which an organization closed feedback loops using insights and knowledge gained from formal and informal feedback processes. Categories of actions and decisions included selling products and services more efficiently, using alternative approaches to offer same products and services, modifying rules and policies, creative and innovative products and services and changing customer or client base. Similar to previous studies, competitive advantage was measured by assessing profitability, sales growth, and market share and customer satisfaction, (Hardeep & Bakshi, 2014; Porter, 2008). The study used a scale comprised of 6 items to measure competitive advantage through a likert type scale.

IV. RESULTS AND DISCUSSION

4.1 Response Rate

Data was collected from state corporations in Kenya which are registered under the state corporations’ advisory committee. Even though the study sample comprised of 240 staff from 40 state corporations, only 198 (83%) staff from 35 (88%) state corporations responded to the study. The high response rate was due to the structured follow-up visits by the trained research team.

Table 2: Response Rate

Sector	Sample	Actual	Response Rate
Finance	7	7	100%
Tertiary Education and Training	4	4	100%
Public Universities	5	5	100%
Commercial and Manufacturing	24	19	79%
Total	40	35	88%

4.2 Background Information

4.2.1 Respondent Background Information

A simple majority of the gender were female 52.5% as shown in table 4.2. This distribution depicts a fair balance of gender in the sampled state corporations. Considering that majority of the responses are perceptual in nature, this kind of distribution helps to accommodate opinions and views from either gender. On another note, this balance in gender in state corporations’ points to the progress achieved by the ongoing efforts in Kenya’s public service to mainstream gender in response to the constitutional threshold on gender. Majority of the respondents (64.1%) indicated that they had at least a degree level of education while a relatively high percentage (42.4%) possessed a higher degree at postgraduate level. This was expected due to high levels of tertiary education in the country and 62% of respondent were

middle or senior managers who require higher academic qualifications.

Table 3: Summary of student demographics

	Frequency	Percent
<i>Gender</i>		
Male	94	47.5
Female	104	52.5
Total	198	100.0
<i>Respondent Job Level</i>		
Senior Manager	22	11.1
Middle-level Management	101	51.0
Non-Management staff	75	37.9
Total	198	100.0
<i>Department or unit</i>		
Production/Services	46	23.2
Purchasing	20	10.1
Human Resource Management	54	27.3
Research and Development	21	10.6
Marketing (Including the selling function)	15	7.6
Accounting and Finance	42	21.2
Total	198	100.0

Majority of the respondents were middle-level managers (51%) and the least were senior managers (11%). This distribution shows the staffing situation in state corporations and is very important because it shows that the span of control within the firms allowed approximately 4 middle managers per senior manager in the targeted departments. Additionally, learning occurs at all levels of the organizations hence it is important to capture opinions and facts from all key staffing categories. Furthermore, over-reliance on the opinion of senior managers was noted in the literature as a limitation of most organizational learning studies. High responses were received from the 36-45 and 26-35 age brackets giving 33.33% and 28.8% respectively. The mean age was 39.6 years with a standard deviation of 10.9 years. These results are consistent with the fact that majority of the respondents were middle managers and the non-management staff whose age ranged from 25-45 years. This is a common phenomenon in organizations where employees climb up the professional ladder with time hence the length of service often reflect a growth in job-levels. Lastly, these results also demonstrate that the workforce in the public service is young which aligns to the country’s population dynamic that is dominated by a young working population aged 25-45.

In an effort to determine the length of years of employees, majority of the respondents (78.8%) had worked in the organization for less than 11 years with 60% having worked for five years or less. The mean years of service for the employees was 7.3 with a standard deviation of 7.6 years. This shows a sufficient diversity of experience to allow for analysis of the study variables. At the same time, these results show that majority of the staff were hired in their current organizations or roles within the past ten years which is also around the same time that organizational learning and the knowledge economy became

a ‘household’ concepts in state corporations in Kenya and also Kenya was launching its economic transformation blue print, Vision 2030(Government of Kenya, 2007). State corporations typically consist of a number of departments or functions and organizational learning may be more pronounced in some departments than others for various contextual reasons. With this background, the study was keen to identify the departments in which the respondents worked. Majority of the respondents were from Human resources (27%), and the production departments (23%). Cumulatively, departments dealing with the core business including production, service, purchasing, research and development and marketing were 51% while those associated with support functions including accounting, finance and human resources were 49%. This departmental diversity accords the study an opportunity to assess the role of some organizational learning variables like systems thinking which partly looks at relationships between various departments in the organization.

4.2.2 Background of State Corporations

Majority (54%) of the sectors were classified as commercial and manufacturing while 24% were from either training, tertiary education or public universities. The finance sector was represented by 20% of the sample state corporations. The high proportion of the manufacturing industry was expected and planned during sample selection since they form the highest proportion of state corporations. The representation from all key sectors that met the selection criterion is key in assessing differences within sectors.

Table 4: Sectors of state corporations

Sector	Frequency	Percent
Finance	7	20%
Tertiary Education and Training	4	11%
Public Universities	5	14%
Commercial and Manufacturing	19	54%
Total	35	100%

4.3 Descriptive Statistics Results

4.3.1 Organizational Culture in State Corporations

The study sought to find out the extent to which the state corporations nurtured and promoted a culture that reinforced learning at departmental level. To achieve this objective, the study used Likert Scale with six constructs including open discussion of mistakes, honest feedback, reward to innovation, access to information, recognition of performance and learning opportunities. Majority (63%) of the respondents were of the view that the culture within their departments supported learning and learning opportunities. These high scores were noted particularly in open discussions of mistakes (68.2%), giving of open feedback (71.7%) and ready access to information (69.2%). However, when it comes to rewards, only 45% of the respondents said that in their departments people are rewarded for exploring new ways of working. Similarly, there were low score for support to requests for learning opportunities and training as well recognition of people for taking initiative. This shows that even though majority of the state corporations supports a learning culture, they do not resource it by rewarding innovative thinking and practice.

4.3.2 Learning Processes

In an effort to assess the learning processes within state corporations, the study analyzed at 11 constructs. At least 61% of the respondent agreed or strongly agreed that learning processes were implemented within their state corporations. Despite this appreciation of the learning processes within their institutions, it was clear that learning processes associated with training were weak within state corporations. There were 44% of respondents who indicated that experienced employees were provided with training when switching to new positions. This has been attributed to the fact that they are seen or considered to know their work hence limited investment in their knowledge and skills. In addition to the weak training systems, there were limited mechanisms within the organization to guarantee sharing of emerging, good, and best practices across departments which essentially compromised inter-departmental learning within the state corporations. Other areas that employees scored low included seeking out dissenting views during discussions (57%), revisiting well-established perspectives during discussions (58%), and employees joining formal or informal networks made up of people from outside the organization (58%).

4.3.3 Systems Thinking

The study also sought the extent to which state corporation applied systems thinking practices within their organizations. Results showed that on average, 64.5% of the respondent felt that their organizations adopted systems thinking practices. Specifically, majority (71.7%) felt that their leaders ensured that the organization’s actions were consistent with its values and the organization worked together with the outside stakeholders to meet mutual needs (70.7%). These were fairly high scores for systems thinking and can be partly explained by the nature of state corporations and Government policy and bureaucracy which largely requires that that the state corporations conduct elaborate stakeholder consultations as part of their decision-making process. On the other hand, a smaller percentage of respondents (55.6%) felt that their organizations considered the impact of decisions on employee morale and encourages people to get answers from other departments and staff when solving problems (59%).

4.3.4 Rate of learning

In order to establish level performance within state corporations, the study focused on establishing the frequency with which state corporations acted on feedback from formal and informal sources including staff, customers and others stakeholders. Particularly, the study was interested in capturing and handling of suggestions associated with changes in strategies and methods, requests to offer different products, modification to policies or procedures and reaching a different set of clients or customers. Table 4.17 shows the descriptive statistics for frequency of learning which indicate that average frequency of learning, measured by the number of learning action taken over the past year was 14.28 (SD = 3.85). The state corporations that reported the least number of learning actions had four while the highest had 24 making a range of 20. As expected there were higher rates of learning for the single loop when compared to double loop.

Table 5: Percentage statistics for frequency of learning

Used feedback to take action or decide on:	Frequency of learning per year				Total
	0 / 1	2/ 3	4/5	6+	
Use alternative methods/strategies to offer same products or services.	1%	22%	59%	18%	100%
Start offering more creative and innovative products or services	2%	23%	60%	15%	100%
Modify our policies or procedures to help us offer better products or services	14%	52%	30%	4%	100%
Decide or take action to reach a different client or customer base	12%	46%	37%	6%	100%
Average	7%	36%	46%	11%	100%

4.4 Factor Analysis

4.4.1 Normality of the Dependent Variable

To assess the assumption of normality of the dependent variable, the study employed various normality tests. These included the observation of histogram, normal probability plot and statistical test using the Shapiro-Wilki test. The study further employed the Shapiro-Wilk Test for normality (Conover, 1999). The test is commonly used by statisticians and is typically tested at the $\alpha = .005$ level of significance. The Shapiro-Wilks Test is a statistical test of the hypothesis that sample data have been drawn from a normally distributed population (Conover, 1999; Shapiro and Wilk, 1965; Royston, 1995). The formula for the test is as follows: Table 4.17 shows the Shapiro-Wilk results obtained by this test for the dependent variable, competitive advantage. The null-hypothesis of the Shapiro-Wilki test is that the population is normally distributed. Thus, if the p-value is less than the chosen alpha level, then the null hypothesis is rejected and there is evidence that the data tested are not from a normally distributed population; in other words, the data are not normal. On the contrary, if the p-value is greater than the chosen alpha level, then the null hypothesis that the data came from a normally distributed population cannot be rejected (e.g., for an alpha level of 0.05, a data set with a p-value of 0.02 rejects the null hypothesis that the data are from a normally distributed population). Given that p-value was 0.128 for competitive advantage which is greater than the α of 0.05, the null hypothesis was accepted and the study concluded that the samples were drawn came from a normally distributed population. Table xxx shows the results of the Shapiro-Wilki test. However, considering that the Shapiro-Wilki test is biased by sample size, the test may be statistically significant from a normal distribution in any large samples the study used a normal probability plot (Q-Q plot) for further verification of the normality assumption. In a Q-Q plot, each observed variable is paired with its expected value from the normal distribution. If the sample is from a normal distribution, then the cases are expected to fall more or less in a straight line. Figure 4.7 shows that the cases fall more or less in a straight line indicating that the sample was from a normal distribution.

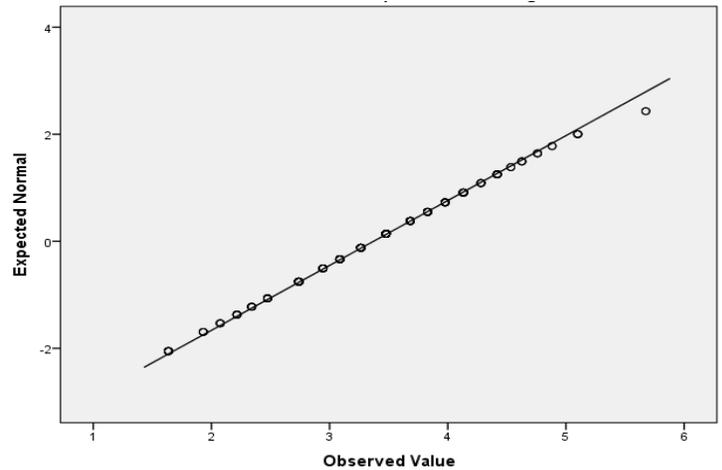


Figure 1: Q-Q plot for dependent variable

4.4.2 Reliability and Validity Analysis

In order to conduct analysis through structural equation modeling (SEM) for the purpose of testing the model, the study conducted a series of tests were run on the variables to improve the reliability of the various constructs. Using SPSS version 21, the study employed Cronbach's Coefficient Alpha to test for internal consistency of the constructs within the six variables of study. The data on each of the variables were separately analyzed based on the values of coefficient of reliability and item total correlation as shown in table 4.22. For the purpose of analysis, each variable was abbreviated as follows: Competitive Advantage (CompAd.); Learning Culture (LearnC.); Learning Processes (LearnP.); and Systems Thinking (SyThink.). Items under variable were numbered accordingly. Since the coefficient alpha of individual scales indicated that the reliability estimate of items Lead.1, LearnP.8, LearnP.10, and LearnP.13 were marginal, a secondary analysis was conducted by dropping these items. The reliability estimates and item-total correlations of the remaining items under learning process improved after dropping these items. The researchers decided to delete items Lead.1, LearnP.8, LearnP.10, and LearnP.13 to enhance Cronbach's coefficients. Table 4.18 shows a summary of the Cronbach's alpha coefficient for each of the variables. After the deletion process, all the four independent variables and dependent variable registered an acceptable Cronbach's alpha coefficient of above 0.7. This is line with findings by Saunders Lewis and Thornhill (2009) and Christensen, Johnson and Turner (2011) who noted that scales of 0.7 and higher, suggest satisfactory reliability. The study concluded that the constructs measuring learning culture for this study had sufficient internal consistency and hence, reliable for the analysis of learning culture as an independent variable.

4.4.3 Sampling Adequacy

To examine whether the data collected was adequate for statistical tests such as factor analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Barlett's Test of Sphericity were performed on all the study variables. For a data set to be regarded as adequate and appropriate for statistical analysis, the value of KMO should be greater than 0.5 (Field, 2000). Results from table xxx the study found that all the KMO coefficients were above the critical level suggested of 0.5 as

noted by Field, (2009). Similarly, all the results of the Bartlett's Test of Sphericity were highly significant ($p < 0.05$). These two results confirm that the variable was suitable for analysis.

Table 6: Summary KMO and Bartlett's Chi-Square Tests for Sampling Adequacy

Variable Name	KMO	Bartlett's Chi-Square	Df	Sig.
Learning Culture	0.728	236.591	15.000	0.000
Learning Processes	0.848	685.511	55.000	0.000
Systems Thinking	0.823	391.985	10.000	0.000
Rate of Learning	0.671	246.960	6.000	0.000
Competitive Advantage	0.860	567.388	15.000	0.000

4.5 Inferential Analysis and Hypothesis Testing

Hypothesis associated with the relationship between the independent variables and the depending variable were done through linear regression analysis using SPSS version 21 software.

4.5.1 Effect of Learning Culture on Competitive Advantage

The study sought to test the following hypotheses in assessing the effects of learning culture on competitive advantage.

H_{01} : There exists no relationship between learning culture and the competitive advantage of State Corporations in Kenya

H_{a1} : There exists a relationship between learning culture and the competitive advantage of State Corporations in Kenya

First, the study conducted a bivariate Pearson Correlation analysis to determine the linear relationship between learning culture and competitive advantage. The results showed that learning culture and competitive advantage were significantly correlated, $r = .475$, $p < .05$. The magnitude, or strength, of the association is moderate ($.3 < |r| < .5$). After confirming a positive and significant linear relationship between learning culture and competitive advantage, the study went ahead to employed linear regression analysis using SPSS to assess if the learning culture significantly predicted competitive advantage of state corporations. From Table 4.25, the results of the regression indicated that learning culture explained 94.9% the variance ($R^2 = .38$, $F(1,197) = 120.06$, $p < .000$). For regression through the origin (the no-intercept model), R Square measures the proportion of the variability in the dependent variable about the origin explained by regression. The model used had an R square value of 0.38 thus indicating that the model accounted for 38% of the change in the dependent variable, competitive advantage, for every change in the independent variable, learning culture. This is a strong prediction model for the intended analysis. Using the coefficients model, the results showed learning culture was significantly associated with competitive advantage ($p < .000$). Therefore, the study rejected the Null hypothesis and concluded that there exists a relationship between learning culture and the competitive advantage of State Corporations in Kenya. Based on these results, for every one unit change in learning culture, a corresponding change of .945 units occurred in the competitive advantage of state corporations. The findings suggest that state corporations with a high levels of learning culture have higher

chances gaining competitive advantage over their counterparts that have lower levels of learning culture.

4.5.2 Effectiveness of Learning Processes on Competitive Advantage

The study sought to test the following hypotheses in assessing the effects of learning processes on competitive advantage.

H_{02} : There is no relationship between learning processes and competitive advantage of State Corporations in Kenya.

H_{a2} : There is a relationship between learning processes and competitive advantage of State Corporations in Kenya.

Bivariate Pearson correlation analysis to determine the linear relationship between learning processes and competitive advantage established that learning processes and competitive advantage had a statistically significant positive linear relationship, $r = .683$, $p < .001$. The direction of the association suggests that a higher measure of learning processes score is associated with greater competitive advantage score. The strength of the association was high ($.5 < |r| < 1$). A simple linear regression was calculated to predict the influence of learning processes on competitive advantage of state corporations. From Table 4.29, the results of the regression indicated that a significant regression equation was found ($F(1,197) = 155.22$, $p < .05$) with an R^2 of .442. For the no-intercept model, R Square measures the proportion of the variability in the dependent variable about the origin explained by regression. The model had an R square value of 0.442 thus indicating that the model accounted for 44.2% of the change in the depending variable, competitive advantage, for every change in the independent variable, learning culture. This is a strong prediction model for the intended analysis. The results showed that $Y = .385(LP) + e$ where Y is the dependent variable (competitive advantage), LP is the dependent variable (Learning Processes) and e is the error term. Therefore, the study rejected the null hypothesis and concluded that there exists a relationship between learning processes and competitive advantage of state corporations in Kenya. The means that competitive advantage of state corporations increased by .385 units for each unit increase in learning processes. The independent variable, Learning Processes, was a significant predictor of competitive advantage, $p < .05$.

4.5.3 Effect of Systems Thinking on Competitive Advantage

The study sought to test the following hypotheses in assessing the effects of systems thinking on competitive advantage.

H_{03} : There is no relationship between systems thinking and competitive advantage of State Corporations in Kenya.

H_{a3} : There is a relationship between systems thinking and competitive advantage of State Corporations in Kenya.

Bivariate Pearson correlation analysis to determine the linear relationship between systems thinking and competitive advantage established that systems thinking and competitive advantage had a statistically significant positive linear relationship, $r = .631$, $p < .001$. The direction of the association suggests that a higher measure of learning processes score is associated with greater competitive advantage score. The strength of the association was

high ($.5 < |r| < 1$). A simple linear regression was calculated to predict the influence of systems thinking on competitive advantage of state corporations. From Table 4.31, the results of the regression indicated that a significant regression equation was found ($F(1,197)= 108.41, p<.000$) with an R^2 of .356. For the no-intercept model, R Square measures the proportion of the variability in the dependent variable about the origin explained by regression. The model had an R square value of 0.961 thus indicating that the model accounted for 35.6% of the change in the depending variable, competitive advantage, for every change in the independent variable, learning culture. This is a strong prediction model for the intended analysis. The results showed that $Y = .470(LP) + e$ where Y is the dependent variable (competitive advantage), LP is the dependent variable (Learning Processes) and e is the error term. Therefore, the study rejected the null hypothesis and concluded that there exists a relationship between systems thinking and competitive advantage of state corporations in Kenya. The means that competitive advantage of state corporations increased by .470 units for each unit increase in systems thinking. The independent variable, Learning Processes, was a significant predictor of competitive advantage, $p<.05$.

4.5.4 Multivariate Linear Regression Analysis for Competitive Advantage

A multiple linear regression analysis was used to model the relationship between all independent variables and competitive advantage that were found significant in simple linear regression stage. A multiple regression was calculated to predict competitive advantage of state corporations based on three independent variables namely: learning culture (LC), learning processes (LP) and systems thinking (ST). From Table 4.5, the results of the regression indicated that a significant regression equation was found ($F(3,194)= 68.661, p<.05$) with an R^2 of .515. In this model, the R Square measures the proportion of the variability in the dependent variables about the origin explained by regression. The model had an R square value of 0.515 thus indicating that 51.5% of the change in the depending variable, competitive advantage, was accounted for by the changes in the independent variables. The results showed that $Y = .170(LC) + .200(LP) +.187(ST) + e$ where Y is the dependent variable (competitive advantage), LC is rate of learning, LP is learning processes, and ST is systems thinking and e is the error term. Competitive advantage increased 0.170 for each unit of learning culture, 0.200 for each unit of learning processes, and 0.187 for each unit of systems thinking. The independent variables, rate learning culture ($P<0.003$), learning processes ($P<0.000$) and systems thinking ($P< 0.001$) were all significant predictors of competitive advantage at $p<0.005$.

Table 7: Coefficients Table for Learning Culture and competitive advantage

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	1.596	.131		12.213	.000		
Learning culture	.170	.053	.233	3.192	.002	.471	2.125

Learning Processes	.200	.045	.346	4.451	.000	.413	2.419
Systems Thinking	.187	.053	.237	3.515	.001	.550	1.818

4.5.5 Mediating Role of Rate of Learning

Mediating Role of Rate of Learning on the Relationship Between Systems Thinking and Competitive Advantage

The study sought to test the following null hypothesis:

Ho5a: There is no mediating role of rate of learning on the relationship between systems thinking and competitive advantage of State Corporations in Kenya.

Using the no directs model, the study fit a ‘systems thinking’ model by adding a path from systems thinking to competitive advantage. This model exhibited satisfactory fit indices [$X^2(19)=56.590, p<0.01$; GFI=0.942; CFI=0.954; RMSEA=0.100]. The fit indices were an improvement to the ‘no direct’ model [$X^2(20) = 83.062, p < 0.01$; GFI = 0.922; CFI = 0.923; RMSEA = 0.127]. This implies that the direct effect of systems thinking to competitive advantage was significant and in deed it was significant ($\beta_{yx.m} = 0.384, p<0.05$). Similarly, the indirect effect of systems thinking to competitive advantage via rate of learning was significant (Sobel=2.192, SE=0.036, $p<0.05$). The indirect effect was further tested using a bootstrap estimation approach with 2000 samples (Shrout& Bolger, 2002). These results indicated the indirect coefficient was significant, ($\beta = .078, SE = .041, p<.05$). The indirect (mediated) effect of systems thinking on competitive advantage was .078. That is, due to the indirect (mediated) effect of systems thinking on competitive advantage, when systems thinking goes up by 1 unit, competitive advantage goes up by 0.078. This is in addition to any direct (unmediated) effect that systems thinking may have on competitive advantage. Table xxx shows the boot strapping results confirming the partial mediation role of rate on learning in the relationship between systems thinking and competitive advantage. In summary, the results how that indirect effect of systems thinking to competitive advantage via rate of learning was significant showing the presence of mediational relationship. Furthermore, the direct $X \rightarrow Y$ relationship were also significant. These results demonstrate that rate of learning partially mediates the effect of systems thinking on competitive advantage of state corporations ($p < 0.05$). These results suggest that systems thinking predict competitive advantage, and it does so by strengthening rate of learning within the state corporation.

Mediating Role of Rate of Learning in the Relationship Between Learning Processes and Competitive Advantage

The study tested the following null hypothesis by fitting a ‘learning process’ model by adding a path from learning processes to competitive advantage to the ‘no direct’ model.

Ho5c: There is no mediating role of rate of learning on the relationship between learning processes and competitive advantage of State Corporations in Kenya.

This model exhibited satisfactory fit indices [$X^2(19)=33.823, n.s$; GFI=0.964; CFI=0.982; RMSEA=0.063]. The fit indices were a large improvement to the ‘no direct’ model [$X^2(20) = 83.062, p$

< 0.01; GFI = 0.922; CFI = 0.923; RMSEA = 0.127]. This implies that the direct effect of learning processes to competitive advantage was significant and indeed it was ($\beta_{yx.m} = 0.287$, $p < 0.05$). The indirect effect of learning processes to competitive advantage via rate of learning was not significant (Sobel=1.586, SE=0.022, P=0.113 n.s).The indirect effect was further tested using a bootstrap estimation approach with 2000 samples (Shrout& Bolger, 2002) and the results affirmed that the indirect effects were not significant ($\beta = .035$, SE = .023, n.s). This shows that the mediated effect of learning process on competitive advantage was 0.035. That is, due to the mediated effect of learning process on competitive advantage, when learning process goes up by 1 unit, competitive advantage goes up by 0.035. This is in addition to any direct (unmediated) effect that learning process may have on competitive advantage. A further test of significance using bootstrapping technique with 2000 samples showed that the mediation effect was significant ($P < 0.1$). In summary, the both the direct effect ($\beta_{yx.m}$) and the indirect effect (β_{mx_bym}) were significant leading to the rejection of the null hypothesis, therefore concluding that learning performance partially mediates the effect of learning processes on competitive advantage of state corporations ($p < 0.10$).

Table 8: Test of significance of direct and indirect effects

Relationship	Direct	Indirect	Comment
OLP→LP→CA	0.287**	0.035*	Partial Mediation

*= $P < 0.1$; **= $P < 0.05$

Mediating Role of Rate of Learning on the Relationship Between Learning Culture and Competitive Advantage

The study tested the following null hypothesis by fitting a 'learning culture' model by adding a path from learning processes to competitive advantage to the 'no direct' model.

Ho5d: There is no mediating role of rate of learning on the relationship between learning culture and competitive advantage of state corporations in Kenya.

This model exhibited satisfactory fit indices [$X^2(19)=42.652$, n.s.; GFI=0.956; CFI=0.971; RMSEA=0.079]. The fit indices were an improvement to the 'no direct' model [$X^2(20) = 83.062$, $p < 0.01$; GFI = 0.922; CFI = 0.923; RMSEA = 0.127] suggesting that the direct effect of 'learning culture' to competitive advantage was significant and in deed it was significant ($\beta_{yx.m} = 0.318$, $p < 0.05$). On the contrary, the indirect effect of learning culture to competitive advantage via rate of learning was not significant (Sobel=0.200, SE=0.031, n.s.).The study further tested these indirect effects using boot strapping and confirmed that effects of learning processes to competitive advantage through rate of learning was not significant in this model ($\beta = .008$, SE = .031, 95%, n.s.). These results indicate that there was no mediating role of learning culture and competitive advantage of state corporations. Table xxx presents the boot strapping results testing the full mediation role of rate of learning on the relationship between learning process and competitive advantage.

Organizational learning, Rate of Learning and Competitive Advantage

Lastly, the study tested the following null hypothesis by fitting a 'Overall model' model that had all the independent variables leading to the independent and mediating variable. The models exhibited excellent fit indices [$X^2(16)=15.55$, n.s; GFI=0.983; CFI=1.00; RMSEA=0.000] that were an improvement over the no direct model [$X^2(20) = 83.062$, $p < 0.01$; GFI = 0.908; CFI = 0.923; RMSEA = 0.127]. Table 4.45 shows that the direct and indirect results form systems thinking were significant which is consistent with a partial mediation hypotheses. On the contrary, even though the direct effects of learning culture were significant, the indirect effects were not significant showing that there was no mediation.

Table 9: Bootstrapping for the overall mediation model

	P value	Direct	P value	Indirect	P value	Mediation
ST	.001	.164	.026	.068	.002	PM
LP	.001	.268	.003	.051	.029	PM
LC	.002	.188	.005	.016	.390	NM

Key: PM = Partial Mediation; NM = No Mediation

The study concluded that rate of learning partially mediating the relationship between systems thinking and competitive advantage and between learning processes and competitive advantage. The results also confirmed that there was no mediation role of rate of learning on the relationship learning culture and competitive advantage. In summary, the series of model tests illustrated the chain of evidence required for different types of intervening effects in a multivariate situation. In summary, the results above have shown the type of mediating effects that rate of learning has on the relationship between the antecedents and competitive advantage. Systems thinking and learning processes were partially mediated by rate of learning. No mediation existed in the relationship between learning culture and competitive advantage.

4.6 Summary of major findings

4.6.1 Effect of learning culture on competitive advantage of state corporations

Linear regression results revealed that the independent variable learning culture had a significant and positive influence on the competitive advantage of state corporations. This influence remained positive and significant in a multiple regression analysis showing that learning culture played a significant role with the three other variables in influencing competitive advantage. These results are consistent with (Weihong et al., 2008) who found that openness of the organizational culture and the organizational learning capability has a significant impact on the enterprise sustainable competitive advantage. Similarly, the result are supported by (Gbenro&Agboola, 2015) whose study found trust was an important aspect of organizations that predicted the willingness of worker to share and use tacit knowledge and (Sanz-Valle et al., 2011) who found that organizational culture can foster both organizational learning and technical innovation. The study found that organizations that consistently possessed the attributes of a learning culture were

also these that scored highly on the competitive advantage scale. The degree of tolerance towards adventurous spirit, democratic participation and innovation activities, which drive organizations to accept new things, discover new needs better and faster, then make a first-mover advantage strategy is positively associated with competitive advantage. Therefore, leaders of state corporations should nurture and build organizational culture that encourages people to openly discuss mistakes to learn from them, and give and receive open and honest feedback. Additionally, they should develop a reward system that recognizes individuals and team who take initiative and exploring new ways of working. Lastly, they should nurture a culture of learning and efficiently resource training of staff.

4.6.2 Effectiveness of learning processes in fostering competitive advantage

In determining the effectiveness of learning processes in fostering competitive advantage, the study found that a positive and significant relationship existed in both single and multiple linear regression analysis. In fact, learning process had the highest strength of association to the competitive advantage compared to the other three independent variables. This affirms the positive and significant role that concrete learning processes play in influencing the performance and competitive advantage of state corporations. Similar to the result of Garvin et al. (2008), this found that for organizations to learn effectively and attain the desired competitive advantage, they need to have more effective and comprehensive knowledge management processes than their competitors. When an organization masters the processes and practices of generation, collection, interpretation, and dissemination of information, to sets itself up for successful competition. Encouraging employees to join formal or informal networks made up of people from outside the organization ensures that there is continuous generation of information within and outside the organization and helps create forums for meeting with and learning from experts from outside the organization. Interpretation of information is essential and this can be achieved by the conduct of regular post-audits, after-action reviews as well as executing formal mechanisms for sharing of best practices among the different activity fields. The organizations need to engage in productive conflict and debate during discussions and intentionally seek out dissenting views during discussions. Organizations also need to revisits well-established perspectives during discussions, identifies and discusses underlying assumptions that might affect key decisions. Most importantly, organizations should pay attention to and act on different views during discussions since they offer opportunity for new learning.

The results of the study emphasized the importance state corporations to have concrete formal processes for generating, collecting, interpreting, and disseminating information. As Garvin et al., (2008) pointed out, concrete learning processes and practices ensures that the team and company values to experiment with new offerings, to gather intelligence on competitors, customers, and technological trends and solving problems. State corporations that attain competitive advantage prioritizes developing employees' skills because it appreciates that it is when employees grow that organizations grow. Therefore, learning processes ensure capacity of employees is

continuously strengthened to meet the work needs. These efforts targets both the experience employees, new employees, and employees switching to new positions. The study has demonstrated that when organizations consistently and systematically invests in training and growth of staff by availing time for education, training and mentorship activities of staff, they lay a strong foundation for competitiveness.

Based on the high significance of learning processes in increasing rate of learning and consequently attaining competitive advantage, the study concluded that concrete learning processes are the cornerstone of a learning organization. Blended with a system's thinking approach to analyzing issues and a supportive learning environment that is driven by a open and flexible culture, learning processes had the potential of transforming the competitive value of state corporations. However, it is important to appreciate the that mere establishment of a variety of learning processes is not a sufficient condition to nurturing a learning organization and attaining competitive advantage. Effective and efficient utilization of the learning processes by intended users is the primary ingredient for acquiring value from concrete learning processes. In ensuring correct utilization of learning processes, the study identified what it considered as core barriers to concretizing learning processes in state corporations: unnecessary bureaucracy that largely excluded junior employees from reflection and decisions associated with goods and service provision; and perpetual victimization of employees based on finding from formal feedback mechanisms without intensive analysis and reflection to explore truth and root causes of feedback points. Bureaucracy and victimization limited the acquisition of objective and timely feedback from junior employees despite the widespread recognition that they were closest to the majority of the clients. Victimization makes it difficult for employees to support and promote the use of feedback mechanisms.

4.6.3 Effect of systems thinking on the competitive advantage

System thinking was found to have a strong positive and significant effect on competitive advantage both in a single linear and multiple regression equations. The results of this study reinforced results of other scholars who regarded systems thinking as the conceptual cornerstone of a learning organization (Alegre and Chiva, 2008; Alegre et al., 2013). Higher scores of systems thinking scale were associated with high scores in competitive advantage. Organizations that have cultivated strong systems thinking practice encourage people to think beyond their individual and departmental roles and responsibility and look at how others' roles and responsibilities affect their work. These kinds of organizations approach issues from a stakeholder perspective and works with the outside stakeholders to meet mutual needs. When leaders ensure that the organizations actions are consistent with its values and considers organizations actions on employee morale, and when they encourage people to seek answers from across the organizations, the organization benefits from multiple perspectives and achieve a high sense of ownership that smoothens implementation of strategic choices to realize better success. These are fundamental ingredients to

building a learning organization and achieving a sustained competitive advantage.

4.6.4 Re-Examination of the Priori Model

As shown in Figure 5.1 of the revised model, one out of four hypothetical casual paths cannot gain full support. Regression analysis results all variables, learning culture, learning processes and systems thinking were positively and significantly associated with competitive advantage. The results validated findings of studies by (Bell, 2013; Garvin et al., 2008; Ollows & Moro, 2015) for the supported casual paths and disagrees with the findings by (Amitay, Popper, & Lipshitz, 2005; Garcia-Morales, Jimenez-Barrionuevo, & Gutierrez-Gutierrez, 2012; MacNeill & Vanzetta, 2014). Results of mediation analysis showed that two of the three paths were not supported. This implies that rate of learning did not mediate the relationship between learning culture and competitive advantage. On the other hand, the results showed that rate of learning partially mediated the relationships between learning processes and systems thinking practice on competitive advantage. This shows that both learning processes and systems thinking practice influence competitive advantage by increasing rate of learning.

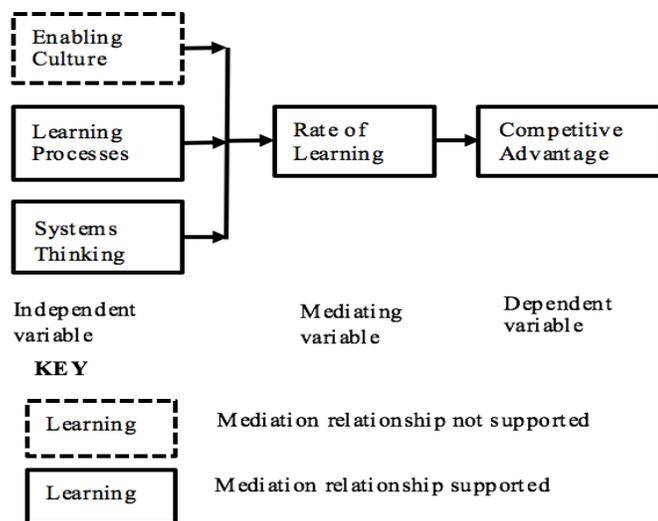


Figure 2: Resultant model

V. CONCLUSION AND IMPLICATIONS

The study results have affirmed the theoretical underpinning that organizational learning is positively associated with competitive advantage of state corporations. Results from both simple and multiple linear regression showed that each of independent variables was positively and significantly associated with competitive advantage. Rate of learning partially mediated the relationship between learning process and competitive and systems thinking and competitive advantage.

Based on these results, managers need to consider implementing strategies that will increase the rate of learning with the organization by focusing on concrete learning processes, learning culture and systems thinking practices. Both formal and informal learning processes that maximize utilization-focused knowledge

acquisition and sharing approach are encouraged. To ensure staff or fully engaged in the learning process, organizations need to invest in building capacity of new and existing employees and partners to encourage reflective practices within the organization. Longitudinal studies can help strengthen similar future studies.

Concrete learning processes are strong predictors competitive advantage directly and indirectly through rate of learning. This affirms the assertion by Garvin et al., (2008) that a learning organization is not developed effortlessly but arises from concrete steps and widely distributed activities that assure efficient and effective generation, collection, interpretation, and dissemination of information. Managers who seek to attain competitiveness are encouraged to invest in concrete learning processes form maximum impact. They include experimentation to develop and test new products and services; intelligence gathering to keep track of competitive, customer, technological and other contextual trends; rigorous analysis and interpretation of data to identify and address problems; and education, training and mentorship to develop both new and established employees. Even though learning processes need to be formalized and concretized, they should be flexible enough to harness informal learning opportunities. Learning happens when individuals and teams pause to reflect and question their actions and this cannot be guaranteed in a fast-passed, non-reflective environment. Managers are advised to institute and resource intentional mechanisms that encourage staff to regularly reflect on their work.

Results of the study reinforced the importance of an enabling culture to foster learning by facilitating the innovative exploitation of learning processes and opportunities for the success of the organizations. Organizational leaders are encouraged to nurture organizational culture that ensure support for learning and creates appropriate and safe learning environment. Components of a learning culture that leaders, managers and employees need to nurture include psychological safety, appreciation of differences, and openness to new ideas. These factors will guarantee employees the safety needed to be creative, encourage to challenge their own assumptions without fear of being out-casted. In addition to the intangible attributes of a supportive learning environment, managers are encouraged to provide time and skills for reflection to their employees and between their employees and their clients. An enabling learning environment ensures that there is time, resources and motivation to utilize the learning processes and to adopt system thinking practices. Recognizing that it is futile to hold numerous reflection events without the involvement of reflective practitioners in an improving learning outcomes is essential. To gain the best value from resourcing learning opportunities, organizations should invest in hiring and nurturing reflective practitioners. This will help staff to debate on matters intelligently, question their openly and genuinely challenge their underlying assumptions and learning to respect and value perspectives of others (including employees and clients) and prioritize the use of evidence while taking decisions.

Similar to studies by, Senge, (2006) and Skaržauskiene, (2010), Systems thinking practice was found significant in influencing learning performance and competitive advantage. Systems thinking ensures that learning and performance is viewed from a systems perspective. In order to correctly and comprehensively diagnose sources and nature of organizational problems and design holistic solutions, leaders, managers and employees are encouraged to adopt system thinking practices. System's thinking practices provide an objective lens and framework to assess inter-relationships and intra-relationships that underlie complex situations and interactions rather than simplistic and often inaccurate linear cause-effect chains (Senge, 2006). Systems think provide a means of understanding successes and failures at a deeper level in order to establish the various paths available to bring about changes and consistency more effectively and efficiently. To achieve systems thinking, managers are encouraged to form an intensive social network that will create a family within and outside the organization. Leaders and managers need to invest in helping each employee to understand and appreciate how their individual actions influence the whole system and finds ways that ensure employee actions promote synergy. Job rotations, team building events and inter-departmental reflection events are some to help entrench the practice of systems thinking within the organization.

The present study faced number of limitations, which should be considered in interpreting the results. First, the study adopted a cross-section design which limits its assessment of causality. Longitudinal studies that examine the lagged effect of learning activities may further contribute to our understanding of how organizational learning can enhance competitive advantage of state corporations. Secondly, accessing financial data from state corporations was virtually impossible during the time of the study. Many visits were done by the research assistance and the team lead but only 15% of the expected financial records were found. This limit the level of analysis that the study could conduct. To mitigate this effect, the study opted for the perception based assessment of competitive advantage similar to what was used by other authors (Azad et al., 2014; Martinette & Obenchain-leeson, 2012). Accessing the financial data may have had varying results.

VI. APPENDIX

Appendix 1: Summary of Reliability Estimates and Item-Total Correlations

Competitive Advantage		Cronbach's Alpha	Item-Correlations
Competitive Advantage (CompAd)		.876	
CompAd1			.580**
CompAd2			.694**
CompAd3			.688**
CompAd4			.713**
CompAd5			.702**
CompAd6			.727**
Learning Culture (LearnC)		.804	
LearnC1			.630**
LearnC2			.606**
LearnC3			.531**
LearnC4			.597**
LearnC5			.573**
LearnC6			.429**
Learning Processes (LearnP)		.848	
LearnP1			.606**
LearnP2			.559**
LearnP3			.639**
LearnP4			.593**
LearnP5			.505**
LearnP6			.564**
LearnP7			.477**
LearnP9			.411**
LearnP11			.416**
LearnP12			.529**
LearnP14			.558**
Systems Thinking (SyThink)		.846	
SyThink1			.551**
SyThink2			.686**
SyThink3			.712**
SyThink4			.670**
SyThink5			.650**

Note, ** item-total correlation is significant at the $p < 0.05$ level (2-tailed).

Appendix 2: Regression Results Tables

Table 4.1.: ANOVA Table for Learning Culture and competitive advantage

Model	Sum of Squares	df	Mean Square F	Sig.
1 Regression	50.913	1	50.913	.000 ^b
Residual	83.115	196	.424	
Total	134.029	197		

Table 4.2: Coefficients Table for Learning Culture and competitive advantage

Model	Unstandardized Coefficients		Standardized t	Sig.
	B	Std. Error	Beta	
1 (Constant)	2.022	.132	15.361	.000
LC	.451	.041	10.957	.000

Table 4.3: ANOVA Table for Learning Culture and competitive advantage

Model	Sum of Squares	df	Mean Square F	Sig.
1 Regression	36.171	1	36.171	.000 ^b
Residual	97.858	196	.499	
Total	134.029	197		

Table 4.4: Coefficients Table for Learning Culture and competitive advantage

Model	Unstandardized Coefficients		Standardized t	Sig.
	B	Std. Error	Beta	
(Constant)	2.128	.154	13.778	.000
Leadership	.355	.042	.519	.000

Table 4.5: ANOVA Table for learning processes and competitive advantage

Model	Sum of Squares	df	Mean Square F	Sig.
1 Regression	59.233	1	59.233	.000 ^p
Residual	74.796	196	.382	
Total	134.029	197		

Table 4.6: Coefficients Table for Learning Processes and competitive advantage

Model	Unstandardized Coefficients		Standardized t	Sig.
	B	Std. Error	Beta	
(Constant)	1.835	.131	14.024	.000
Learning Processes	.383	.031	.665	.000

Table 4.7: ANOVA Table for Systems Thinking and competitive advantage

Model	Sum of Squares	df	Mean Square F	Sig.
1 Regression	47.731	1	47.731	.000
Residual	86.298	196	.440	
Total	134.029	197		

Table 4.8: Coefficients Table for Learning Processes and competitive advantage

Model	Unstandardized Coefficients		Standardized t	Sig.
	B	Std. Error	Beta	
Constant	2.198	.122	17.984	.000
Leadership	.470	.045	.597	.000

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VIII. REFERENCES

Akhtar, N., Ahmed, R., & Mujtaba, B. G. (2013). Exploring and measuring organizational learning capability and competitive advantage of petroleum industry firms. *International Business and Management*, 6(1), 89–103. <http://doi.org/10.3968/j.ibm.1923842820130601.1170>

Amitay, M., Popper, M., & Lipshitz, R. (2005). Leadership styles and organizational learning in community clinics. *The Learning Organization*, 12(1), 57–70. <http://doi.org/10.1108/09696470510574269>

Andreou, P. C., Louca, C., & Petrou, A. P. (2016). Organizational learning and corporate diversification performance. *Journal of Business Research*, 69(9), 3270–3284. <http://doi.org/10.1016/j.jbusres.2016.02.022>

Azad, N., Mehrabi Majolan, E., Peej, V., Buheji, M. J., Cong, X., Pandya, K. V., ... Aggestam, L. (2014). Knowledge creation and competitive advantage in turbulent environments: a process model of organizational learning. *Knowledge Management Research & Practice*, 11(3), 374–388. <http://doi.org/10.1057/kmnp.2012.33>

Bell, E. (2013). Organisational culture and learning: A case study. *Nurse Education Today*, 33(11), 1337–1341. <http://doi.org/10.1016/j.nedt.2013.02.009>

Bess, K. D., Perkins, D. D., & McCown, D. L. (2011). Testing a measure of organizational learning capacity and readiness for transformational change in human services. *Journal of Prevention & Intervention in the Community*, 39(April 2015), 35–49. <http://doi.org/10.1080/10852352.2011.530164>

Britton, B. (1998). The Learning NGO. *International NGO Training and Research Centre*, (July).

Buheji, M. J. (n.d.). Knowledge Management Influence on Government

- Organisations Competitiveness . Mohamed Jasim Buheji, 305.
- Donate, M. J., & Sánchez de Pablo, J. D. (2015). The role of knowledge-oriented leadership in knowledge management practices and innovation. *Journal of Business Research*, 68(2), 360–370.
<http://doi.org/10.1016/j.jbusres.2014.06.022>
- Džini, J. (2015). Correlation between the administrative leadership style and inclination towards organizational learning in local administrative organizations, 3–27.
- Garcia-Morales, V. J., Jimenez-Barrionuevo, M. M., & Gutierrez-Gutierrez, L. (2012). Transformational leadership influence on organizational performance through organizational learning and innovation. *Journal of Business Research*, 65(7), 1040–1050.
<http://doi.org/10.1016/j.jbusres.2011.03.005>
- Garvin, D. A., Edmondson, A. C., & Gino, F. (2008). Is yours a learning organization? *Harvard Business Review*, 86(3).
<http://doi.org/10.1037/e413842008-018>
- Government of Kenya. (2007). Kenya Vision 2030 - A Globally Competitive and Prosperous Kenya, (October), 1–180.
- Hardeep, P. C., & Bakshi. (2014). Examining intellectual capital and competitive advantage relationship: Role of innovation and organizational learning. *International Journal of Bank Marketing*, 33(3), 376–399. Retrieved from www.emeraldinsight.com/0265-2323.htm
- Kanji, G. (2006). *100 Statistical Tests*. Sage Publications. California.
<http://doi.org/10.1017/CBO9781107415324.004>
- Kim, Y. A., Akbar, H., Tzokas, N., & Al-Dajani, H. (2013). Systems thinking and absorptive capacity in high-tech small and medium-sized enterprises from South Korea. *International Small Business Journal*, 32(8), 876–896.
<http://doi.org/10.1177/0266242613483632>
- Kothari, C. (2004). *Research methodology: methods and techniques*. Vasa. Retrieved from <http://medcontent.metapress.com/index/A65RM03P4874243N.pdf%5Cnh>
<http://books.google.com/books?hl=en&lr=&id=8c6gkbKi-F4C&oi=fnd&pg=PR7&dq=Research+Methodology+-+Methods+and+Techniques&ots=iGoAmVQ5mJ&sig=HDstqLuUosKAeZklgQUht4YnUg0%5Cnh>
<http://books.google.com/book>
- Leufvén, M., Vitrakoti, R., Bergström, A., Ashish, K. C., & Mälqvist, M. (2015). Dimensions of Learning Organizations Questionnaire (DLOQ) in a low-resource health care setting in Nepal. *Health Research Policy and Systems / BioMed Central*, 13(1), 6. <http://doi.org/10.1186/1478-4505-13-6>
- Linz, A., & Resch, O. (2010). Double loop learning in work based settings. *CEUR Workshop Proceedings*, 575, 57–65.
- MacNeill, F., & Vanzetta, J. (2014). Appreciative leadership: delivering sustainable difference through conversation and inquiry. *Industrial and Commercial Training*, 46(1), 16–24. <http://doi.org/10.1108/ICT-09-2013-0058>
- María Martínez-León, I., & Martínez-García, J. a. (2011). The influence of organizational structure on organizational learning. *International Journal of Manpower*, 32(5/6), 537–566.
<http://doi.org/10.1108/01437721111158198>
- Martinette, L. A., & Obenchain-leeson, A. (2012). Of Competitive Advantage : A Service Organization Perspective. *Journal of Service Science*, 5(1), 43–58.
- Ollows, L., & Moro, A. (2015). Intra- Organizational Knowledge Transfer in the SME Lending Process: A Study of Commercial Banks in Kenya. *European Conference on Knowledge Management U6 - ctx_ver=Z39.88-2004&ctx_enc=info%3Aofi%2Fenc%3AUTF-8&rft_id=info:sid/summon.serialssolutions.com&rft_val_fmt=info:ofi/fmt:kev:mtx:book&rft.genre=proceeding&rft.title=European+Conference+on+n+Knowledge+Manage*, 578. Retrieved from http://asu.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwnV1NSwMxEB20XjxZseJHhQHPq7vZbrP1UIRaFBUEBfFUZpMsFDWrVg_992ayu3ax0IPnkJCQ8CaZeS8PIBYnYfAHE1yQ7ZOOUmTTGkRUjoQMs0VGWIE4guojcpMKernTEG52zVleuTWheKk-SkbK7nHSZj2hu8fAdtcbm18tRYhw3BX9K6Ay6fnpdw1mPmeAv
- Peeters, A., & Robinson, V. (2015). A Teacher Educator Learns How to Learn from Mistakes: Single and Double-loop Learning for Facilitators of In-service Teacher Education. *Studying Teacher Education*, 11(3), 213–227.
<http://doi.org/10.1080/17425964.2015.1070728>
- Porter, M. E. (2008). The Five Competitive Forces that Shape Strategy. *Harvard Business Review*, 86(January), 78–94. <http://doi.org/Article>
- Prugsamat, R. (2010). Factors that influence organization learning sustainability in non-profit organizations. *The Learning Organization*, 17(3), 243–267.
<http://doi.org/10.1108/09696471011034937>
- Sangari, M. S., Hosnavi, R., & Zahedi, M. R. (2015). The impact of knowledge management processes on supply chain performance. *The International Journal of Logistics Management*, 26(3), 603–626.
<http://doi.org/10.1108/IJLM-09-2012-0100>
- Saunders, M., Lewis, P., & Thornhill, A. (2015). *Research Methods for Business Students*. *Research methods for business students*.
- Senge, P. (2006). *The Fifth Discipline: The Art and Practice of the Learning Organization*.
- Skaržauskiene, A. (2010). Managing complexity: systems thinking as a catalyst of the organization performance. *Measuring Business Excellence*, 14(4), 49–64. <http://doi.org/10.1108/13683041011093758>
- USAID. (2016). Collaborating, Learning, and Adapting Framework and Key Concepts.
- Weihong, X. W. X., Caitao, S. C. S., & Dan, Y. D. Y. (2008). A Study on the Relationships between Organizational Culture, Organizational Learning, Technological Innovation and Sustainable Competitive Advantage. *2008 International Conference on Computer Science and Software Engineering*, 5, 9–13. <http://doi.org/10.1109/CSSE.2008.92>
- Witherspoon, R. (2014). Double-Loop Coaching for Leadership Development. *The Journal of Applied Behavioral Science*, 50(3), 261–283.
<http://doi.org/10.1177/0021886313510032>
- Zhou, W., Hu, H., & Shi, X. (2015). Does organizational learning lead to higher firm performance? *The Learning Organization*, 22(5), 271–288.
<http://doi.org/10.1108/TLO-10-2012-0061>

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The Relationships between Language Learning Strategies and Learning Styles of Ethnic Students at Thai Nguyen University, Viet Nam

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Abstract: The present study aims to explore the frequency of Language learning strategy use and examines the Language Learning strategies (LLS) of Thai Nguyen University (TNU) ethnic EFL learners in order to identify whether there is any meaningful relationship between the LLS and the learners' learning styles. 527 ethnic students at Thai Nguyen University participated in the study. The Language Learning Strategy Questionnaire which is based on the Strategy Inventory Language Learning from Oxford's (1990) and The Perceptual Learning Styles Preferences Questionnaire were administered to collect data for the present study. The findings from the present investigation, TNU ethnic students were medium strategy users. However, one strategy category, i.e., metacognitive category, was used at a high frequency as the most frequently used strategy category. Memory and cognitive strategies were used as the least frequently used categories by the participants of the study. In addition, learning styles did not have much influence on the learning strategy use.

Index Terms: language learning strategy, ethnic students, learning styles, Thai Nguyen University

I. INTRODUCTION

Research results over the past decades have indicated that a key reason why many second language learners fail, while some learners do better with less effort, lies in various learner attributes such as personality traits, educational perspectives, motivation, cultural backgrounds, or language aptitude. It is also worth mentioning that types of strategies used by different learners vary due to stage of learning, teacher expectations, general learning styles, degree of awareness, teaching methods, text-books innovation, purpose for learning the language, and nationality or ethnicity (Bedell, 1993). To put it differently, a learner's individual factors can influence which learning strategy the learners will use for their foreign language learning. Once well-managed, these variables can significantly contribute to a learner's success in language learning. Many researchers (e.g., Reid, 1995; Zhang, 2005; Rahimi and Riazi, 2005; Yang, 2010; Minh, 2012; Zeynali, 2012; and Salahshour and Sharifi, 2013) suggest that strategies of successful language learners can supply a basis for aiding language learners, and the conscious use of language learning strategies makes good language learners.

From the researcher's experience as a teacher of English for more than 17 years with Thai Nguyen University (TNU), I am aware of the fact that students in general and ethnic students in particular are often confused to use their own strategies and abilities to transform their failing situations into successful learning experiences. In addition, I found that students with different individual identities study English in different ways and have different levels of proficiency. It seems that they are not what so called "lazy" and "not motivated". Their language achievement may be affected by many individual factors and the culture which they inherited.

Thai Nguyen University (TNU) is located in the northern midland and mountainous region where many ethnic minorities live in harmony for a long tradition, in which ethnic minorities accounted for 24% - the highest rate in the country with their own cultural identities. At present, TNU has a current enrollment of 90,000 students, of which there are about 65,000 undergraduate (55,000 full-time and 10,000 part-time) and others are professional vocational students. The annual application average is from 70-80,000 applications from various parts of the country, mostly from 16 northern upland provinces of Vietnam.

So far, in Vietnam, quite a few studies have been conducted to explore the use of LLS at tertiary level and the relationships between LLS and learning styles. None have explored the choice or use of LLS which is influenced by learning styles in order to provide enough information which aid both teachers and educators in planning and of individual and group instruction.

The present study examines the LLS of TNU ethnic EFL learners in order to identify whether there is any meaningful relationship between the LLS and the learners' learning styles.

II. LITERATURE REVIEW

Language Learning Strategies Definitions and classifications

Difficulties in defining LLS remain even at the basic level of terminology, each individual researchers define LLS in different ways such as 'technique', 'tactic' and 'skill'. These definitions are sometimes overlap and conflict to each other. Just as Oxford (1990) defines the term as 'behaviours' or actions. This means LLS is observable, whereas Weinstein and

Mayer (1986) argues LLS involve both behaviours and thoughts (unobservable).

Altogether, the researcher agrees with Liang (2009) that LLS has some characteristics as follows.

- Learning strategies are either behavioral thus observable, or mental then not observable.
- Learning strategies could be either general approaches or specific actions or techniques adopted to learn a Target Language (TL).
- Learners are generally aware of what approaches or techniques they have used in language learning, despite some subconscious activities under certain circumstances.

Oxford (1990) describes language learning strategies as specific, self-directed steps taken by learners to enhance their own learning. She separates strategies into two strategy orientations and six strategies groups: (1) direct learning orientation, consisting of (a) memory, (b) cognitive, and (c) linguistic deficiency compensation strategy groups, and (2) an indirect learning orientation, consisting of (a) metacognitive, (b) affective, and (c) social strategy groups. There are some other ways of classifying language learning strategies (Rubin 1981; Skehan 1989; Ellis 1997). Chamot (1990) presents three major classes of strategies: (a) metacognitive, (b) cognitive, and (c) socio-affective. Language learning strategies have been classified as (a) meta-cognitive, cognitive, or socio-affective (e.g. O'Malley & Chamot, 1995) or (b) direct or indirect (e.g., Oxford, 1990; Rubin, 1975, 1987).

As can be seen from above, the LLS classification still overlaps and conflict in opinions and the process of establishing terminology, definitions. Classification systems for language learning strategies are far from straightforward. This study is only based on the classification with the main focus on types of LLS used by the TNU ethnic students. The present study concentrates on LLS with the purpose to examine the relationship between language learning strategies and the TNU ethnic students from the cultural anthropology perspectives.

Language Learning Strategies and Learning Styles

The term 'learning styles' has been defined as "cognitive, affective, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment". Keefe, (1982, p. 44). In addition, learning styles are the general approaches – for example, global or analytic, auditory or visual – that students use in acquiring a new language or in learning any other subject. These styles are "the overall patterns that give general direction to learning behavior" (Corbett, 1999, p. 9). Claxton and Murrell (1987) analyze learning styles at four levels: personality, information processing, social interaction, and instructional methods. After reviewing the state of the art of research in learning styles, the authors indicated a need for further investigation in a number of areas. They reported that we need to know more about the actual impact on learning

when methods used by an instructor are inconsistent with a student's style. Dunn & Griggs (1988, p. 3) affirm that "learning style is the biologically and developmentally imposed set of characteristics that make the same teaching method wonderful for some and terrible for others".

Although learning styles are not dichotomous (black or white, present or absent), learning styles generally operate on a continuum or on multiple, intersecting continua. For example, a person might be more extroverted than introverted, or more closure-oriented than open, or equally visual and auditory but with lesser kinesthetic and tactile involvement. Few if any people could be classified as having all or nothing in any of these categories (Ehrman, 1996).

Active and reflective learners are related to extrovert and introvert, as described by the Myers-Briggs model (the model of personality development created by Briggs Myers). Sensing learners learn by observing, gathering data through the senses, while intuitive learners learn by indirect perception and imagination. Visual learners learn by seeing pictures, diagrams and timetables. On the other hand, verbal learners learn through words, written and spoken explanations. Sequential learners learn by following logically step by step, whereas global learners learn more randomly without any connections (Gunduz & Ozcan, 2010).

Reid (1987; 1995) and Oxford and Anderson (1995) demonstrate that ESL students varied significantly in their sensory preferences, with people from certain cultures differentially favoring the three different modalities for learning. Students from Asian cultures, for instance, were often highly visual, with Koreans being the most visual. Many studies, including Reid's, found that Hispanic learners were frequently auditory. Reid discovered that Japanese are very non-auditory. ESL students from a variety of cultures were tactile and kinesthetic in their sensory preferences.

It has been stated that people from different cultures and even individuals within the same culture have distinctive learning style patterns (Guild, 1994). Due to different types of learning style, teaching methods which are used by instructors may vary. Some instructors prefer giving lectures at classroom; other may focus more on rules, some use demonstration, while some prefer memorization. As a result, the mismatch between the individual's learning style and the instructor's teaching style may lead to failure of learners. In order to address different learning styles, effective teachers use a variety of teaching styles and apply diverse teaching strategies and make effective educational decisions and practices that work best for all students (Guild, 1994; Felder & Silverman, 1998; Lawrence, 1993; Oxford, Ehrman, & Lavine, 1991; Schemek, 1998).

Although a great amount of research has been conducted on learning styles, Wintergerst et al., (2003) argue that not as much research has been documented on non-native speakers and second language learners. In this respect, the present study explores the possible relationships between the TNU ethnic students preferred learning styles and their language learning strategies.

III. METHODOLOGY

Research questions

1. What English language learning strategies are frequently used by the TNU ethnic students?
2. To what extent, do the students' choices of language learning strategies vary significantly with their learning styles? If so, what are the main patterns of variation?

Data Collection Instruments

Language Learning Strategy Questionnaire

In this study, the instrument used to elicit and collect information is in the form of questionnaire. In order to measure language learning strategy use, The Strategy Inventory for Language Learning Version (SILL) was used. The SILL, a self-scoring questionnaire, developed by Oxford (1990), is a tool to assess a broad range of general L2 learning strategies. The SILL includes two versions: version 5.1 (70 items) and version 7.0 (50 items). Version 5.1 was designed to assess the frequency of use of language learning strategies by native-speaking English students and version 7.0 was designed to measure the use of language learning strategies by non-native speaking English students who are learning English as a second or foreign language.

For the present study, the Language Learning Strategy Questionnaire (LLSQ) which is based on the Strategy Inventory for Language Learning Version 7.0 (SILL), the Cronbach's alpha, which indicates the internal consistency reliability of the survey items was .85 for the sample of 527 participants in this study. In regards to the content validity, the inter-rater agreement, which correlates five judges rating was .95, a very high level of agreement statistically speaking. The LLSQ was then translated into Vietnamese, so that the students had no difficulty in understanding them.

Perceptual Learning Style Preference Questionnaire

The questionnaire used in the study was an adapted version of the Perceptual Learning Style Preference Questionnaire (PLPQ) was designed and developed by Reid (1987, 1990, 1998).

Because this instrument was developed by Western researchers for ESL learners, the statements were either rephrased or rewritten. A small number of the statements (items 10, 7, 6, 5, 3), five of them (15%), were revised by the researcher himself. E.g., item 3 and item 5 the word "others" was revised into "classmates"; or item 7 "When someone tells me how to do something in class, I learn it better" was changed into "When teacher tells me how to do something in class, I learn it better" and so on

Participants

the participants consisted of 527 ethnic students who were randomly selected from over 4000 ethnic students at TNU. The students are all native speakers of Vietnamese. They were respondents to the Language Learning Strategy Questionnaire

(LLSQ) and the Perceptual Learning-Style Preference Questionnaire (PLPQ). Most of the students are 18-35 years of age and they are from different learning styles.

Data Collection Procedures

The quantitative data was collected from ethnic students at Thai Nguyen University. As a first step in the process of data collection, the researcher contacted the directors of the Academic Affairs and Student Affairs Department at TN University of Sciences (TNUS), TN University of Agriculture and Forestry (TUAF), TN University of Technology (TNUT) and TN University of Education (TNUE), explaining the nature and purpose of the study. Permission was granted to conduct the study. The students were notified in advance that they would be completing the two questionnaires on a certain day. Before the questionnaires were administered, the students were given guidelines and instructions for administering the questionnaire.

The ethnic students were fully informed, both verbally and in writing, of the following: their rights, what was required of them, and how the data collected was going to be used and treated in regard to their privacy. The students were informed that their participation was entirely voluntary and that they were not under any obligation to consent to participate. The LLSQ and the LPLQ were administered to all ethnic students in (n=527) during the first week of the semester in academic year 2015-2016. The purpose of the questionnaire is to explore and examine students' learning strategy uses, the possible patterns of variation between LLS and ethnic students' gender, major fields of study, and levels of proficiency. After finishing the LLSQ, the ethnic students were asked to complete the PLPQ with the aim to explore the ethnic students preferred learning styles. The two questionnaires took students 1 hour to complete.

IV. RESULTS AND DISCUSSIONS

1. What English language learning strategies are frequently used by the TNU ethnic students?

According to Oxford's (1990) classification, the range of 3.5-5.0 (mean score) for each of the SILL item is thought to reflect the high level use of the strategy; a mean of all participants in the range of 2.5-3.4 is thought to be in medium use, and 1.0-2.4 belongs to low use.

Table 1 below shows overall picture of ethnic students' reported strategy use in terms of overall strategy use. As can be seen in Table 2.2, the mean frequency score of the ethnic students' reported overall strategy use is 3.20. This means that these 527 ethnic students at Thai Nguyen University, as the whole, reported employing language learning strategies with moderate frequency when they have to deal with language learning.

Table 1: Frequency of Students' Overall Strategy Use

	N	Mean	S.D	Frequency Category
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Students' Reported Overall Strategy Use	527	3.20	.20	Medium use
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Regarding frequency of use of strategies in six main categories, Table 2 below shows the application of all language learning strategies used by ethnic students at Thai Nguyen University. No strategy groups were reported as “never or almost never used”. In other words, 527 ethnic students at TNU used all six categories of learning strategies at a medium level. Basically, the ethnic students actively applied a variety of strategies to facilitate acquiring English. As can be seen in Table 2.3, ethnic students reported using metacognitive strategies more frequently than other strategies (M=3.42, SD=.53), and this was followed by compensation strategies (M=3.28, SD=.45), social strategies (M=3.22, SD=.61), memory strategies and affective strategies (M=3.19, SD=.45). Cognitive strategies ranked the lowest (M=3.04, SD=.32). In other EFL studies, too, metacognitive and compensation strategies were found to be among the most highly frequently used strategies and memory strategies, the least frequently used ones, as in Wharton, 2002; Yang,1994; Oh, 1992; and Green, 1991, to name a few.

Table 2: Frequency of Use of Strategies in the Six Main Categories

	N	Mean	S.D	Frequency Category
Memory Category	527	3,19	,45	Medium use
Cognitive Category	527	3,04	,32	Medium use
Compensation Category	527	3,28	,53	Medium use
Metacognitive Category	527	3,42	,45	Medium use
Affective Category	527	3,19	,57	Medium use
Social Category	527	3,22	,61	Medium use

In finding the relationship between the ethnic students' choice of language learning strategies and their perceptual learning styles, One-way ANOVA (analysis of variance) was applied to test whether there was a significant relationship between students' English learning strategies and learning style preferences, and the significant level was set at $p < .05$. Table 3 reveals the means and standard deviations of the subjects' overall strategy use by the six learning style preference groups. The mean scores show that the visual learning style students use the fewest strategies (M = 3.18), whereas the kinesthetic and group learning style students use the most (M = 3.21). However, the difference did not reach significance level (F = 0.44, $p > .05$), i.e., no significant differences were found

V. CONCLUSION

among the six learning style groups in overall strategy use. According to “good language learner” studies, good language learners use learning strategies more often and are able to apply the appropriate learning strategies to their own learning style, personality, and the demands of the task. In contrast, the less successful language learners sometimes are not able to match the appropriate strategies with the task during the learning process. In the present study, the results showed that none of the six learning style groups used significantly more strategies than any other group.

Table 3 Overall Students Learning Style Preferences

	N	Mean	Std. Deviation
Visual	135	3,18	,18
Tactile	103	3,20	,20
Auditory	63	3,19	,21
Kinesthetic	65	3,21	,21
Group	78	3,21	,18
Individual	83	3,20	,20
F= .44, p = .81 ($p > .05$)			

All in all, the results showed that learning styles did not have much influence on the learning strategy use. Those results did not support the previous studies. Based on Wen and Johnson's (1997) statement, they proposed that learning styles would influence the strategy use, but in the present study, the results did not show this conclusion. However, for more detailed discussion, among the six types of learning strategies, there is significant difference existing on social strategy and learning styles. From the findings, the researchers found that learners with auditory learning style use more social strategies than those with visual learning style. According to Celce-Murcia (2001), the main characteristics of visual are those who prefer to have information presented in graphs, maps, plots and illustrations, whereas auditory learners are those who depend on hearing and speaking as a main way of learning. Auditory learners must be able to hear what is being said in order to understand and may have difficulty with instructions that are written. They rely on listening input such as conversation to sort through the information that is sent to them.

In sum, the results of the present study showed that TNU ethnic students were medium strategy users. However, one strategy category, i.e., metacognitive category, was used at a high frequency as the most frequently used strategy

category. Memory and cognitive strategies were used as the least frequently used categories by the participants of the study. In addition, learning styles did not have much influence on the learning strategy use. However, the relationship between students' choices of strategy use and learning styles is still complex because it is bi-directional - it cannot be clearly determined whether learning strategy use is the cause or result of students' learning styles.

REFERENCES

- [1] Bedell, D. (1993). *Cross cultural variation in choice of language learning strategies: A mainland Chinese investigation with comparison to previous studies*. Unpublished master's thesis. University of Alabama, Tuscaloosa.
- [2] Chamot, A. U. (2001). The role of learning strategies in second language acquisition. In M. P. Breen (Ed.), *Learner contributions to language learning: new directions in research*. Essex: Pearson Education Limited.
- [3] Claxton, C. S., & Murrell, P.H. (1987). Learning styles: Implications for Improving Educational Practice. (Vol. 4): Washington, DC: George Washington University.
- [4] Corbett, J. (1999). Chewing the fat' is a cultural issue. *IATEFL 1*(48), 2-3.
- [5] Ehrman, M., & Oxford, R. . (1995). Cognition plus: correlates of language learning success. *The Modern Language Journal*, 79(1), 67-89.
- [6] Ellis, R. (1997). *The study of second language acquisition*. Oxford: Oxford University Press.
- [7] Felder, R. M., & Silverman, L.K. (1998). Learning and Teaching Styles in Engineering Education. *Engineering Education*, 78, 674-681.
- [8] Green, J. M. (1991). *Language learning strategies of Puerto Rican university students*. Paper presented at the Puerto Rico Teachers of English to Speakers of Other Languages, San Juan, Puerto Rico.
- [9] Guild, P. (1994). The culture/leaning style connection. *Educational Leadership*, 51(8), 16-21
- [10] Keefe, J. K. (1982). Assessing student learning styles: an overview, in J. W. Keefe (ed.), *Student Learning Styles and Brain Behavior*, Reston, VA: National Association of Secondary School Principals. pp. 43-53.
- [11] Liang, T. (2009). Language Learning Strategies --- The Theoretical Framework and Some Suggestions for Learner Training Practice. *English Language Teaching*, 2(4), 199-206.
- [12] Minh, D. D. (2012). *Language Learning Strategy Employed by Science-oriented University Students in Vietnam*. Unpublished doctoral dissertation. Suranaree University of Technology, Thailand.
- [13] Myers, I. B., & McCaulley, M. H. (1985). *Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator*, Palo Alto, CA: Consulting Psychologists Press.
- [14] Oh, J. (1992). Learning strategies used by university EFL students in Korea. *Language Teaching (Korea)*, 1, 11-22.
- [15] O'Malley, J. M., & Chamot, A. U. (1995). *Learning Strategies in Second Language Acquisition*. UK: Cambridge University Press.
- [16] Oxford, R. (1990). *Language Learning Strategies: What every teacher should know*. Boston: Heinle & Heinle.
- [17] Rahimi, M., & Riazi, A. (2005). Iranian EFL learners' pattern of language learning strategy use. *Journal of Asia TEFL*, 2(1), 103-129.
- [18] Reid, J. M. (1995). *Learning styles in EFL/ESL classrooms*. Boston: Heinle and Heinle.
- [19] Rubin, J. (1987). *Learner strategies in language learning*. Cambridge: Prentice-Hall.
- [20] Schmeck, R. R. (1998). *Learning Strategies and Learning Styles*. New York: Plenum Press.
- [21] Salahshour, F. S., M. (2013). The relationship between language learning strategy use, language proficiency level and learner gender. *Social and Behavioral Sciences*, 70, 634 - 643.
- [22] Skehan, P. (1989). *Individual differences in second-language learning*. London: Edward Arnold.
- [23] Weinstein, C. E., Husman, J., & Dierking, D. (2000). Self-regulation interventions with a focus on learning strategies. In P. M. Boekaerts, P., & Zeidner, M. (Ed.), *Handbook of self-regulation* (pp. 727-747). New York: San Diego Academic press
- [24] Yang, M. (2010). *Language Learning Strategies Of English As A Foreign Language University Students In Korea*. UMI Dissertations Publishing.
- [25] Zeynali, M. (2012). Exploring the gender effect on EFL learners' learning strategies. *Theory and Practice in Language Studies*, 2(8), 1614-1620
- [26] Zhang, C. (2005). The study of language learning strategies of non-English majors. *Sino-US English Teaching*, 2(5), 36-41.

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Correlation of impaired flow mediated dilatation in coronary artery disease patients with erectile dysfunction in north Indian population

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Abstract- Endothelial dysfunction, an important antecedent event in atherosclerosis development, has been suggested as the common pathophysiological factor between erectile dysfunction (ED) and coronary artery disease (CAD). Flow mediated dilatation (FMD) is frequently used, reliable non invasive marker for endothelial assessment. The present study, we set out to address the relationship of FMD with ED patients undergoing diagnostic coronary angiography. 243 male patients were enrolled in this study. Patients were evaluated by the erectile dysfunction domain of IIEF, a self validated 15 items. There was statistically significant value ($P = .0001$) between the severe ED patients and extent of CAD. Also the result shows that moderate and severe ED was more in patients with impaired FMD $< 5.5\%$ as compared to those with normal, FMD $> 5.5\%$. This association was statically significant, P value ($< .001$). Thus the study finally concludes that functional endothelial abnormality seems to contribute to generalized vascular atherosclerotic process.

Index Terms- Endothelial dysfunction, coronary artery disease, erectile dysfunction, and flow mediated dilatation.

I. INTRODUCTION

Endothelial dysfunction is observed in the early stages of atherosclerosis, and this abnormality can be assessed by measuring flow-mediated dilatation of the brachial artery (FMD) (1-3). FMD is thought to be a marker of vascular damage and/or a predictor of future cardiovascular events in subjects with cardiovascular disease (CVD) risk factors (1-3). The relationship between ED and cardiovascular diseases (CVD) has received considerable attention because they not only often coexist but also share multiple risk factors including diabetes, hypertension, hyperlipidaemia, obesity and smoking. The presence of concomitant ED is known to predict future coronary heart disease, stroke and increased mortality in both low-risk and high-risk cardiovascular patient populations, independent of conventional cardiovascular risk factors (4-6).

Flow-induced vasodilation is an endothelium-dependent process, and impaired response to reactive hyperaemia-induced shear stress is a sign of endothelial dysfunction. Ultrasonographic assessment of brachial artery flow-mediated vasodilatation (FMD) is a frequently used, reliable and reproducible non-invasive surrogate marker for endothelial function assessment (7-

8). Impaired brachial artery FMD in patients with ED has previously been reported, usually in patients without associated CAD, thus demonstrating the presence of endothelial dysfunction in these patients (9-14).

There are no data regarding the endothelial function, FMD and ED in these patient populations with angiographically documented CAD. The present study was conducted to examine the relationships between FMD and ED among patients undergoing coronary angiography for CAD.

II. METHOD

Design and Subjects:

The present study was conducted in the Department of Cardiology, King Georges Medical University, Lucknow. 243 Patients were enrolled in our study from November 2011 to October 2012 as per the inclusion criteria. Patients were evaluated by using IIEF questionnaire, and were divided into groups according to IIEF scores, angiographic involvement of coronary arteries, and presentation (acute and chronic). All the patients with ST elevation myocardial infarction, non ST elevation myocardial infarction or unstable angina having angiographically proven CAD, $> 50\%$ lesion in at least one coronary artery, were included in this study. All patients went for the evaluation of erectile dysfunction at urology department. Patients with psychogenic and neurogenic cause of erectile dysfunction, chronic renal failure, cirrhosis, hypothyroidism, hyperthyroidism and also with pelvic, urethral, penile injury were excluded from the study. After the enrollment, patients were subjected to detailed history, physical examination, investigations including complete hemogram, lipid profile, blood sugar and renal function tests and treatment as per the protocol of the department. After taking the informed consent were obtained from all the patients they were divided into two groups based on the basis of presentation:

Group 1 - Acute Presentation (STEMI, NSTEMI, UA)

Group 2 - chronic (CSA)

Groups were divided according to coronary angiography findings –

Group A - minimal disease or single vessel disease

Group B – double vessel or triple vessel disease

Significant coronary artery disease was defined as $> 50\%$ luminal diameter stenosis

Evaluation of erectile function:

Erectile dysfunction was evaluated by the erectile function domain of the International Index of Erectile Function (IIEF-EFD) a validated 15-item self-administered questionnaire. IIEF questionnaire(15) was administered to patients after a mean time interval of 3 days since the admission to the hospital. Erectile function is specifically addressed by six questions that form the so called 'erectile function domain' of the questionnaire. Each question is scored 0 to 5.

Assessment of the Flow-Mediated Dilatation of Brachial Artery:

Subgroup analysis was also done by doing flow mediated dilation in patients endothelial function in the form of flow-mediated brachial artery vasodilatation (FMD) was measured using high-frequency 7.5 MHz ultrasound probe at our department. FMD of the brachial artery was assessed from the subject's left arm once it was comfortably immobilized in the extended position. The diameter of the brachial artery is measured by a 7.5 MHz ultrasound probe, positioned 5 cm above the elbow, at rest and during reactive hyperemia induced by 5-min occlusion of the brachial artery by an inflated cuff positioned on the forearm. FMD (%) was defined as maximum vessel diameter change after cuff deflation/average control diameter. Flow mediated dilatation of <5.5% was taken as impairment, based on available literature(16). Vasoactive medications, such as nitrates, calcium antagonists, angiotensin-converting enzyme inhibitors, and beta blockers were withheld 24 to 48 h before the study. Caffeinated beverages and smoking were not allowed on the day of the study.

Statistical analysis:

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software. The values were represented in Number (%) and Mean±SD. The ANOVA test was used to compare the within group and between group variances amongst the study groups *i.e.* the three different sealers. Analysis of variance of these three sealers at a particular time interval revealed the differences amongst them. ANOVA provided "F" ratio, where a higher "F" value depicted a higher inter-group difference.

III. RESULTS

During the one year period of study, a total of 243 patients with CAD (acute and chronic), undergoing coronary angiography in the Cardiology Department of King George's Medical University, were enrolled. The baseline characteristics of the patients (only male patients enrolled) were similar in both groups shown in **Table 1**. Mean age of patients in group A was 56 ± 8.43 yrs, and in group B patients was 58 ± 8.53 yrs. The average systolic blood pressure was 143.48 ± 14.17 mm Hg and diastolic 82.54 ± 8.82 mm Hg at presentation in hospital during this study. In group A, 57.3 % Patients were hypertensive where as group B, 54.7 % Patient were hypertensive. Hypertension was defined as systolic BP greater than 140 mm of Hg and diastolic greater than 90 mm of Hg. Smoking and tobacco usage percentages in group A and B were 35.4% and 31.7% respectively. Patients in both groups had comparable proportion of diabetic patients, 41.5 % and 42.33% in group A and B respectively. The mean BMI of

patients in group A and group B was 24.75 and 25.32 respectively. Patients having BMI above 25 indicates obesity (BMI >25 according to Indian standards). Low ejection fraction was seen (LVEF <50%) in 135 patients (55.55%) out of total 243 patients. In our study majority of patients had acute presentation, 171 patients (70.3 %) presented as ACS (STEMI, NSTEMI, UA) where as patients with chronic stable angina comprised smaller fraction of 72 patients (29.6%), **Table-1**. The CVD risk factors were defined as follows: obesity: BMI ≥ 25; smoking: current smoker; hypertension: blood pressure levels at the time of measurement of FMD ≥ 140/90 mmHg; hypercholesterolemia: TC ≥ 6.22 mmol/L; diabetes mellitus: FPG 6.99 > mmol/L.

In this study patients with progressive lower IIEF score (severe ED), more frequently had triple or double vessel CAD on coronary angiography. Group B (double vessel ds or more) patients had more prevalence of severe ED as compared to Group A (single vessel or minimal ds) This finding was statistically significant (P = .0001). The correlation between severe ED and extent of CAD is demonstrated in **Table-2 and Figure-1**

Table-3 shows that moderate and severe ED was more in patients with impaired FMD <5.5% as compared to those with normal, FMD > 5.5%. This association was statistically significant, P value (<.001). Thus functional endothelial abnormality seems to contribute to generalized vascular atherosclerotic process **Figure-2**.

IV. DISCUSSION

There is rapidly growing interest in the association between ED and risk of CAD. A recent Meta-analysis by **Jia-yi-dong et al(17)**, of 12 prospective cohort studies, provides evidence that ED is significantly and independently associated with an increased risk of CVD, CHD, stroke, and all-cause mortality. Men with ED, compared with the reference group, experienced a significantly increased risk of 48% for CVD, 46% for CHD, 35% for stroke, and 19% for all-cause mortality. ED may be considered an independent risk factor of CAD.

At present, the association between ED and CAD is not fully understood. It is well accepted that CAD is a risk factor of ED. It is also recognized that ED is a marker of further vascular diseases. However, whether ED is independently associated with incidence of CVD remains controversial. Results from sensitivity analysis restricted to studies with control for conventional cardiovascular risk factors, including age, body mass index, blood pressure, diabetes, cholesterol, and smoking, suggest that ED is probably an independent risk factor of CVD. Moreover, if ED was merely an early marker, it would be more likely to occur near the time of onset of cardiovascular events. In fact, the mean length of follow-up in primary studies ranged from 4 to 16 years. Such a large interval between the 2 diseases further supports the hypothesis that ED is an independent risk factor.

In our study majority of patients had acute presentation, 171 patients (70.3 %) presented as ACS (STEMI, NSTEMI, UA) where as patients with chronic stable angina comprised smaller fraction of 72 patients (29.6%), ED was seen more in patients with ACS (65.50%) compared to stable angina (51.38) but no statistical significant association seen between presentation of CAD and prevalence of ED. This finding was different from

study by PieroMontorsi et al(18)which showed more prevalence of ED in patients of stable angina.

Another explanation is endothelial function is a systemic phenomenon, and it has been proposed that FMD might provide indirect but relevant information on clinically more valuable vascular beds. Flow-mediated dilation is strongly influenced by the presence of risk factors and their interaction(19). However, it remains to be clarified whether the assessment of endothelial function provides information that is additive to, or whether it simply recapitulates, that of traditional risk factors. Findings concerning the existence of a correlation between FMD and the extent of CAD patients with erectile dysfunction are somewhat controversial.

In this study 42.7 % of total patients had impaired FMD ,out of these moderate and severe ED was more(31.73%) in patients with impaired FMD <5.5% as compared to those with normal FMD > 5.5% i.e(10.07 %). This association was statistically significant, P value (<.001). Thus functional endothelial abnormality seems to contribute to generalized vascular atherosclerotic process. Thus this suggests that patients with CAD have impaired endothelial function prior to development of actual anatomical obstruction, as in our study 42.7 % had impaired FMD, one third of these cases also had severe ED suggesting generalized involvement of endothelium in systemic vasculature involving penile arteries also. Only 8.65% of patients had normal penile erections those having impaired FMD, whereas only 10.07% with normal FMD had abnormal penile erections. Large percentage (42.7%) in our study population had abnormal FMD suggesting importance of endothelial dysfunction in development of CAD, ED may alarm about ongoing endothelial dysfunction, which may involve coronary bed in future.

In our study, we showed a relationship between FMD values and IIEF scores in a patient population with ED and CAD. This correlation of FMD in brachial artery suggests that the endothelial dysfunction in ED is not confined to the cavernosal circulation, but is probably a part of a generalized vasomotor. Endothelial dysfunction is the key feature in the early phase of ED, whereas it is one of many factors accounting for sexual dysfunction in the late phase of the disease. Evidence is accumulating in favor of ED as an independent predictor of future cardiovascular events in patients without overt heart disease.

V. CONCLUSION

From this study it has shown that erectile dysfunction is a common in north Indian patients with angiographically documented CAD, with most patients have modest or severe erectile dysfunction. It has been also shown that impaired FMD is significantly correlated with erectile dysfunction patients. Result implicating that endothelial dysfunction as an important underlying pathophysiological factor in CAD patients.

CONFLICT OF INTEREST-None

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REFERENCES

- [1] Widlansky ME, Gokce N, Keaney JF Jr, Vita JA: The clinical implications of endothelial dysfunction. *J Am Coll Cardiol* 2003; 42: 1149–1160.
- [2] Moens AL, Goovaerts I, Claeys MJ, Vrints CJ: Flow-mediated vasodilation: a diagnostic instrument, or an experimental tool? *Chest* 2005; 127: 2254–2263.
- [3] Corretti MC, Anderson TJ, Benjamin EJ, et al, International Brachial Artery Reactivity Task Force: Guidelines for the ultrasound assessment of endothelial-dependent flow-mediated vasodilation of the brachial artery: a report of the International Brachial Artery Reactivity Task Force. *J Am Coll Cardiol* 2002; 39: 257–265.
- [4] Roumeguere T, Wespes E, Carpentier Y, Hoffmann P, Schulman CC. Erectile dysfunction is associated with a high prevalence of hyperlipidemia and coronary heart disease risk. *Eur Urol* 2003; 44: 355–9.
- [5] Gazzaruso C, Giordanetti S, de Amici E, Bertone G, Falcone C. Relationship between erectile dysfunction and silent myocardial ischemia in apparently uncomplicated type 2 diabetic patients. *Circulation* 2004; 110: 22–6.
- [6] Dong JY, Zhang YH, Qin LQ. Erectile dysfunction and risk of cardiovascular disease: meta-analysis of prospective cohort studies. *J Am Coll Cardiol* 2011; 58: 1378–85.
- [7] Celermajer DS, Sorensen KE, Gooch VM, Spiegelhalter DJ, Miller OI. Non-invasive detection of endothelial dysfunction in children and adults at risk of atherosclerosis. *Lancet* 1992; 340: 1111–5.
- [8] Corretti MC, Anderson TJ, Benjamin EJ, Celermajer D, Charbonneau F et al. Guidelines for the ultrasound assessment of endothelial-dependent flow mediated vasodilation of the brachial artery: a report of the International Brachial Artery Reactivity Task Force. *J Am Coll Cardiol* 2002; 39: 257–65.
- [9] Lojanapiwat B, Weerusawin T, Kuanprasert S. Erectile dysfunction as a sentinel marker of endothelial dysfunction disease. *Singapore Med J* 2009; 50: 698.
- [10] Ucar G, Secil M, Demir O, Demir T, Comlekci A et al. The combined use of brachial artery flow-mediated dilatation and carotid artery intima-media thickness measurements may be a method to determine vasculogenic erectile dysfunction. *Int J Impot Res* 2007; 19: 577–83.
- [11] Kaya C, Uslu Z, Karaman I. Is endothelial function impaired in erectile dysfunction patients? *Int J Impot Res* 2006; 18: 55–60.
- [12] Uslu N, Gorgulu S, Alper AT, Eren M, Nurkalem Z et al. Erectile dysfunction as generalized vascular dysfunction. *J Am Soc Echocardiogr* 2006; 19: 341–6.
- [13] Kaiser DR, Billups K, Mason C, Wetterling R, Lundberg JL et al. Impaired brachial artery endothelium-dependent and -independent vasodilation in men with erectile dysfunction and no other clinical cardiovascular disease. *J Am Coll Cardiol* 2004; 43: 179–84.
- [14] Chiurlia E, D'Amico R, Ratti C, Granata AR, Romagnoli R et al. Subclinical coronary artery atherosclerosis in patients with erectile dysfunction. *J Am Coll Cardiol* 2005; 46: 1503–6.
- [15] Cappelleri JC, Rosen RC, Smith MD, Mishra A, Osterloh IH. Diagnostic evaluation of the erectile function domain of the international index of erectile function. *Urology* 1999; 54: 346–351.
- [16] Corretti MC, Anderson TJ, Benjamin EJ, et al. International Brachial Artery Reactivity Task Force. Guidelines for the ultrasound assessment of endothelial-dependent flow-mediated vasodilation of the brachial artery: a report of the International Brachial Artery Reactivity Task Force. *JACC* 2002; 39: 257–65.
- [17] Jia-YI -dong et al, Meta-analysis, erectile dysfunction and cardiovascular risk vol 58, NO. 13, *JACC* 2011.
- [18] PieroMontorsi, Paolo M. Ravagnani, Stefano Galli. Association between erectile dysfunction and coronary artery disease. Role of coronary clinical presentation and extent of coronary vessels involvement: the COBRA trial. *European Heart Journal* (2006) 27, 2632–2639

[19] Celermajer DS, Sorensen KE, Bull C, Robinson J, Deanfield JE. Endotheliumdependent dilation in the systemic arteries of asymptomatic subjects relates to coronary risk factors and their interaction. J Am Coll Cardiol 1994;24:1468-1474.

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Table 1: Base line characteristics in two groups (Group A and Group B)

	Group A (Single Vessel) (n=82) Mean±SD	Group B (Double vessel or more) (n=161) Mean±SD	p value
Age (Years)	56.83±8.43	58.08±8.53	0.25 NS
Diabetes Mellitus	34 (41.5%)	68 (42.33%)	1.0
Hypertension	47 (57.3%)	88 (54.7%)	0.56
Smoking	29 (35.4%)	51 (31.7%)	0.78
Mean Hb (gm%)	11.59±1.25	11.52±1.78	0.46 NS
Serum Creatinine (mg/dl)	1.28±1.07	1.14±0.3	0.12 NS
LVEF %	52.45±8.85	48.92±11.15	0.08 NS
BMI kg/m ²)	24.75±2.90	25.32±2.93	0.15 NS
Beta blocker	22%	38%	0.056%
Statins	21%	32%	0.062%

Table 2: Correlation of severity of ED and CAD in two groups (Group A and Group B)

	Group A Single vessel ds (n=82)	Group B Double vessel ds. or more (n=161)	OR CI	P value
No ED	51 (62.2)	33 (20.5)	-	-
Mild ED	8 (9.8)	22 (13.66)	4.25 (1.69-10.66)	0.001
Mild-Mod ED	11 (13.41)	24 (14.90)	3.37(1.45-7.79)	0.0047
Mod ED	10 (12.2)	44 (27.32)	6.80(3.01-15.36)	0.0001
Severe ED	2 (2.44)	38(23.60)	29.36(6.63-130.05)	0.0001

Table 3: Correlation of FMD and ED with CAD

	>5.5 % (n=139)	<5.5% (n=104)	OR CI	P value
No ED	65 (46.76)	9 (8.65)	-	-
Mild ED	17 (12.233)	9(8.65)	1.47 (0.63-3.44)	0.40
Mild moderate	23 (16.54)	15 (14.42)	1.17 (0.58-2.38)	0.72
Mod ED	20 (14.38)	38 (36.5)	3.42(1.84-6.36)	<0.001
Severe ED	14 (10.07)	33 (31.73)	4.15 (2.08-8.27)	<0.001

Figure 1-The correlation between severe ED and extent of CAD

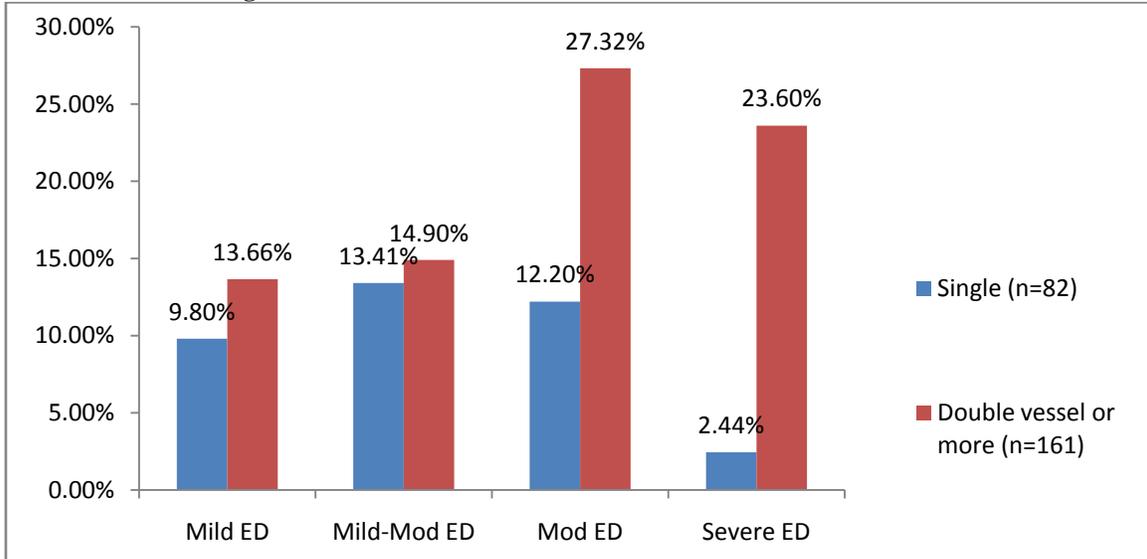
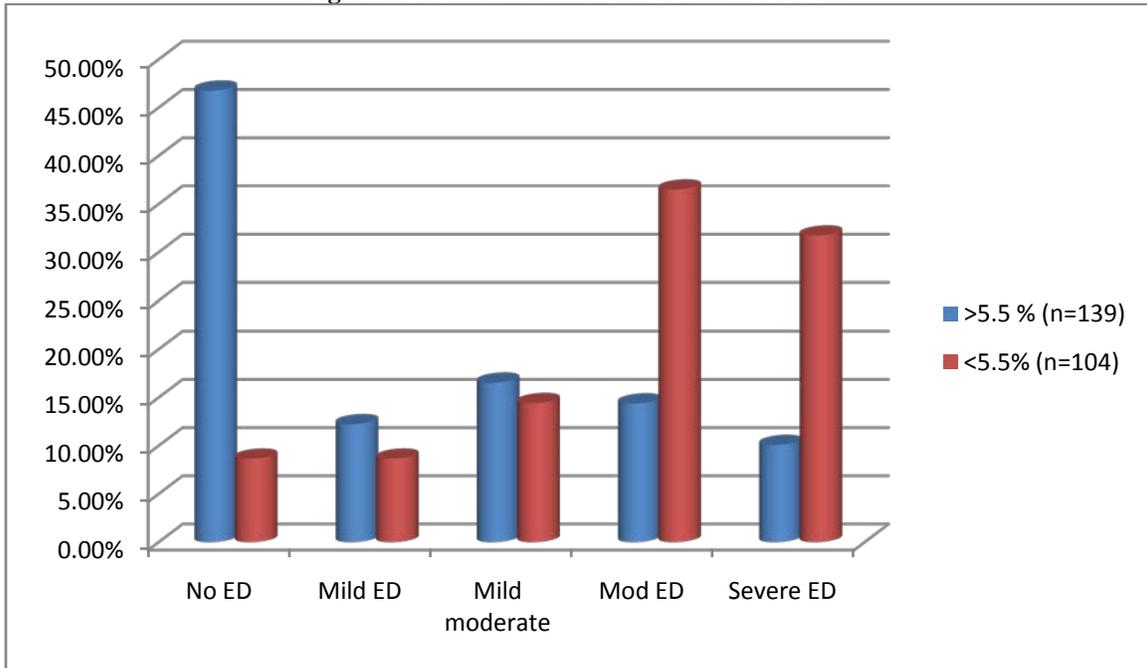


Figure 2: Association of FMD and ED with CAD



Population, Incipient Desertification and Prediction of Household Agroforestry Uptake in Tabora Region, Tanzania

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Abstract- Environmental conservation in the world presents a daunting task due to population increase. In Tanzania, environmental degradation has occurred at an alarming rate in specific areas including Tabora. The continued burgeoning of the human population has resulted in changes in land use, increasing demand for resources and excision of forests. This study employed the theory of planned behaviour to predict on-farm tree planting behaviour of farmers. A sample size of 288 farmers drawn from Nzega and Sikonge districts in Tabora region was interviewed to measure standard theory of planned behaviour constructs. The data and hypotheses were examined using structural equation modeling performed in partial least squares algorithms. Results from the maximum likelihood estimation showed that attitudes, subjective norms and perceived behavioural controls were significantly and positively associated with stronger intention and related to farmers' behaviours in farming decisions. Farmers saw hindrance in tree planting operations being a result of cultural beliefs which yielded negative impacts. However, these were outweighed by perceptions of positive impacts. The drivers of these constructs can be harnessed by policy makers by directing farmers' intentions and behaviours toward conserving and sustaining fragile eco-environmentally areas against a threatening population growth in the region through agroforestry uptake programs.

Index Terms- Population growth, Deforestation, Tree planting, Gender, Theory of planned behaviour.

1. INTRODUCTION

Population increase, agricultural productivity and environmental degradation have characterised many developing countries including Tanzania. These trends have negatively impacted on the development and natural resources, amidst the increasing demand for resources in the wake of ever increasing population. Environmental degradation in several parts of Tanzania not only affects biodiversity but also has a direct impact on water quantity and quality, livelihood, poverty and development of a nation.

The Tanzanian population grew from about 12 million people in 1967 to 44.9 million in 2012, almost four times. With the annual population growth rate of 2.7 percent, Tanzania's population is projected to go up to 69.1 and 129.1 million in 2025 and 2050 respectively [1]. Population growth, in both rural and urban areas, is the underlying factor behind rapid rates of deforestation in Tanzania. Population growth intensifies the necessities for basic needs such as food, shelter, infrastructure development, fuelwood, furniture, construction materials and other products. In meeting these accumulating demands, deforestation is inevitable. The impact of population growth on deforestation is worsened by the reality that the growing population remains in poverty with limited livelihood strategies and, therefore, compelled to undertake unsustainable economic options including deforestation.

Tanzania is facing an exceptional loss of its forests and other woodlands. Over the last three decades, blocks of forests in Tanzania have been heavily impacted by official forest excisions as well as illegal, irregular and unplanned settlements. Evaluation of vegetation cover change based on time-series satellite images and repeated aerial surveys showed that between 1990 and 2010, the country lost an average of 403,350 ha or 0.97 percent per year and also, between 1990 and 2010 the total loss was estimated to be 19.4 percent (about 8,067,000 ha) of the forest cover [2]. Within this timespan, Tanzania was, among the ten countries that had the largest annual net loss of forest area. A recent report indicates that the country had already lost about 38 percent of its forest cover [3]. According to the report, the rate of loss is 400,000 ha per year and the risk considered to be high as the country's entire forests are likely to be depleted within the next 50 to 80 years if the current trend remains persistent.

Although there are information gaps for some disciplines on a sustained basis, already links have been suggested between population growth, land cover change, land degradation and an acute shortage of water [4]. Among the reasons for desertification caused by population growth are deforestation, overgrazing and over cultivation. Expansion of agriculture, especially the massive clearance of

land for cultivation of cash crops such as cotton and tobacco to increase export earnings has been mentioned as one of the leading causes of deforestation in Tanzania [5].

While data for various land vegetation in Tanzania from 1990 to 2010 displays a declining trend for forests and other wooded lands, subsistence agriculture alone is accountable for 48 percent of deforestation while commercial agriculture contributes 32 percent [6]. In Tanzania, the impact of agriculture on deforestation (see figure 1) is affected by a number of factors including human population growth, poverty and unfavourable government policies. Human population increase translates into the expansion of land under agriculture in forest areas in order to meet the growing demand for food and income. As pointed out earlier, poverty is linked to incapability to afford the agricultural inputs for bumper crop production. As a consequence, people are forced to leave the existing farms and clear virgin forests for new farms, the practice commonly known as shifting cultivation. To farmers, virgin lands have a number of advantages, making it less laborious. Virgin forest soils are easy to work with; fresh farms have fewer weeds for about two seasons. Therefore, weeding is very much lessened; new farms are less infested by pests; fresh forest soils are well drained and require minimum tillage before planting [7].

With reference to the 2002-2012 intercensal period, Tabora region's 2.9 percent average annual population growth rate was the 9th highest in the country [8]. It was also the 24th most densely populated region with 30 people per square kilometre. Census data for the last two decades indicate a dramatic population increase in Tabora region. The projections show that population growth rate will increase from 3.8 percent in 2003 (with a population of 1,777,437) to 3.9 percent in 2025 (with a population of 4,181,327) [9]. The rapid population increase since 1980 has occurred mainly due to the influx of farmers, attracted by fertile forest soils and improving infrastructure. The demand for water and other natural resources to serve basic needs is growing steadily as the population continues to increase. This is putting tremendous pressure on what are already scarce and highly vulnerable natural resources. Tabora region's land converted from natural vegetation to cultivated land (see figure 1) between 1984 and 1995 was 4.7 percent compared to 11.2 percent that was converted between 1995 and 2000 [10]. There is a total of 33 Forest Reserves which have a total area of 3,422,500 hectares out of which about 119,691 hectares are catchment forests, and as of now, about 201,017 hectares have disappeared through encroachment [11]. As a result of the high deforestation rate and subsequent fire-based agricultural land preparation with little or no fertiliser input, soil fertility has declined tremendously in the area. Natural secondary succession in the left bushlands and grasslands is also prevented by a constant annual recurrence of fire.



Fig 1. Miombo woodland invasion in Mitowo Village, Sikonge District, Tabora region

Source: Author, December, 2016

Agroforestry and reforestation practices, when appropriately directed toward biophysical and socio-economic conditions, have the potential to solve some of the problems of poverty, food insecurity and environmental degradation. Tree planting is essential to reduce the pressure on natural forests. It has been demonstrated that agroforestry and reforestation of public lands can augment the ability of farmers to face the effects of climate change [12], improve soil fertility and boost crop yields [13]. In Tanzania, several studies have

reported increased yields in agroforestry systems compared to monoculture crops [14]. Bumper crop yields coupled with the sale of tree products such as fruits, firewood and poles can increase income, as has been demonstrated in Tanzania, Nigeria and Zambia [15, 16, 17] respectively.

Although it is anticipated that recognition of the importance of forests is likely to increase tree planting, this has not always been the case with reference to Nzega and Sikonge districts of Tabora region. There are other factors which intervene and discourage farmers from planting trees within and surrounding their farms and compounds. Despite the multiple benefits associated with tree planting activities, it has been argued that agroforestry uptake has lagged behind [18]. The need to look for alternative approaches to reduce deforestation in Tabora region is widely acknowledged [19, 20]. However, there have been serious constraints in tree establishment on farmers' fields or on marginal lands because of various reasons.

Several studies have examined the challenges facing the uptake of agroforestry, yet conventional adoption studies have had a tendency to look at personal, social and economic variables when explaining agroforestry adoption [21, 22, 23, 24, 25].

Cultural beliefs, particularly in the Tanzanian context, have a strong influence on tree planting adoption. It is not easy to generalise about cultural norms and customary rulings because they differ from different people in various areas. In western Kenya, for example, tree planting activities are dominated by men and the concept of tree owners has been effectively sustained through well manipulated cultural practices (taboos) resulting in fewer women than men participating in tree activities [26, 27]. Cultural taboos observable in western Kenya are gender-bound such that a woman is feared to become barren or her husband is more likely to die if she dares planting a tree [28].

Traditionally, farmers in Tabora region do not grow trees because until recently, wood was regarded as plentiful and because they lacked information on tree planting and germplasm [29]. Therefore, farmer's knowledge on planting and management of trees in the region is limited. Even after the introduction of communal woodlots in the region, earliest efforts were not successful owing to among other things, farmers disliking the species (e.g. eucalyptus). Of more importance, farmers were unwilling to cooperate in the establishment of communal woodlots because of the perceived and actual implications of woodlots planting. As of recent (see figure 2), these woodlots have slowly been found to be economically and ecologically and socially sound in Tabora region [30].



Fig 2. Agroforestry in Ngwatu Village, Nzega District, Tabora region
Source: Author, December, 2016

More recent studies have also looked at socio-psychological factors, such as perceptions and attitudes, to explain adoption behaviour in relation to farm level tree planting [31, 32, 33, 13, and 25]. [34] for example studied the perceptions and attitudes of farmers in Pakistan and found that willingness to grow trees on the farms was a function of their attitudes towards the benefits and challenges of growing trees. [35] looked at the role of self-efficacy in the decision-making process of agroforestry adoption in Brazil and concluded that perceived behavioural control, attitudes about conservation and available labour contributed significantly to the intention to adopt

or maintain agroforestry and reforestation. Likewise, [36] claimed that socio-psychological factors of farmers need to be taken into consideration when planning socially acceptable agroforestry programs in the Western Himalayas.

Overall, these studies demonstrate that socio-psychological factors such as perceptions and attitudes can explain the incidence and extent of tree planting activities; however, many existing analyses have not taken into account the perspectives harnessed from local farmers [37, 38]. Specifically, relatively few studies have looked at the role of socio-psychological factors in explaining agroforestry and reforestation adoption. Owing to the methodological difficulties related to studying tree planting behaviour, it is unclear whether socio-psychological factors such as beliefs, norms, attitudes, and intentions are responsible for tree planting behaviour in Tabora region and Tanzania in general. The general objective of this study was to identify and evaluate the influential factors on attitudes toward participation in tree planting among households in selected community sub-samples drawn from the two districts of Tabora region, Tanzania. The specific objectives of this study were threefold. First to identify and analyse the factors that underlie farmers' decisions to engage in farm forestry. Secondly, to examine the gender differences in tree planting between farmers in the northern and southern districts of Tabora region and thirdly, to assess the utility and efficacy of the Theory of Planned Behaviour (TPB) (see figure 4) to explain farmers' intention to adopt agroforestry as an aid to the provision of practical information which may lead to curtailing deforestation and poverty.

Theoretical Framework and Research Hypotheses

Theory of Planned Behavior (TPB)

A modified TPB [39] was used in this study to predict and analyse farmers' socio-psychological factors toward tree planting. [39] TPB presents a theoretical framework for analysing in an orderly manner the behaviour concerning tree planting. In accordance with the theory, a person's behaviour is based on his or her preparedness to execute that behaviour (i.e. intention). This intention is primarily anchored on three antecedent determinants: (1) attitude (A), which is purely a personal positive or negative perception of executing a behaviour. An attitude is defined as "a person's favourable or unfavourable evaluation of the behaviour and is formed by the beliefs about the likely outcomes of the behaviour (salient beliefs) and the evaluations of these outcomes" [40]. (2) Subjective norm (SN), which is the individual's perception of social pressure to engage or not in a behaviour and is constructed by beliefs about the perceived behavioural control which reflects the extent to which the individual feels he or she can actually carry out the behaviour (normative beliefs) and the motivation to comply with these expectations. It refers to a person's understanding of other people's social pressure to execute or not to execute the behaviour [40]. Influence may stem from social referents like peers and (3) perceived behavioural control (PCB), which is a personal understanding of his or her ability to execute a given behaviour. It refers to the individual's perception of the fact that there exists personal and situational impediments to the performance of the behaviour. It reflects the extent to which the individual feels he or she can actually carry out the behaviour, which is based on beliefs and the perceived power of these factors [39]. In sum, the combination of the attitude toward the behaviour, the subjective norm, and the perception of behavioural control leads to the establishment of a behavioural intention, which consequently leads to the execution of the behaviour [39]. The TPB has been used to study the attitudes, intentions and behaviour in relation to farm-level tree planting and has been found to be a suitable model to understand such attitudes and behaviour [35] and [34].

Within the context of the TPB, more concentration is given to the identification of the underlying factors that influence separation behaviours. Several studies have recommended for additional variables to improve the predicting validity of the theory. A supportive example is drawn from Sao Paulo where moral obligation had a meaningful influence on the prevention behaviours among households [41]. Davis proposed that situational factors should also be added as a variable in the model [42]. This variable could be measured by evaluating the extent to which the respondents understand situational factors as impediments to performing tree planting behaviour. Ramayah put environmental knowledge as an additional variable to his model [43]. This particular study added situational factors in the model.

Research Hypotheses

The specific hypotheses tested by this study on the uptake of tree planting are stated below.

H1: Socio-demographic variables significantly and positively influence the TPB constructs which differ by gender and geographic locations.

H2: Farmers' attitudes toward tree planting significantly and positively influence their intentions to adopt on-farm tree planting.

H3: Farmers' subjective norms significantly and positively influence their intentions to adopt on-farm tree planting.

H4: Farmers' perceived behavioural control over tree planting significantly and positively influence their intentions to adopt on-farm tree planting.

H5: Farmers' intentions toward tree planting have a positive effect on on-farm tree planting behaviour.

H6: Situational factors have a significant influence on on-farm tree planting behaviour.

II. MATERIALS AND METHODS

Study area

Tabora Region is located in mid-western Tanzania on the central plateau, between latitudes 4°- 7°south and longitudes 31°- 34°east (Figure 3). The region covers an area of 76,150 km², representing 9 percent of mainland Tanzania, and lies at an altitude of between 1000 and 1800 metres above mean sea level. The area is bounded to the north by the Manonga Valley, to the east by Wembere River, to the south by the Ugalla River and the west by the Malagarasi swamps. Tabora region is located on an east-west trending regional watershed.

This study focused on two study sites in Tabora Region: the northern district Nzega and the southern district Sikonge. Nzega District is one of the seven districts of the Tabora region of Tanzania. It is bordered to the north by Shinyanga region, to the south and south-west by the Uyui District and to the east by the Igunga District. Its coordinates are 4°19'60" N and 33°4'60" E in degrees, minutes and seconds, [44]. Nzega district has a total land area of 6,961 square kilometres. Of these, 4,296 square kilometres are either forest reserves or natural forest. Its headquarters is in Nzega township. According to the 2002 Tanzania National Population and Housing Census, the population of the Nzega district was 417,097 and again according to the 2012 Tanzania Population and Housing Census, the population had increased to 502,252. The district of Sikonge, on the other hand, has its administrative seat in Sikonge township. The district, with geographical coordinates of 50 38' 0" S and 320 46' 0" N has an area of 27, 873 km² but 26,834 km² of it is occupied by forest and game reserves. It is bordered to the northwest by Urambo district, to the north by Uyui district, to the east by Manyoni district of Singida region, to the south by Chunya district of Mbeya region, and to the south-west by Mlele district of Katavi region. The population of Sikonge district was 133, 388 by 2002 and by 2012, it had risen to 179, 883 [45]. Sikonge District is characterised by relatively high levels of forest cover and low population densities. In contrast, most forests have disappeared in Nzega District, where population densities are high.

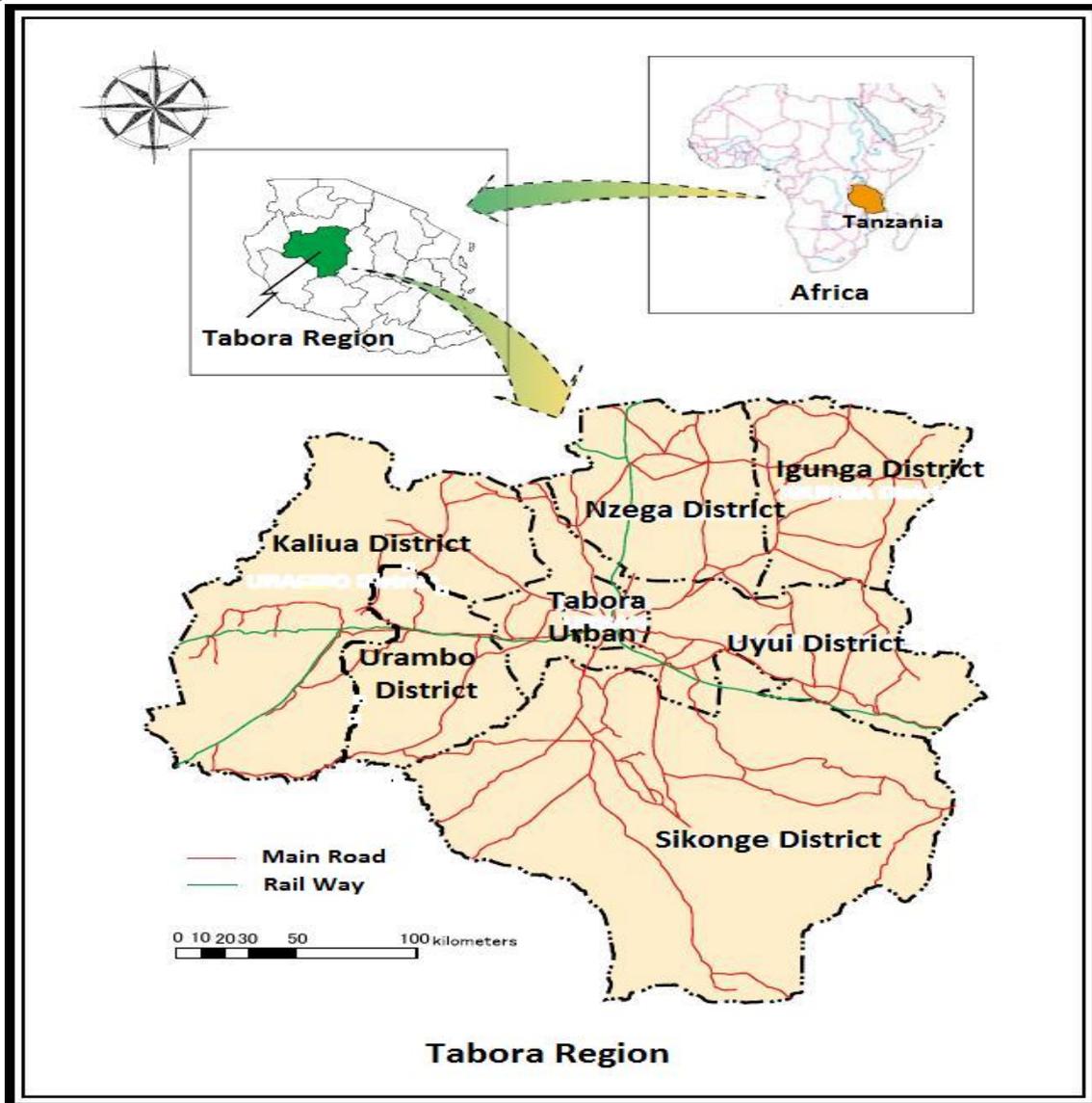


Figure 3. Map of Tabora region showing locations of research districts of Nzega and Sikonge.
Source: Modified from Japan International Cooperation Agency (JICA), 2009

Approach and Design

This study employed a mixed method approach, drawing on both quantitative as well as qualitative research methods [46]. A mixed methods approach is valuable as it can draw from the strengths and minimise the weaknesses of both and it is now being widely used and recognised as a research paradigm in itself [47]. A cross-sectional quantitative household survey was used to elicit information on respondents’ characteristics, their behaviour in relation to on-farm tree planting, as well as the attitudes, subjective norms and perceived behavioural control in relation to tree planting. In addition, qualitative focus group discussions were conducted to explore some of the findings in more detail and as a way of triangulating the results of the survey.

Sampling and Sampling Procedure

A total of 288 respondents were randomly selected from a sampling frame of 540 households established by the National Population and Housing Census of 2012 using the formula by [48]. The unit of analysis was the household and the subject of analysis was the household head.

$$S = \frac{s^2 NP(1 - P)}{d^2 (N - 1) + X^2 P(1 - P)}$$

Where:

s = required sample size

N = Sampling frame (the given population size, this case $N = 540$)

P = Population proportion that for table construction was assumed to be 0.50 as this magnitude yielded maximum possible sample size required.

d = degree of accuracy as reflected by the amount of error that can be tolerated in the fluctuation of a sample proportion (P)

χ^2 = Chi-square value corresponding to one degree of freedom relative to the desired level of confidence (95 percent)

Various researchers have found that using mixed methodologies during in-field studies are particularly helpful because it enables a study to capture the complexities seen on the ground [49]. This study combined household surveys, focus group discussions and field observations. The quantitative analyses add rigour to studies that often lack in agroforestry project evaluations [50].

A household survey was used to elicit information about respondents' attitudes, perceptions and behaviour in relation to tree planting. Preceding the survey, informal visits and discussions with farmers and an exploratory survey were conducted in both study areas to elicit information about beliefs, attitudes, normative referents and control factors in relation to tree planting. In these interviews, respondents were asked about their experiences with and opinions of planting trees and this information was used to develop the final questionnaire. The questionnaire comprised two parts. The first part contained questions about personal, household and farm characteristics, as well as questions on the extent of tree planting. Several socio-economic variables were extracted from this part of the survey and used in the analysis in this paper. These included age, sex, education level, employment, wealth, household size, estimated annual income (estimated by the respondent in the local currency) and farm experience. The questionnaire also asked respondents about any trees they have planted on their farms or on communal lands, making the behaviour studied reported rather than actually measured behaviour.

The second part of the questionnaire consisted of an attitude scale to assess the attitudes, subjective norms and perceived behaviour control towards tree planting. Based on the responses during the informal discussions and exploratory survey, items for an attitude scale were developed to measure the modified TPB constructs towards tree planting. The response format used in the attitude scale was a five-point Likert scale [51]. The components of attitude were each measured on a scale ranging from 'strongly agree' (5) to 'strongly disagree' (1). The components of subjective norm were evaluated on a scale ranging from 'strongly agree' (5) to 'strongly disagree' (1). The control beliefs were also measured on a scale ranging from 'strongly agree' (5) to 'strongly disagree' (1).

In each district, 12 villages were selected using random numbers from a list of villages provided by District Lands Officers. In each village, 12 households were selected randomly from the lists of all farm households in each village. The household head was interviewed, in most cases, this was a male, but in some cases, mostly due to divorce, death, separation or long term absence of the husband, the woman was the household head. If the head of the household was not available to be interviewed, another household was selected from the list using the random sampling procedure. In Nzega District, the household survey was administered to 65 male headed households and 79 female-headed households, whereas 86 male-headed households and 58 female-headed households were included in the survey in Sikonge. The final list was piloted to improve the order of the statements. The final questionnaire was administered to 288 respondents.

Upon completion of all interviews and surveys, interactive focus group discussions were conducted. They were carried out according to the methodology described by [52]. In each district, two focus group discussions were carried out with female participants and two with male participants resulting into 8 focus group discussions in total. Each Focus Group Discussion (FGD) consisted of 7-9 participants and lasted approximately one hour. After the villages had been selected, participants were selected randomly from the list of all farming households provided by the Village Executive Officers (VEOs). Some participants of the focus group discussions had also participated in the household survey in the preceding cycle. A discussion guide was developed and the focus group discussions were conducted in the national language of Kiswahili. The focus group discussions included several open discussion questions about people's experiences and opinions about tree planting.

Structured Equation Modeling

This study made use of the Structural Equation Modelling (SEM) approach performed in Partial Least Squares (PLS), a path modelling technique, to analyse the survey data. The SEM, as opposed to other widely used techniques (such as multiple regression, multivariate analysis of variance, factor analysis and path analysis) which can only treat a single relationship at a time, combines

factor analysis and multiple regression analysis which makes the investigation of a series of dependent relationship much easier [53]. SEM techniques should not be operated without a strong theoretical foundation for specification of both the structural and measurement models [54]. SEM has often been used to study environmental behaviour in different disciplines including tourism [55], agriculture [56], and risk perception [57]. Therefore, the usage of SEM along with the TPB was best suited for this study.

Measurement Scale

A measurement scale was developed for each major variable consisting of multiple items (indicators) borrowed from previous studies. Guided by the theoretical understanding derived from the literature, questionnaire items that were relevant to the constructs in this study were identified. The principal constructs were developed based on existing measures where possible or were adapted from similar scales. Measures for attitude (A), perceived behavioural control (PBC), and subjective norms (SN) (societal norms and social influences) were based on empirical studies of [25], [24], and [18]. Although most items were based on previous empirical studies, actual measurement scales were developed to capture the context of this study. The questionnaire items were then modified to match this study of on-farm tree planting in Tabora region.

Analytic Framework

The quantitative survey data collected was analysed using non-parametric statistical techniques to detect associations and differences between respondents of the two study sites and between male and female household heads. First, the psychometric quality of the measures was assessed by calculating their validity and reliability. Second, the theoretical relationship between the variables was tested by estimating structural models. To obtain more accurate results, the SEM technique using the PLS algorithms was applied to evaluate the measurement model and structural model simultaneously. To conduct a quantitative study on practical problems, the SEM assesses the theoretical model according to the extent of consistency between the theoretical model and the actual data. The use of the SEM is mainly justified in the social sciences due to its capacity to impute relationships between unobserved (latent variables) and observable constructs.

This approach lends itself to this research because SEM answers a set of interrelated research questions in a single, systematic, and comprehensive analysis [58]. It also accommodates latent variables (LV) that are unobservable and cannot be directly measured. Therefore, the use of LVs in this study has the potential to model theoretical constructs such as intentions, attitudes, and perceptions that are difficult to measure directly. Analysis of Variance (ANOVA) was used to test if attitudes, subjective norms and perceived behavioural control were different among the respondents. The test was performed in order to assess whether the TPB constructs explain significant variance in tree planting behaviour among farmers. This step was necessary because there was no prior knowledge of potential multicollinearity among variables. It was necessary to use this test to explain variations in tree planting behaviour. SEM techniques were performed with the aid of Analysis of Moment Structure (AMOS) version 19 [59] software package. Focus group discussions were transcribed verbatim and coded according to a thematic framework and presented in narrative summaries. The software used for the Tran blocked ions was f4 (Windows). Data were analysed using the Software Atlas.ti v 6.2.26.

III. RESULTS

Response rate

Two hundred and ninety questionnaires were administered to household heads in selected villages of Nzega and Sikonge Districts of Tabora region, Tanzania. The respondents’ response rate was 100 percent, with 288 valid questionnaires, which was accepted adequate for testing the stated hypotheses. Sample size plays a major role in the estimation and interpretation of SEM results [60]. In general, the literature suggests that sample sizes for structural equation models commonly run in the 200 to 400 range. This study sample size is reasonable enough to analyse descriptive statistics, multivariate analysis and structural equation model. There are several studies using less than 300 of sample size, such as seatbelt use (N=277) by [61], motorcyclists’ intention to speed (N=110) by [62], drivers’ decision speed (N=250) by [60], and truck driver behaviour (N=232) by [63].

Socio-demographic Characteristics of the Respondents

The socio-demographic characteristics of the sample are summarised in Table 1 and the parameters included are age, sex, education, household size, wealth and farming experience. Referring to the age of the respondents, most of them laid between 20 to 50 years (64 percent and 73.8 percent in Nzega and Sikonge districts respectively), then followed by those aged below 20 years and above 50 years by (2 percent and 0 percent) and (34 percent and 26.2 percent) for Nzega and Sikonge districts respectively. The mean age was 39.4 years (SD = 11.7, range = 18 – 63) while only a few of the respondents were above sixty-five years of age. The larger number of a young population could imply increased pressure on agricultural land and therefore momentarily affect its economic value. The chi-square tests indicated no significant (p>0.05) difference in age between villages in the two districts. As regards, gender, out of the total sample, (45.1 percent) and (59.7 percent) of the respondents were males in Nzega and Sikonge districts respectively. The majority of the sample was male (52.4 percent). In this respect, this proportion

Table 1. Summary of socio-demographic profile of the respondents in study villages in two districts of Tabora region

Respondents characteristics	Nzega		Sikonge	
	Frequency	Percentages	Frequency	Percentages
Age				

Age Group	Nzega	Sikonge	Total	Percentage
Below 20 years	3	2	0	0
20 – 50	92	63.8	107	73.9
50 and above	49	34	38	26.2

$$\chi^2 = 2.156, df = 2, p\text{-value} = 0.340$$

Gender	Nzega	Sikonge	Total	Percentage
Male	65	45.1	86	59.7
Female	79	54.9	58	40.3

$$\chi^2 = 0.102, df = 1, p\text{-value} = 0.749$$

Marital Status	Nzega	Sikonge	Total	Percentage
Married	90	62.6	81	56.3
Singles	47	32.8	54	37.4
Widowed	7	4.6	9	6.3

$$\chi^2 = 2.237, df = 2, p\text{-value} = 0.327$$

Education	Nzega	Sikonge	Total	Percentage
None formal education	9	6	22	14.8
Primary school	127	88	109	75.4
Secondary school	9	6	12	8.2
Adult education	0	0	3	1.6
Post secondary	0	0	0	0

$$\chi^2 = 10.125, df = 4, p\text{-value} = 0.038$$

Wealth	Nzega	Sikonge	Total	Percentage
Economically poor	81	56	95	65.6
Very poor	55	38	40	27.9
Better off	9	6	10	6.6

$$\chi^2 = 1.55, df = 2, p\text{-value} = 0.461$$

Household size	Nzega	Sikonge	Total	Percentage
1-3 people	9	6	36	24.6
4 - 6 people	58	40	36	24.6
7- 10 people	75	52	66	45.9
More than 10 people	3	2	7	4.9

$$\chi^2 = 11.750, df = 2, p\text{-value} = 0.003$$

Farming experience	Nzega	Sikonge	Total	Percentage
1-10 years	39	27	35	24.3
11-19 years	48	33	41	28.5
20 and above years	57	40	68	47.2

$$\chi^2 = 0.276, df = 2, p\text{-value} = 0.871$$

Notes: Alpha level or significance level set at 0.05

Source: Tabora Population-Agroforestry study, 2016

explains the fact that most of those who practice agroforestry and tree planting, in general, are mostly matured males though, in reality, it is the women who are engaged in crop farming. On the other hand, female respondents were (54.9 percent) in Nzega and (40.3 percent) in Sikonge. These findings reveal the presence of more males than females when both districts are combined. The chi-square tests showed no significant difference ($p > 0.05$) in gender between villages in the two districts. Education wise, majority (88 percent and 75.4 percent in Nzega and Sikonge districts respectively) of respondents had completed primary school education, followed by those with none formal education (6 percent in Nzega and 14.8 percent in Sikonge), while those attained secondary education were 6 percent in Nzega and 8.2 percent in Sikonge. Very few of them have attended adult education (0 percent in Nzega and 1.6 percent in Sikonge). The chi-square test indicated significant difference ($p < 0.05$) in education level between villages in the two districts. Additionally, a one-way ANOVA test was performed and presents that there were significant age differences among people reporting different education levels: $F(4, 7.68) = 4.011, p = .047, \eta^2 = .01$. The mean age of those who obtained a primary school education level certificate was ($M = 42.24, SD = 12.52$). These results show that majority of respondents attained primary education, thus indicating a low level of education in the study area. It further reveals minimal application of land management practices in the study villages, which partly could be caused by low level of education, amongst other factors. Regarding wealth, a large proportion of respondents were economically poor by 56 percent in Nzega, and 65.6 percent in Sikonge, followed by very poor (38 percent) in Nzega and 27.9 percent in Sikonge and better off were 6 percent in Nzega and 6.6 percent in Sikonge. The chi-square test indicated further no significant difference ($p > 0.05$) in wealth between the two districts. These results imply that majority of respondents in both districts are economically poor. Furthermore, as discernible from Table 1, the average annual income of respondents was the equivalent of Tshs 885,132.05 per annum ($\$1 = \text{Tshs } 2,228$ as per exchange rate of 2017). Farmers in the lowest range of annual income (the very poor) might, however, need to augment their income earnings as they were all leaving below the

poverty line by earning below Tshs 2,300 which is approximately \$1 per day. This confirms the prevalence of poverty among rural farmers in Tabora region and Tanzania in general.

On household size, the majority of respondents in Nzega (52 percent) and Sikonge (45.9 percent) had a household size ranging from 7 to 10 household members. 1 to 3 households' members were 6 percent in Nzega and 24.6 percent in Sikonge, while 58 (40 percent) in Nzega and 36 (2.6 percent) in Sikonge had 4 to 6 households' members. Few respondents by 2 percent in Nzega and 4.9 percent in Sikonge had more than 10 households' members. Overall 59.52 percent of the respondents have an average household size of 5 people with a Standard Deviation (SD) of ± 2 in both areas. Chi-square tests indicated high significant difference ($p < 0.05$) in the size of households between the two districts.

As regards marital status, the majority of the sample included couples (62.6 percent), followed by singles (32.8 percent), and widowed (4.6 percent) for Nzega and 56.3 percent for the married, followed by singles (37.4 percent) and widowed (6.3 percent) for Sikonge. The chi-square tests for marital status indicated no significant ($p > 0.05$) difference in age between villages in the two districts. The farming experience of the respondents ranged from 14 - 51 with a mean of 31.19 (+18.09) years. Furthermore, 35.72 percent of farmers had an average total farm size of 0.74 (SD 0.64) hectare in Nzega and 2.37 hectares (SD 2.29) in Sikonge. This goes to confirm that land holdings in the rural areas are usually small and is obtained mostly through inheritance. Almost all households (98 percent) own land, and some respondents (11 percent) said they rented additional land for farming. In the bivariate (chi-square) test, farm experience and tree planting yielded insignificant results at $p = 0.871$.

Assessment of validity and reliability of the measurement items

As a first step, construct reliability and validity was assessed. The interpretation of the resultant coefficient takes into account the actual factor loadings rather than assuming that each item is equally weighted in the composite load determination. In this study, construct reliability was measured using [64], with a value of 0.7 or higher being recommended [65]. Construct reliability for all the factors in this study's measurement model were above 0.7 an acceptable threshold representing strong reliability. [53] recommended a factor loading of 0.5 and above to be an acceptable indicator of validity at the item level. Construct validity for the measurement scales was assessed from their convergent and discriminant validity values. Convergent validity which indicates how each measurement item strongly correlated with its specific theoretical construct was determined from the constructs' respective Average Variance Explained (AVE) values. Convergent validity was evaluated for the measurement scales using three criteria suggested by [66]: (1) all indicator factor loadings should be significant and exceed 0.7, (2) construct reliabilities should exceed 0.7, and (3) the square root of the average variance explained (AVE) by each construct should exceed the variance due to measurement error for that construct (i.e., AVE should exceed 0.50). All values in the Confirmatory Factor Analysis (CFA) model exceeded 0.7 and were significant at $p = 0.001$. Composite reliabilities of constructs ranged between 0.78 and 0.93. AVE ranged from 0.58 to 0.87 indicating that on average, all Latent Variables (LVs) were able to explain more than half of the variance of their respective indicators and thus demonstrated sufficient convergent validity. Therefore, all three conditions for convergent validity were met.

Evaluation of the Measurement Model (outer model)

The measurement model specifies the relationships between the constructs and the associated indicators. The parameters in the SEM were estimated by maximum likelihood (ML) method using the computer software program AMOS version 19. A variety of indices was used in this study. Absolute fit indices that measure how best the proposed model replicates the data were included. In other words, the fit indices assess the overall discrepancy between the implied and observed covariance matrices.

Absolute, incremental, and parsimonious indices of fit were included in the measures of the overall model fit. The commonly known index of absolute fit is the Chi-square (χ^2). Despite the fact that the χ^2 statistic has been found to be sensitive to sample sizes, two other indices were used in this study to assess the overall absolute fit of the proposed model: the Goodness of Fit Index (GFI) and the Comparative Fit Index (CFI). For assessing the fit of the proposed model as well as for incremental fit measures, the Adjusted Goodness of Fit Index (AGFI), The Incremental Fit Index (IFI), and the Normed Fit Index (NFI) were also applied. Lastly, the Root Mean Square Error of Approximation (RMSEA) was used to assess the parsimonious fitness of the model used in this study. The minimum accepted values and the observed values from this model are presented in Table 2. Results of the test of the overall model fit present $\chi^2 = 289.2$ with 177 degrees of freedom and a p-value of more than 0.05. In this manner, it was accepted that the model fits the data. The other indices were found to be higher than the suggested values. The recommended cut-off value for the goodness of fit indices was based on [67] recommendation. On the ground of the recommended values, the study concludes that the research model fitted the data well.

Table 2. Goodness-of-fit test results.

Fit index	χ^2 (p-Value)	GFI	CFI	RMSEA	AGFI	IFI	NFI
Suggested value	>0.05	>0.9	>0.9	<0.08	>0.8	>0.9	>0.9

Observed value	0.061	0.902	0.973	0.022	0.837	0.911	0.902
Conclusion	Accepted	Good fit					

Source: Tabora Population-Agroforestry study, 2016

3.5 Evaluation of Structural Model (inner model)

The structural model represents the relationship between the constructs. It specifies the relationships between the latent variables. Latent variables can play the role of predicting. A latent variable which is never predicted is called an exogenous variable. Otherwise, it is called endogenous variable. This section presents results of the test of the structural model (in which research hypotheses are embodied). The structural model was tested using the structural equation modelling (SEM) approach performed in PLS. This approach is particularly appropriate for testing theoretically justified models [68]. Each indicator (manifest variable) was modelled in a reflective manner which means a variation of the construct yields a variation in the measures. As a result, the direction of causality is from the construct to the indicator. Each manifest variable represents the corresponding latent variable, which is linked to the latent variable using a simple regression model. The six constructs comprise four exogenous variables (attitudes, subjective norms, perceived behaviour control, and situational factors) and two endogenous variables (intention and behaviour). All of these were linked as hypothesised (see Figure 4), and model estimation was done by assessing the path coefficients that indicate the strength of the hypothesised relationship between the exogenous and the endogenous variables and the variance explained (R^2 value) by each path. Figure 4 presents the standardised path coefficients as well as the path significance as reported by PLS. The betas were used to determine the relative weights of each factor.

The sample size of $n=288$ was sufficient because the required number of cases for this PLS analysis is only ten times the number of indicators in the reflective constructs [69]. The modified model derived from the Theory of Planned Behavior was made up of all reflective constructs that are influenced by the prime latent indicators [70]. These reflective latent constructs (attitude, subjective norms, perceived behavioural control, intention situational factors, and behaviour), are characterised by the fact that changes in the underlying latent construct will be reflected in changes in their corresponding measurement indicators. Since the indicators in a reflective construct represent the construct in a reflective model, a high degree of correlation between the indicators was expected to be seen.

Hypothesis 1 examined the influence of socio-demographic variables on the TPB constructs. A one-way ANOVA test was performed to determine whether socio-demographic characteristics significantly and positively influence the respondent's attitude, subjective norm, and perceived behaviour control pertaining to tree planting behaviour. In this case, the socio-demographic characteristics are statistically significant only when the p-value is less than 0.05. Table 3 presents the statistics of the effects of the socio-demographic characteristics on tree planting. Results indicate that age, gender, wealth, and farming experience do not seem to be statistically significant except household size and education. Farmers with different levels of education have different separation behaviours, with the secondary education group demonstrating more positive behaviour as opposed to those with lower education. For situational factors, all sociodemographic variables were not significant.

Table 3. Analysis of variance of socio-demographic variables.
 Values of Significance (p)

Socio-demographic Variable	Attitude Norm	Subjective Behavioural Control	Perceived	Intention	Situational Factors	Behaviour
Gender	0.610	0.483	0.660	0.711	0.164	0.264
Age	0.589	0.391	0.372	0.703	0.314	0.405
Education	0.027	0.043	0.036	0.033	0.221	0.049
Household size	0.006	0.027	0.002	0.046	0.331	0.039
Income	0.803	0.344	0.534	0.360	0.522	0.662
Farming experience	0.069	0.211	0.257	0.077	0.311	0.682

Source: Tabora Population-Agroforestry study, 2016

Through the lens of the TPB, this study went further examining whether differences in gender exist within TPB constructs and whether these differences explain observed gender differences in agroforestry. T-test for independent groups was performed for each case.

Attitude toward tree planting was more favourable among females ($M= 3.97, SD= .75$) than males, ($M= 3.65, SD= .83$), $t(3301) = -11.31, p < .001$. Further, on each behavioural belief item comprising the attitudes construct, women reported more favourable beliefs than men, $p < .001$. Females also reported greater control beliefs and perceived facilitation over tree planting ($M= 3.75, SD= .96$) than

males ($M= 3.50, SD= 1.07$), $t(3291) = -6.91, p < .001$. Across all items comprising the construct, women reported higher confidence than males, $p < .001$. Males on the other hand reported greater normative beliefs regarding tree planting ($M= 2.29, SD= .83$) than females ($M= 2.13, SD= .81$), $t(3305) = -5.66, p < .01$. As regards geographic locations of the study, respondents in Nzega district had more positive attitudes and subjective norms towards tree planting compared to respondents in Sikonge district. Irrespective of differences on their influence to TPB constructs, background factors held direct paths to antecedents of intention.

Hypothesis 2 examined the relationship between farmers' attitude towards tree planting and their behavioural intention to adopt tree planting. In regression analysis, it yielded ($\beta=0.421, t\text{-value}=17.64, p<0.001$). This hypothesis was strongly supported and therefore not rejected. Hypothesis 3, examined the relationship between subjective norms and farmers' intention to adopt tree planting ($\beta=0.213, t\text{-value}=7.59, p<0.01$). This hypothesis was also strongly supported and therefore not rejected. The fourth hypothesis examined the relationship between perceived behavioural controls and farmers' intention to adopt tree planting. ($\beta=0.138, t\text{-value}= 4.41, p<0.05$). This hypothesis was also strongly supported and therefore not rejected. Hypothesis 5 examined the relationship between intention and behaviour to adopt tree planting ($\beta=0.62, t\text{-value}=17.59, p<0.001$). This hypothesis was strongly supported and therefore not rejected. Hypothesis 6 examined the relationship between situational factors and behaviour to adopt tree planting ($\beta = -0.55, t = -9.12, p < .001$). Although 'situational factors' on tree planting behaviour was negatively correlated, still the influence was statistically significant. In this manner, H6 was supported. Tree planting behaviour will only be restricted when farmers have barriers.

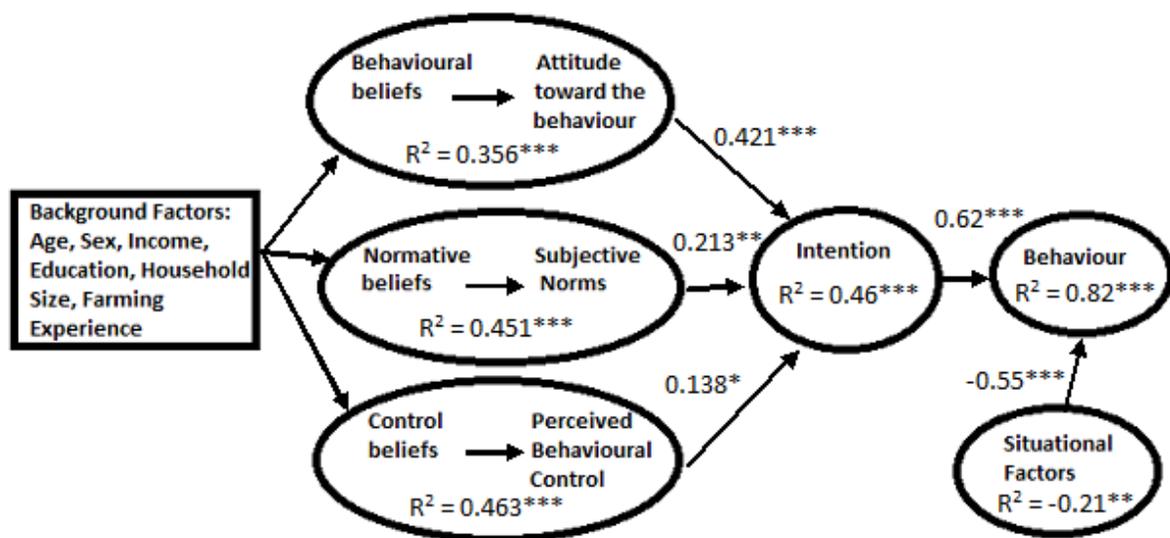


Figure 4. PLS Analysis of Research Model (modified version of Theory of Planned Behaviour by Ajzen, 1991)

Note: Observed manifest variables (survey items) are presented as a rectangle. Latent variables are presented as ellipses

Note: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, R^2 = the coefficient of determination.

Measurement model not shown above for purposes of clarity.

Source: Ajzen and Fishbein, 2005, p. 194 and Tabora Population-Agroforestry Study, 2016

The inner model provides that among the three determinants, attitude toward the behaviour had the most substantial impact on farmers' intentions to adopt a behaviour of tree planting, producing a change of 0.421 units in behavioural intention for each unit change in attitude. This influence on intention is more than twice that of subjective norm (0.231) and more than three times that of perceived behavioural control (0.138). This finding suggests that farmers' decisions about tree planting are influenced substantially by their views of its value, moderately by the opinions of significant others, and less strongly by their farmers' perceived ability to do so.

The coefficient of determination, R^2 , is 0.46 for the Intention endogenous latent variable. This means that the three latent variables (Attitude, Subjective Norm and Perceived Behavioural Control) moderately explain 46 percent of the variance in Intention while Intention itself explains 82 percent of the variance of Behaviour.

The findings of the survey were reinforced by the outcomes of the focus group discussions. During the group discussions, farmers were asked to point out the most important impediments that obstruct tree planting among the people in their villages. Interestingly, the most important impediments cited were laziness, land scarcity and lack of tree seeds. Farmers further explained that planting and caring for trees is labour intensive and because of many other responsibilities within the farm and around the house, some were not

motivated to take on tree planting as additional duties. Others might have been unsuccessful with tree planting activities in the past and were consequently seen to be disinterested in any further tree planting activities.

The study probed for the reasons behind the fact that large parts of Tabora region have already been denuded of trees and still people cut without planting. A farmer at Ilagaja village, Nzega District reported that *“fuelwood gathering has been responsible for deforestation and environmental degradation”*. She further narrated that *“some fuelwood, however, is used for village industries including tobacco curing and burning bricks”*. Within the same focus group discussion, another participant reacted that *“fuelwood gathering is probably a less important cause of deforestation than land clearing for crop production”*. This response was echoed by another participant who said that *“production of charcoal for sale is probably a much more severe cause of deforestation than firewood gathering for home consumption in rural areas because charcoal burners cut the whole tree”*.

One of the factors that the participants mentioned and that could pose as a barrier to the adoption of farm level tree planting is cultural practices (taboos). A 42-year-old male farmer in Ngwatu village (Nzega District) said: *“Many farmers in our village do take care of sacred trees for worshipping and other rituals. Other types for domestic and other uses receive less attention.”* A 47-year-old female in Mitowo village (Sikonge District) put it succinctly: *“These trees are not allowed to be cut unless under special circumstances, especially for ritual purposes or for treating be-witched persons.”* A female youth in Mitwigu village (Sikonge District) said: *“Some trees are left on the farms during land preparation or harvest for provision of fruit/food, medicines, shade or use in rituals and some are left on the farm because it is believed that they protect the harvest in the field from witchcraft.”*

FGDs of farmers expressed hindrance in tree planting operations and the harbouring of cultural beliefs as having negative impacts since they have a strong influence on agroforestry uptake. These cultural beliefs appear to be powerful determinants of farmers' actions and often exert more influence than rules and regulations enforced by the government. In the case of this study, these beliefs appear to have been outweighed by social pressure and perceptions of positive impacts.

FGDs also provided interesting insights into the proportion of households where the household head is the main decision-maker. For decisions on activities such as planting, sowing, and weeding of crops, the main decision-maker is the household head in about half of the households sampled (this does not seem to differ between male- and female-headed households.). For tree planting and tree management, however, the household head is more often the main decision-maker in male-headed households and less often in female-headed households compared to the other activities. For most agricultural activities, the decision-making pattern was a mix of decision-making by the husband, the wife, or by both.

As an alternative to the escalating fuelwood problem in the Tabora region of Tanzania, farmers are attracted to woodlots. Tobacco farmers in Tanzania used to get all of their firewood from the miombo woodlands, but this is no longer the case as deforestation takes its toll. An FGD participant in Mitwigu village, Sikonge District confirmed that *“farmers are now slowly opting for alternative sources of fuelwood such as having an on-farm supply, hence the interest in woodlots”*.

Following reports from the FGDs, physical observations of on-farm tree planting in the two districts suggest that intercropping the nitrogen fixing tree *Leucaena leucocephala* with maize provides the farm family with sufficient fuelwood in addition to supplying the maize with nitrogen.

IV. DISCUSSION

Results of the survey revealed that the 'Attitudes' had the highest standardised effect on intention toward tree planting behaviour followed by 'Subjective norms' and lastly 'perceived behavioural control'. This observation confirmed the findings of [71] in other domains. The effect of 'Attitude' to 'Intention' and 'Behaviour', and the effect of 'Subjective Norms' to 'Behaviour' as well as 'Perceived Behavioural Control' to 'Behaviour' were significant at ($p < 0.001$, $p < 0.01$ and $p < 0.05$ respectively). Like [71], the results of this study revealed that intention was a significant predictor of the behaviour. Findings revealed that attitude was a positive predictor of intention. There was also evidence that attitude itself was a stronger predictor of tree planting behaviour. In other words, participants with more positive attitudes toward tree planting also had greater intentions to engage in the behaviour.

In evaluating inherent human behaviour towards tree planting adoption in Tabora region, respondents believed that 'Attitude' to adopt or not to adopt tree planting (SNs) significantly influences their adoption behaviour (H2). Attitude which in this study yielded a path coefficient of 0.421 has been proposed in several studies using different theories to influence behavioural intentions [40]. Respondents also believed that perceived social pressure to adopt or not to adopt tree planting (SNs) significantly influences their attitude toward adoption (H3) with a significant path coefficient of 0.213. SNs refer to the perceived social pressure to perform or not to perform the behaviour. This relates to one's intuition about others' exertion of influence. This study justified that, based on TPB, social pressure—be it from society, peers, or government—will have a positive influence on an individual's intention to adopt tree planting. Similarly, respondents also believed that their PBC (controllability and self-efficacy) to adopt tree planting significantly influences their attitude (H4) (path coefficient = 0.138). As expected, H4 received strong support. PBC involves people's beliefs that they have control over

the behaviour; performance or non-performance of the behaviour is up to them [72]. Several studies support the direct effect of PBC on intended and/or actual usage [73,74].

In H5, this study posited that farmers' intention toward tree planting positively influences their behaviour to adopt on-farm tree planting. The model strongly supported this hypothesis. The results were not surprising because the intention is proposed to influence behaviour. This theoretical prediction has received considerable empirical support in a variety of settings [75,76]. The intention is an overall evaluation of an individual's perception of tree planting adoption. Additionally, an intention is the cognitive representation of a person's preparedness to perform a given behaviour, and it is taken to be the immediate antecedent of behaviour.

Therefore, following the TPB, a positive intention undoubtedly affects the individual's behaviour to engage tree planting activities.

Consequently, the application of TPB offers a theoretical foundation for the consideration of behavioural attributes in tree planting uptake. By relating the three constructs (attitude, subjective norm and perceived behavioural control) to tree planting, a farmer is likely to gather information, share the information and ultimately utilise the information for the purpose of enhancing on-farm tree planting in the region and country in general. The tree planting achievements tend to be incremental (at the individual level) and transformative (at the community level). According to [77] incremental changes eventually lead to stable transformative community development.

The findings of the survey were reinforced by the outcomes of the focus group discussions, which besides noting the view that on-farm tree planting and tree management are mostly a task for husbands, the focus group discussions revealed that women still participated in the implementation of tree planting, and there were some gender-specific roles for women, which is in agreement with previous studies [78, 79].

V. CONCLUSION

Continuing degradation of existing forest cover driven by rapid population growth and anthropogenic activities are serious threats to the sustainability of forestry in Tabora region. Farm and community land forestry uptake has been identified as a feasible solution. Given this scenario, results of this study have shown that farmers' intention and behaviour toward conserving ecological achievements have been explained well by TPB. The farmers' behaviour was significantly positively influenced by their intention toward conserving ecological achievements, and their intention significantly predicted their attitude (positive or negative value of performance), followed by the subjective norm (social pressure in engaging behaviour), and least by perceived behavioural control (perceptions of their ability). The farmers' degree of support for agroforestry uptake and its recognition of environmental effects is the main factor that most influenced the farmers' attitude.

Guided by these findings and in response to the demonstrated need for sustainable agroforestry in Tanzanian villages, this study has adequately addressed its key objective of testing the explanatory ability of the TPB on farmers' intention to adopt on-farm tree planting behaviour and has also illuminated the factual evidence gathered from them. The application of this theory in the two selected districts of Tabora region provides an insight on farmers' behaviour towards growing trees on their farms. The achievement of on-farm tree planting is a function of the three TPB constructs. These findings can assist in developing tailored forestry programmes, to increase attitudes and foster behavioural change, in order to speed up agroforestry in the region. This approach can successfully engage farmers to support the sustainability of the ecology and environment against the uncontrolled agricultural expansion and demand for rural energy fuelled by population growth in the region.

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REFERENCES

1. PRB (Population Reference Bureau). (2013) World Population Sheet. Washington, DC 2013; www.prb.org
2. FAO, (2010a) FAO Global Forest resources assessment 2010 Food and Agriculture Organization of the United Nations, Rome.
3. United Republic of Tanzania (2014) Fifth National Report on the Implementation of the Convention on Biological Diversity; Vice President's Office, Division of Environment, United Republic of Tanzania (URT), Dar es Salaam 2014
4. Bremer, J., L.C. David., L. Suter., and J. Davis (2010) Population, Poverty, Environment and Climate Dynamics in the Developing World; *Interdisciplinary Environmental Review*, Vol. 11 Nos 2/3
5. OSSREA (n.d.) Deforestation in Tanzania: A Development Crisis? www.ossrea.net/publications/images/stories/ossrea/ssrr/ssrr-series-13.pdf
6. Miya, M., Ball S.M.J., and Nelson F.D., Ball S.M.J., and Nelson F.D., (2012). Drivers of deforestation and forest degradation in Kilwa District. MCDI. http://www.mpingoconservation.org/fileadmin/downloads/redd/Drivers_of_Deforestation_and_Forest_Degradation_in_Kilwa_District.pdf

7. Kideghesho, J. (2015) Realities on Deforestation in Tanzania — Trends, Drivers, Implications and the Way Forward in [Miodrag Zlatić](#) (ed) Precious Forests - Precious Earth. DOI: 10.5772/61002
8. URT (2013) Population Distribution by Administrative Units; *National Bureau of Statistics*, Dar es Salaam
9. Mkai, P.B., Kaimu, A. M., Aboud, S., Chuwa, A. A., Amour, B. H., Ntimba, G. L., Mbonile, M., Ngalinda, I., Naimani, G. M. and Chuma, A. (2006) *Tabora Regional and District Projections*. UNSPECIFIED. (Unpublished)
10. Yanda P.Z. (2010). Impact of small scale tobacco growing on the spatial and temporal distribution of Miombo woodlands in Western Tanzania. *J. Ecol. Nat. Environ.* 2: 10-16
11. National Bureau of Statistics (2012) Tabora Regional Statistical Abstract (2011) Ministry of Finance, Dar es Salaam
12. Verchot L.V., Noordwijk M.V., Kandji S., Tomich T., Ong C., Albrecht A., Mackensen J., Bantilan C., Anupama K., and Palm C. (2007). Climate change: linking adaptation and mitigation through agroforestry. *Mitigation and Adaptation Strategies for Global Change* 12:901-18.
13. Sileshi G., Akinnifesi F., Ajayi O., and Place F. (2008). Meta-analysis of maize yield response to woody and herbaceous legumes in sub-Saharan Africa. *Plant & Soil* 307(1): 1-19.
14. Mbwapo, J; P. Saruni, P; and G. Masawe (2013) Agroforestry as a solution to poverty in rural Tanzania. Lessons from Musoma Rural District, Mara Region, Tanzania; *Kivukoni Journal* Vol. 1 no. 2, 2013: 15-30
15. Ngambeki, D.S., (1985) Economic-evaluation of alley cropping Leucaena with maize-maize and maize-cowpea in Southern Nigeria. *Agricultural Systems*, 17 (4) (1985), pp. 243–258
16. Reyes, T., R. Quiroz, S. Msikula (2005) Socio-economic comparison between traditional and improved cultivation methods in agroforestry systems, East Usambara Mountains, *Tanzania Environmental Management*, 36 (5) (2005), pp. 682–690
17. Ajayi, O.C., F.K. Akinnifesi, G.W. Sileshi, W. Kanjipite (2009). Labour inputs and financial profitability of conventional and agroforestry-based soil fertility management practices in Zambia *Agrekon*, 48 (3), pp. 276-292, [10.1080/03031853.2009.9523827](https://doi.org/10.1080/03031853.2009.9523827)
18. Mercer, D.E. (2004) Adoption of agroforestry innovations in the tropics: a review of *Agroforestry Systems*, 61 (1), pp. 311–328
19. Temu A. B. Fuelwood scarcity and other problems associated with tobacco production in Tabora region, Tanzania. Morogoro: University of Dar es Salaam, Faculty of Agriculture, Forestry and Veterinary Science, 1979
20. Solon L. B. and Krishna B. (1996) Deforestation in Tanzania Beyond Simplistic Generalizations; *Ecologist*, Vol. 26, No. 3
21. Franzel, S., R. Coe., P. Cooper., F. Place., and S.J. Scherr (2001) Assessing the adoption potential of agroforestry practices in sub-Saharan Africa; *Agricultural Systems*, 69 (1–2), pp. 37–62
22. Keil, A., M. Zeller, S. Franzel (2005) Improved tree fallows in smallholder maize production in Zambia: do initial testers adopt the technology? *Agroforestry Systems*, 64 (3) (2005), pp. 225–23
23. Kiptot, E., P. Hebinck, S. Franzel, P. Richards (2007) Adopters, testers or pseudo-adopters? Dynamics of the use of improved tree fallows by farmers in western Kenya, *Agricultural Systems*, 94 (2) (2007), pp. 509–519
24. Ajayi and Catacutan, (2012) Role of externality in the adoption of smallholder agroforestry: case studies from Southern Africa and Southeast Asia S. Sunderasan (ed.), *Externality: economics, management and outcomes*, NOVA Science Publishers, New York pp. 167–188
25. Meijer, S.S., D. Catacutan, O.C. Ajayi, G.W. Sileshi, M. Nieuwenhuis (2015) The role of knowledge, attitudes and perceptions in the uptake of agricultural and agroforestry innovations among smallholder farmers in sub-Saharan Africa; *International Journal of Agricultural Sustainability*, 13 (1) (2015), pp. 40–5
26. Chavangi N (1994) Cultural aspects of fuelwood procurement in Kakamega district. KWDP Working Paper No. 4. KWDP/The Beijer Institute, Nairobi, Kenya
27. Nair, R. and Garrily, D. (2012): *Agroforestry-the future of global Lands*. New York. Springer, Dordrecht.
28. Kiptot, E and Franzel, S. (2011). Gender and Agroforestry in Africa: Are Women Participating? Available at <http://www.worldagroforestry.org/>. Retrieved on May 10, 2017.
29. NATF (National Agroforestry Task Force). 1988. A Blueprint for Agroforestry Research in the Uni-modal Upland Plateau of Tanzania. *AFRENA Report* No. 6. ICRAF, Nairobi, Kenya, 30 pp.
30. Ramadhani, T., Otsyna, R. and Franzel, S. (2002). Improving household incomes and reduce deforestation using Rotational Woodlots in Tabora District, Tanzania. *Agriculture Ecosystems and Environment* 89: 229 - 239.
31. Douthwaite, V.M., Manyong, J.D.H., and Keatinge, J. Chianu (2002) The adoption of alley farming and Mucuna: lessons for research, development and extension; *Agroforestry Systems*, 56 (3) (2002), pp. 193–202
32. Fischer, A., and L. Vasseur (2002) Smallholder perceptions of agroforestry projects in Panama; *Agroforestry Systems*, 54 (2) (2002), pp. 103–113
33. Mekoya, A., S.J. Oosting, S. Fernandez-Rivera, A.J. Van der Zijpp (2008) Farmers' perceptions about exotic multipurpose fodder trees and constraints to their adoption; *Agroforestry Systems*, 73 (2) (2008), pp. 141–153
34. Zubair, M., and C. Garforth (2006) Farm level tree planting in Pakistan: the role of farmers' perceptions and attitudes; *Agroforestry Systems*, 66 (3) (2006), pp. 217–22
35. McGinty, M.M., M.E. Swisher, J. Alavalapati (2008) Agroforestry adoption and maintenance: self-efficacy, attitudes and socio-economic factors; *Agroforestry Systems*, 73 (2) (2008), pp. 99–108
36. Sood, K.K., and C.P. Mitchell (2004) Do socio-psychological factors matter in agroforestry planning? Lessons from smallholder traditional agroforestry systems; *Small-Scale Forestry*, 3 (2) (2004), pp. 239–255
37. Pritchett L, Woolcock M. (2004) Solutions when the solution is the problem: arraying the disarray in development. *World Dev* 32(2): 191-212.
38. Scoones I, deGrassi A, Devereux S, Haddad L. (2005). New directions for African agriculture. London: Institute of Development Studies. *IDS Bulletin* 36.2
39. Ajzen, I (1991) The theory of planned behavior; *Organizational Behavior and Human Decision Processes*, 50 (2) (1991), pp. 179–211
40. Fishbein, M., I. Ajzen (1975) Belief, attitude, intention, and Behavior: An introduction to theory and research; Addison-Wesley, Reading, M A Addison-Wesley.
41. Bortoleto, A. P., Kurisu, K. H., & Hanaki, K. (2012). Model development for household waste prevention behaviour. *Waste Management*, 32(12) 2195–2207.
42. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
43. Ramayah, T., Lee, J. W. C., & Lim, S. (2012). Sustaining the environment through recycling: An empirical study. *Journal of Environmental Management*, 102, 141-147
44. The Planning Commission and Tabora Regional Commissioner's office (2005) Tabora region Socio-economic Profile, <http://www.tzonline.org/pdf/Tabora.pdf>
45. NBS (2012) The 2012 Tanzania Population and Housing Census; Population Distribution by Age and Sex; National Bureau of Statistics Ministry of Finance Dar es Salaam and Office of Chief Government Statistician President's Office, Finance, Economy and Development Planning Zanzibar p 283
46. Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, 33(7), 14-26.
47. Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition mixed methods research. *Journal of Mixed Methods Research*, 1, 112-133.
48. Kathuri, N.J., and Pals, D.A. (1993) Introduction to Environmental Research, Egerton University Njoro.

49. Sieber, D.S (1973) The Integration of Fieldwork and Survey Methods. The American Journal of Sociology, Vol. 78, No. 6, 1335–1359.
50. Franzel S., Scherr S.J., (2002b) "Assessing the Adoption Potential: Lessons Learned and Future Directions" in Trees on the Farm: Assessing the Adoption Potential of Agroforestry Practices in Africa, Wallington, Oxon, UK; New York: CABI Pub in association with the International Centre for Research in Agroforestry, 2002. 169-182
51. Likert, R. (1931) A technique for the measurement of attitudes, Columbia University Press, New York
52. Hennink, Monique M. (2007). International focus group research. Cambridge: Cambridge University Press.
53. Hair, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2006). Multivariate data analysis (6th ed.). Uppersaddle River, N.J.: Pearson Prentice Hall
54. Hair, J. Black, W., Babin, B., Anderson, R., & Tatham, R. (2010). Multivariate data Analysis (7 ed.). Upper Saddle River, NJ: Prentice Hall.
55. Ramkissoon, H.; Graham, S.L.D.; Weiler, B. (2013) Testing the dimensionality of place attachment and its relationships with place satisfaction and pro-environmental behaviours: A structural equation modelling approach. *Tourism Manage.* 36, 552–566.
56. Bayard, B.; Jolly, C. (2007) Environmental behavior structure and socio-economic conditions of hillside farmers: A multiple-group structural equation modeling approach. *Ecol. Econ.* 62, 433–440.
57. Sparrevik, M.; Ellen, G.J.; Duijn, M. (2011) Evaluation of factors affecting stakeholder risk perception of contaminated sediment disposal in Oslo Harbor. *Environ. Sci. Technol.* 2011, 45, 118–124.
58. Gefen, D., D. Straub, and M. Boudreau (2000) "Structural Equation Modeling Techniques and Regression: Guidelines for Research Practice," *Communications of the Association for Information Systems* (7)7 August, pp. 1-78.
59. Arbuckle, J. (2010b). IBM SPSS Amos 19 User's Guide. Chicago: Amos Development Corporation.
60. Simsekoglu, O and T. Lajunen. (2008). Social psychology of seat belt use: a comparison of Theory of Planned Behavior and Health Belief Model, *Transportation Research Part F* 11, 181-191.
61. Elliot. M.A. (2010). Predicting Motorcyclists' intentions to speed: effects of selected cognitions from the Theory of Planned Behaviour, Self-Identity and Social Identity. *Accident Analysis and Prevention*, 42, 718-725.
62. Warner, H. W., & Aberg, L. (2006). Drivers' decision to speed: A study inspired by the theory of planned behavior. *Transportation Research Part F*, 9, 427-433.
63. Poulter, M.O., Du, L., Weaver, I.C., Palkovits, M., Faludi, G., Merali, Z., et al. (2008). GABAA receptor promoter hypermethylation in suicide brain: implications for the involvement of epigenetic processes. *Biol. Psychiatry* 64, 645-652. Doi: 10.1016/j.biopsych.2008.05.028
64. Cronbach L. Coefficient alpha and the internal structure of tests. *Psychometrika*. 1951;16: 297-334.
65. Nunnally, J.C., & Bernstein, I.H., (1994). *Psychometric Theory*, (3rd ed) New York, McGraw-Hill
66. Fornell, C., Larcker, D.F., (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* 18 (1), 39-50.
67. Hu, L. and Bentler, P. M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives. *Struct. Equat. Model.*, 6: 1-55.
68. Jöreskog, K. and Sörbom, D. (1993), LISREL 8: Structural Equation Modeling with theSIMPLIS Command Language. Chicago, IL: Scientific Software International Inc.
69. Chin WW (1998). "The Partial Least Squares Approach for Structural Equation Modeling." In GA Marcoulides (ed.), *Modern Methods for Business Research*, pp. 295-336. Lawrence Erlbaum Associates, London.
70. Freeze, R. D. and Raschke, R. L. (2008). An assessment of formative and reflective constructs in research. *MIS Quarterly* 29 (3), 427-459.
71. Wauters, E., Bielders, C., Poesen, J., Govers, G. and Mathijs, E. (2010). Adoption of soil conservation practices in Belgium: An examination of the theory of planned behaviour in the agri-environmental domain. *Land Use Policy* 27(1): 86-94.
72. Ajzen, I. (2002b). Construction of a standard questionnaire for the theory of planned behavior. <http://www-unix.oit.umass.edu/~ajzen>. Accessed May, 2017.
73. Taylor S, Todd PA (1995). Understanding Information Technology Usage: A Test of Competing Models. *inf. syst. Res.*, 6 (2):144 –176.
74. Chau, P. Y. K., and Hu, P. J. (2002). Examining a model of information technology acceptance by individual professionals: An exploratory study. *Journal of Management Information Systems*, 18(4), 191–229.
75. Madden, Thomas J., Pamela Scholder Ellen and Icek Ajzen (1992). "A Comparison of the Theory of Planned Behavior and the Theory of Reasoned Action," *Personality and Social Psychology Bulletin*, 18 (1), 3B9.
76. Akram M.S, and Malik, A. (2012). Evaluating citizens' readiness to embrace e-government services. *Proceedings of the 13th Annual International Conference on digital government research*
77. Perkins, D. D., Bess, K. D., Cooper, D. G., Jones, D. L., Armstead, T., & Speer, P. W. (2007). Community organizational learning: Case studies illustrating a three-dimensional model of levels and orders of change. *Journal of Community Psychology*, 35(3), 303–328. doi: 10.1002=jcop.20150
78. German, G., F. K. Akinnifesi, A. K. Edriss, G. Sileshi, C. Masangano³ and O. C. Ajayi. (2009). Influence of property rights on farmers' willingness to plant indigenous fruit trees in Malawi and Zambia. *African Journal of Agricultural Research* 4 (5), pp. 427-437
79. Kiptot, E. and S. Franzel. (2012). Effectiveness of the Farmer Trainers Approach in Dissemination of Livestock Feed Technologies: A Survey of Volunteer Farmer Trainers in Kenya. Nairobi: East African Dairy Development Project.

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Textural Feature Extraction and Analysis for Brain Tumors using MRI

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Abstract- The proposed research work is to perform textural analysis of the brain tumor on MRI images and this process aims by giving correct decisions towards medication and providing tools for automated extraction of the most discerning features of regions of interest in human brain. The detection of tumor in human brain (MRI) is performed through segmentation and for region characterization we use texture information. Based on extracted information the textural analysis of tumor is done. For the selection of region of interest we use FCM and Level set segmentation. After selecting region of interest we extract GLCM features from the segmented brain tumor image. The textural information is captured from the region of interest using Haralick textural descriptor features. To train and classify the tumor into benign or malignant we use SVM classifier. The ultimate aim is to develop an automated classification of region into one of the classes as benign or malignant. The digital medical imaging and clinical data associating on daily data are witnessed by the hospitals all over the world. The expertise will be able to analyze, inspect quickly the images.

Index Terms- MRI, Segmentation, FCM, Tumor

I. INTRODUCTION

To detect and to identify the pathogenic condition of the brain tumor we need to conduct an analysis on brain MR images. The analysis has been differentiated into three types' i.e shape analysis, intensity analysis and texture analysis. The recognition and identification of real-world objects is defined as Shape analysis. The subject that defines a particular model or intensity space is Intensity analysis. Texture analysis includes analyzing the pattern and intensity that are not even visible to human eye. A texture analysis is mainly used in longitudinal monitoring of recovery from particular disease.

Texture is a measure of intensity variation of a surface, quantifying properties such as smoothness, coarseness, and regularity. In image analyzing and computer vision it is used as region descriptors. For the analysis and characterization many different methods can be applied. To extract the textural features within medical images including fractal dimension, run-length encoding, discrete wavelet transform, and two-dimensional co-occurrence matrices can be used.

Of these, we have implemented both co-occurrence matrices and run-length matrices to classify the textures. The reason of choosing texture to characterize different types of regions resides in the fact that different organ tissues present different textures in the MR images, and thus, we expect the texture descriptors will have enough discrimination power to distinguish among different types of regions. We capture the texture information of the regions of interest using two second-degree statistical models: 1) The gray level co-occurrence matrix and 2) Gray level run length statistics. For each model a set of texture descriptors calculated.

Chest X-rays have been investigating a computer aided detection scheme to improve the sensitivity for providing assistances to the radiologists. The researcher although have worked from long years and still are working on improving the performance of CAD schemes, but still these schemes contain a more number of false positives (FPs). Due to this cause the radiologists are getting distracted and their efficiency is gradually reduced. In addition the radiologists will also lose their confidence with CAD scheme as an efficient tool. For a CAD scheme to be useful it should have a low false positive rate.

Compared to Chest X-Rays the imaging modality MRI gives more precise detailed information. This helps in taking a correct decisions regarding patient's condition of tumor growth as they give detailed textural features.

II. OBJECTIVES

Objectives of the Proposed System are to perform effective segmentation of the region of interest on organs like brain region within the human body. To extract and study the texture features of pathological regions. Analysis and classification of the pathological situation for a brain tumor. Determining whether the tumor is present and if it is benign or malignant.

Segmentation

The goal of segmentation is to simplify and change the representation of an image into something that is more meaningful and easier to analyze. MRI segmentation methods use either a single 2D or 3D image or a series of multispectral or multimodal images. Common segmentation approaches to MR images are thresholding, edge detecting, clustering, genetic algorithms, neural networks, and probabilistic techniques.

Types of Segmentation Methods.

Region Based
 Clustering
 Level set Method.

Region Growing:

Region-growing methods rely mainly on the assumption that the neighboring pixels within one region having similar values. The common procedure is to compare one pixel with its neighbors. If a similarity criterion is satisfied, the pixel can be set to belong to the cluster as one or more of its neighbors. The pixel with the smallest difference measured is assigned to the respective region. This process continues until all pixels are assigned to a region.

In Region Growing Segmentation, the algorithm specifies a pixel in the tumor part input image and after comparing it with the neighboring pixels, segments the tumor portion as seen in the output image.

Clustering Algorithms

The frequently used clustering algorithms are the K-Means and Fuzzy C-Means algorithm.

K-Means clustering algorithm:

K-Means is a well-known partitioning method. Objects are classified as belonging to one of k groups, k chosen a priori . Cluster membership is determined by calculating the centroid for each group and assigning each object to the group with the closest centroid. This approach minimizes the overall within-cluster dispersion by iterative reallocation of cluster members.

Fuzzy C-Means clustering algorithm:

In 1969, Ruspini has given the idea of using fuzzy set theory for clustering. The first specific formulation of Fuzzy C-Means (FCM) is credited to Dunn . But its generalization and current framing is designed by Bezdek .

Level Set Segmentation:

The level set method can be used to efficiently address the problem of curve/surface propagation in an implicit manner. The central idea is to represent the evolving contour using a signed function whose zero corresponds to the actual contour. Then, according to the motion equation of the contour, one can easily derive a similar flow for the implicit surface that when applied to the zero level will reflect the propagation of the contour. Level set methods have been shown to be versatile, robust, and efficient techniques for a wide class of problems in image processing . They work by embedding the propagating front as the zero level set of a higher dimensional function. Another advantage is that it is less sensitive to noise. The membership functions in Level set is given by

$$M_i (\phi_1(y), \dots \dots \dots \phi_k(y)) = \begin{cases} 1, & y \in \Omega_i \\ 0 & else \end{cases} \tag{1}$$

For N=3, ϕ_1 and ϕ_2 are level set functions.

$$\begin{aligned} M_1 (\phi_1, \phi_2) &= H (\phi_1) H (\phi_2), \\ M_2 (\phi_1, \phi_2) &= H (\phi_1) (1- H(\phi_2)), \\ M_3 (\phi_1, \phi_2) &= H (\phi_2) (1- H (\phi_1)), \end{aligned} \tag{2}$$

are the member functions for region. Data term energy using the level sets and member functions.

$$E (\phi, c, b) = \int \sum_{i=1}^N e_i (x) M_i (\phi(x)) dx \tag{3}$$

Energy in level set formulation including regularization term is given by

$$F (\phi, b, c) \triangleq E(\phi, b, c) + R_p (\phi) \tag{4}$$

Minimization of energy is performed by solving the gradient flow equations.

$$\frac{\partial \phi_1}{\partial t} = - \sum_{i=1}^N \frac{\partial M_i(\phi)}{\partial \phi_1} e_i + \vartheta \delta(\phi_1) \operatorname{div} \left(\frac{\nabla \phi_1}{|\nabla \phi_1|} \right) + \mu \operatorname{div} \left(d_p(|\nabla \phi_1|) \nabla \phi_1 \right)$$

$$\frac{\partial \phi_k}{\partial t} = - \sum_{i=1}^N \frac{\partial M_i(\phi)}{\partial \phi_k} e_i + \vartheta \delta(\phi_k) \operatorname{div} \left(\frac{\nabla \phi_k}{|\nabla \phi_k|} \right) + \mu \operatorname{div} \left(d_p(|\nabla \phi_k|) \nabla \phi_k \right) \tag{5}$$

Gradient flow equation is iterated until contours are evolved to the proper shapes and sizes defining the segmentation boundaries for the regions.

Feature Extraction:

Two-dimensional co-occurrence matrices are generally used in texture analysis because they are able to capture the spatial dependence of gray-level values within an image. A 2D co-occurrence matrix, P, is an n x n matrix, where n is the number of gray-levels within an image. For reasons of computational efficiency, the number of gray levels can be reduced if one chooses to bin them, thus reducing the size of the co-occurrence matrix. The matrix acts as an accumulator so that P[i,j] counts the number of pixel pairs having the intensities i and j. Pixel pairs are defined by a distance and direction which can be represented by a displacement vector d = (dx,dy), where dx represents the number of pixels moved along the x-axis, and dy represents the number of pixels moved along the y-axis of the image slice. Run-length matrices capture the coarseness of texture in specified directions. The features extracted using both co-occurrence and run-length matrices provide valuable information about the MR images.

Feature extraction techniques:

- 1) SIFT - Scale-invariant feature transform (SIFT) is an algorithm in computer vision to detect and describe local features in images.
- 2) Gabor Filter – It is a linear filter used for edge detection. Frequency and orientation representations of Gabor filters are similar to those of the human visual system, and they have been found to be particularly appropriate for texture representation and discrimination.
- 3) GLCM - A statistical method of examining texture that considers the spatial relationship of pixels is the gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix.

III. PROPOSED METHODOLOGY

The brain image is obtained from the MRI (Magnetic Resonance Imaging) scan. Images will be processed and the region of interest will be extracted. Texture analysis will be performed for the images. Identification of the disorder will be done using a classifier.

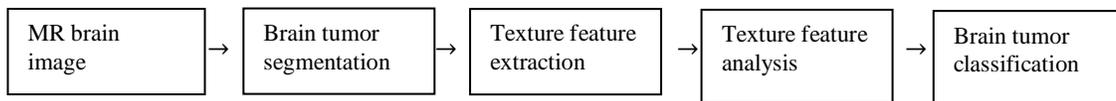


Figure 1: Block diagram of proposed methodology.

Image segmentation groups pixels into regions, and hence defines object regions. Segmentation uses the features extracted from the image. Fuzzy C Means and Level Set Segmentation techniques are studied and employed to effectively segment the region of interest.

GLCM features are extracted using Gray level Co-occurrence Matrix. The texture features such as contrast, homogeneity, energy and correlation may not contribute properly towards the effective classification. Hence GLCM features are also calculated and the tumors are classified. Classification is the process of arriving at a decision for a pathological situation which is normal or abnormal.

IV. PROPOSED ALGORITHM

Objective: To perform segmentation of Brain Tumor region.

Input: MRI scan image.

Expected Output: Segmented Brain Tumor region.

Procedure:

Step1: Initialize the following factors

- Number of clusters
- Assign centroid
- Number of iterations
- Termination parameters
- Fuzziness factor

Step2: Calculate / update membership values (μ_{ik})

- Calculate distance (d_{ik})
- Membership values are to be calculated using calculated distances.

Step 3: Update centroids.

Step 4: Find Objective function (J_r)

Step 5: If $J_r < J_{r-1}$ then go to step 2 or stop.

Feature Extraction:

Feature Extraction is the transformation of input data into a set of features. It is a key stage in performing the task, which identifies sets of features that describe the visual texture of an image. MR Image segmentation is based on a set of measurable features which are extracted or computed from the images. Features themselves can be classified as pixel intensity-based features, calculated pixel intensity-based features and edge and texture-based features. Texture Features: An image texture is a set of metrics calculated in image processing designed to quantify the perceived texture of an image. Image texture gives us information about the spatial arrangement of intensities in an image or selected region of an image.

Classification:

In machine learning and statistics, classification is the problem of identifying a set of categories on the basis of a training set of data containing observations. Classification was performed by starting with the more discriminative features and gradually adding less discriminative features, until classification performance is no longer improved. In fuzzy set theory, every element in the universe belongs to a varying degree to all sets defined in the universe. But in fuzzy clustering objects are not classified as belonging to one and only cluster, but instead, they own a degree of membership with each of the clusters. FCM provides hyper spherically-shaped well separated clusters accurately.

V.RESULTS

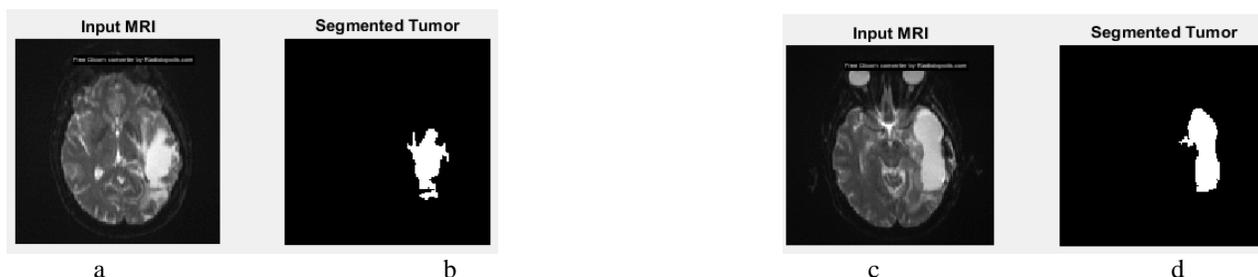


Figure2.a. Input brain image1 and b.Segmented Tumor. c .Input brain image2 and d. Segmented Tumor.

K-Fold Validation

Images	Classification Accuracy
Set 1	80.00%
Set 2	80.00%
Set 3	86.66%
Set 4	86.66%
Set 5	73.33%
Average	81.33%

Table1. Classification of benign and malignant tumors.

K-Fold Validation

K-fold validation is a model validation technique for assessing how the results of a statistical analysis will generalize to an independent data set. It is mainly used in settings where the goal is prediction, and one wants to estimate how accurately a predictive model will perform in practice. In a prediction problem, a model is usually given a dataset of known data on which training is run (training dataset), and a dataset of unknown data (or first seen data) against which the model is tested (testing dataset). The goal of cross validation is to define a dataset to "test" the model in the training phase (i.e., the validation data set).

VI. CONCLUSION & FUTURE SCOPE

The work aims to help the medical sector. Performing textural analysis of brain MRI scans, we aim to be able to detect tumors at the earliest possible stage for the patients. The Fuzzy C-means segmentation algorithm is giving effective segmentation of the tumor region. The algorithms and classifiers we used will be able to differentiate between a normal and a diseased brain and further if the tumor is benign or malignant. The normal features like contrast, homogeneity, energy and correlation are not good enough to distinguish the tumors; hence more GLCM features such as sum of variances, sum of entropy are used. The multifold validation technique is performed to validate the accuracy of the dataset being used. The average accuracy is over 80% for the proposed algorithm. Hospitals throughout the world are witnessing huge volumes of digital medical images and associated clinical data. The number of qualified personnel to inspect, analyze and make decisions is being outnumbered in relation to the number of images needing their expertise. Our work aims to make it easier for medical professionals in detecting brain tumors in patients and diagnosing them at the earliest possible stage.

The future scope of this work entails that this work can be continued by using variant Level set methods for efficient segmentation and different classifiers to further improve the classification accuracy we achieved in this work.

REFERENCES

[1] Chabat, Francis, Guang-Zhong Yang, and David M. Hansell. "Obstructive Lung Diseases: Texture Classification for Differentiation at CT1." Chabat et al. *Radiology* 2003; Vol 228. pp. 871-877.

[2] Deerwester, S., Dumais, S. T., Landauer, T. K., Furnas, G. W., & Harshman, R. A. "Indexing By Latent Semantic Analysis". *Journal of the American Society For Information Science*, 41, 391-407, 1990.

[3] Haralick, R.M. and L.G. Shapiro. "Computer and Robot Vision." Addison-Wesley Publishing Co, 1992.

[4] Haralick, R. M, K. Shanmugam, and Itshak Dinstein. "Textural Features for Image Classification." *IEEE Transactions on Systems, Man, and Cybernetics*, vol. Smc-3, no.6, Nov. 1973. pp. 610-621.

[5] Karkanis, S. A, G. D. Magoulas, D. Iakovidis, D. E. Maroulis, and M. O. Schurr. "On the Importance of Feature Descriptors for the Characterisation of Texture." 4th World Multiconference on Systems, Cybernetics and Informatics (SCI 2000), vol. VI, Image Acoustic, Speech and Signal Processing, Part II. Orlando, Florida, 2000. pp. 96-101.

[6] Kass, Witkin and Terzopoulos. "Snakes: Active Contour Models". *International Journal of Computer Vision*, 1988.

[7] Stan, D. and I. K. Sethi. *Color Patterns for Pictorial Content Description*. Proceedings of the ACM Symposium on Applied Computing, Madrid, Spain, 2002.

- [8] Tang, Xiaou. "Texture Information in Run-Length Matrices."IEEE Transactions on Image Processing, vol. 7, no. 11, Nov.1998,pp.1602-1609.
- [9] Trefethen L. and Bau D. Numerical linear algebra. SIAM, 1997, 28-29.
- [10] Xu and Prince. "Gradient Vector Flow: A New External Force for Snakes". IEEE Proc.Conf. on Comp. Vis. Patt. Recog.,1997.

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Western Print Media Coverage in Eritrean War of Independence 1960-1991 ;(A Study on English Print Media)

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Abstract- Eritrea is an independent African state which is found in the horn Africa. Eritrea is located in very strategic position that attracted foreign colonizers. Red sea long distance helps to have good trade relations with other neighbors, European and Asian countries through the red sea, since ancient times. Italian rule lasted till 1941. After the defeat of the Italians by the allied powers in World War II British military administration hold the territory that lasted from 1941 up to 1952. Afterwards the United Nations decided Eritrea to be federate with Ethiopia as concession between Ethiopian claims for annexation and Eritrea demand for independence. Finally the Ethiopian emperor,HaileSellasie ended Eritrean autonomy in 1962and Eritrea become Ethiopian fourteenth province.

The disbanding of federation called forth a militant nationalist resistance from the Eritreans. As a result the Eritrean armed struggle launched in September1, 1961 by ELF (Eritrean liberation front) aimed to achieve Eritrean independence. Through time organizational and ideological differences appeared within the ELF. As a result of this new splinter group was formed that called EPLF (Eritrean people liberation front) that leads the Eritrean masses towards independence in 1991.Eritrean war of independence takes thirty years.Within these years many ups and downs as well as challenges were faced to the Eritreans. The war for independence is not affected only inside the country but also outside. However Eritrean war of independence was mentioned and given coverage in several world newspapers and profiles. Western print media was describing the condition of Eritrea in its main printed media. This paper will be focus only in print media especially in newspapers, of English print media. We choose English printed media in order to narrow the scope of the study and to give clear and specific information.

Objectives

To analyze the different contents of newspapers periodically which produced by westerners in the case of English media.

To identify how the western printed media viewed Eritrean armed struggle and how they looked as struggle for independence

Index Terms- EPLF,Derg regime,Paris Times,London Times,New York Times

I. INTRODUCTION

Generally the western newspapers in the first half of Eritrean armed struggle were not giving that much coverage and it was not even though as armed struggle .The writers had many reasons to intended to do that because Ethiopia was one of the largest country in Africa and never been colonized unlike the other African countries and this make her to be well known in the world. In those times Ethiopia was considered as dignity of African's that shock the colonizers which is the battle of Adwa in 1896. Italians defeated by Ethiopian in which this made Ethiopia as the first black state to defeat or surrender whites; this helps to have good relationship with the western countries and to be acknowledged as powerful Christian country in the horn Africa. Thus Ethiopian look deemed Eritrean armed struggle as Islamic movement that sponsored by Arab and Islamic states.

Ethiopian emperor Haileselesie relations with the western rulers, was tight. Being a dominant figure hepraised in the Guardian, "the lion has still has his teeth" (The Guardian Dec9, 1961) through this phrase they exposed his power to the world as an outstanding king and the Eritrean revolution was considered as civil war existing in northern Ethiopia.The writers were not giving any much attention to the Eritrean revolution. They wrote about good side of that government, as. **John F.Kennedy American president**hailedHaileselesie as a man "whose place in history is already assured".(The Times, Dec1, 1963).The westerners considered him as a charismatic leader. The first black president that welcomed in white house," emperor Hailselasse of Ethiopia with President Johnson at the white house after arriving in Washington for a two day visit" .(The Newyork Times, feb15, 1967). He met with Johnson family and this makes him different from other leaders.

The newspapers were giving more coverage about the emperor's diplomatic relations with many countries. "Final negotiations between Russia and Ethiopia for the construction of a big oil refinery near the red sea port of Assab ended today with the signing of contract at the ministry of public works here." (The Times,Aug30, 1962).Haileselesie was not having diplomatic relation with Russia only but he was having strong thigs with America, Jamaica and with almost all African countries in every aspect economically and politically. Ethiopian economic relation with many countries was highly covered by newspapers. They covered in this way "the development of Ethiopia is being international trade increased from 316million to 453million Ethiopian economy is in progress". (the new york

times dec 7,1963).American Economic and Technical assistance with Ethiopia to set air craft purchase constructing high way by loans amounting to almost 51 million. Ethiopian relation was not only with western and also with all African countries as the main figure in Africa. (Sunday Times, Nov11, 1964). "Zambia waits for emperor president Kaunda of Zambia has ordered maximum festivity for the state visit this week of emperor Haileselassie of Ethiopia "emperor will be the first head of state to visit the country since the independence celebration in October.

Certain newspapers were trying to give little coverage about Eritrean armed struggle. They used to call it as Ethiopian coup d'état rather than self-determination struggle. In 1960 when the emperor was in his visit to Brazil the emperor bodyguards stand for coup under the slogan of "three thousand years of injustice to be ended" this coup was a failure but in relation to that Eritrean armed struggle considered as a continuation of the coup, "there are also plenty or minority and regional trouble in Ethiopia and from Cairo radio a stream of propaganda has been directed against the emperors government as black imperialism." (London Times, Dec15, 1960).Eritrean armed struggle to some extent got coverage in an incoherent organization and frequency. Especially after 1965, labeled as few guerillas lead" by IdrisHamedAwateon on the Sudan's as the country has always been notorious for its *shifta* or robbers but the situation has deteriorated and the whole of Eritrea now seems to be swarming with Muslim shifts or its better to called pure bandits".(Paris Times, Nov8, 1963). Ethiopia always blame the bandits were assisted by the Arabs against their Christian country.

In the early years ,Eritrean armed struggle was not progressive and only kept within lowlands mass participation was also very little, at the initial stage the struggle's main leaders and fighters were mainly Muslims but this merely indicate the absence of Christians inside the field rather they were few in number and were not entitled to leadership. The absence of coherent organization and clear program lead to have loose relationship between the fighters and leaders in abroad.

"Arabs countries were generally sympathize with the Eritrean revolution. Arab leaders like the Egyptian president Jamal Abdel Nasser supported the Eritrean case covered as Muslim minority that rises against the Christian Ethiopia.(NewYork Times, Oct16, 1966).The western countries and one becomes the main enemy of the bandits it was the time of cold war and in Middle East all the Arabs were stand against Israel as Eritrean war of independence considered as Muslim movement. Israel extensively helps to Ethiopia "Israel began to train Ethiopian police officers in counterinsurgency command tactics designed to end the guerrilla (*shifta*) actions of the Eritrean liberation front. The struggle was seen by Ethiopia Israel and the United States as an Arab backed. Muslim extremists and separatist in relation to cold war if successfully win independence for Eritrea, the liberation movement would be hostile to Israel and enforce a blockade of the *Bab El Mendeb* straits at the southern end of the Red sea: Israel's position was partially based on the belief that Eritreans population had Muslim majority".

"The movement called the ELF (Eritrean liberation front) concern in African and Middle East because the Algerian civil war has shown the perils of African secessionism and because it is linked ideologically with the Palestinian Arab commandos and

Ethiopian officials here in the capital of Eritrea asserted and the rest had growth markedly less active in the last two years. They said this was because the Ethiopian army and police had cracked down with the severity and Arab aid to the movement had dwindled since the Arab –Israeli war of 1967." (The Guardian, Sep26,1968).Ethiopia was used the Arab –Israel war as an opportunity to weaken the ELF in other hand ELF was not supported only by Arabs. "Chinese Communist Weapons have reached the mountain strong holds of the Eritrean independence movement who's Commandos attacked an Ethiopian airline coupled with increasing hands from Kuwait and Saudi Arabia. The two shiploads of arms served to blaster the confidence of the rebels who are fighting to throw off Ethiopian rule over Eritrea." (The Observer, Jun27, 1969):

In armedstruggle weapons and military tactics were not enough.So, the Arabs as their continuations support they offer free radio station, "Open support for the Eritrean secessionist is given by Syria leftist Baath government and a twice a week they receive time a Damascus radio to make provocative broadcasts for Eritrea's in their native tongue." (Daily Telegraph, Apr10, 1969).

In late 1960s the ELF was advanced and unlike in the first decade the western newspapers begun to cover but not in the matter of Eritrean war for independence just a Muslim movement fought for their Muslim province as they advanced better they start to get attention. "From 1961 began the guerrilla were terrorist activity, in Eritrea four years later and has attacked Ethiopian airlines at several European airports. After splits in the political and military leadership earlier this year, the ELF later regrouped and the movement launched a wave of attacks and sabotage operations and killing major generals TeshomeErghetu, the Ethiopian third arm division." (International Herald Tribune, Dec20,1970):

"The freedom fighters attacked and hijacked planes of Ethiopia, airlines to call attention to their cause in the world. A few months ago they kidnapped and later release the USA counselor general in Asmara for the same reason and can to say it is a clear dangerous to Ethiopia and can be expected to become even more so as the arms follows increase from more radical government in neighboring country". (Jan 1970) As the ELF advanced effectively over Ethiopia government in return the government attacked over women and children, villages were damaged. "Several areas of Ethiopian northern provinces of Eritrea have been placed under a state of emergency because of banditry and rebellion which the government said. Where begin investigate by the foreign government

II. GENERAL OVERVIEW OF THE SECOND DECADE

The second decade of the armed struggle was extended from 1971 to 1980. In Thisdecade important events interns of internal organizational changes takes place in the Eritrean armed struggle. What differs this decade from the first decade is because the Eritrean war for independence was flourishing in quality and quantity and the coverage it was given by westerners was drastically changed. Due to internal disagreement of the front civil war between the ELF and the splinter groups of latter EPLF (Eritrean people's liberation front) happened from 1972 till 1974. After the Emperor overthrew by military coup in 1974

a new regime naming itself as *Dergue* came to power only in this time both the ELF and EPLF agree to stop fighting among each other. This agreement was short lived and the second civil war broke out in 1978 till 1981. Inside the Eritrean fields they fought to each other and also to their common enemy Ethiopian. Henceforth they didn't succeed in achieving the Eritrean independence early.

The Eritrean independence movements were led by two fronts: - the mother organization of ELF and EPLF. The ELF convened two congresses for development and changes but in the second congress totally they separate from EPLF. This period was also marked massive flow of Eritreans joining to the armed struggle and many towns was liberated. The flow of the youth to the field was impressive and were joining either ELF or EPLF. Women's perception towards the liberation was grew at this times and like their brothers start to join the movements.

Both ELF and EPLF prime objective was Eritrean independence and development their main difference was their leadership and programs. The ELF's organizational leadership was basis of ethnic and religious affiliation. Whereas the EPLF were free from such ethnic and religious as well as regional differences at the end of the 1970s the follow was increased to EPLF rather than to ELF even many fighters of ELF left their own organization because they were not satisfied organizational system and join to EPLF to narrow their differences and others were left and exiled to different country to live their lives. (Ruth Iyob 1995, p.130). Many attempts had been done to narrow their difference as an example between 1977 to 1980 more than twenty meeting between the EPLF and ELF to bring about a harmony between the two fronts, however the ultimate goal of organizational unity failed due to their conflicting respective. (Ruth Iyob, 1995 p.130).

In 12th September 1974 movement of young officers of the Ethiopian army known as the coordinating committee of the Ethiopian armed forces, police and territorial army which is *Dergue* terminated the 44 years rule of 82 years old the greater emperor Haile Selassie. (Zdenek Carvenka 2009). (Eristruggle article) The Eritrean liberation movements followed the changes in Addis Ababa with greater caution but with no real hopes for change to the better. General Aman Michael Andom, Eritrean born chairman of the provisional military administration council as the Ethiopian governing body. He spoke about Eritrea to the press on September "I have heard of injustice and suffrages that befell Eritrea and I have realized the extent of in human deeds perpetrated in the governorate" (p 44, Herald 1974 sep 8) he seeks for an agreement with the fighters in field and he announced eighteen points program calling for the reform of the administrative authority, amnesty for the political prisoner, promotion of economic development, guaranty of freedom of expression and the abolishment of discredit system of divide and rule along the religion and ethnic lines. Eritreans were not impressed at all and as result representative of EPLF Yohannes Gebremeskel he reject the possibility that the new Ethiopian leaders may be studying a system of confederation in which local administration was to be given back to the people but the sovereign powers were to remain in Addis Ababa this programs were failure they didn't accept what Gebremeskel said "we want our old flag." The ELF rejected too any idea of

negotiations with the *Dergue* unless the Addis Ababa recognized before the negotiation the principle of Eritrean independence.

The policy of the new Ethiopian regime toward the Eritrean question got no difference from the old regime. So the only choice they had was to continue what they begun. The two organizations were received mass support and mobilizations. Inside the field they didn't only concentrated in the war but they fought against the illiteracy, health problem and through political education given to the fighters as well as to the people in the villages that are free from the enemies or called the liberated areas and briefly explain their aim as result the Eritrean people became aware of that and start to and dedicate to the Eritrean armed struggle. The two organizations were reached an agreement in January 1975 to fight for their common enemy and to create a united front and start full scale military operations bringing the war from the countryside to towns. Asmara was one of the beautiful cities of Africa with palm lined and intense business and social life has become a ghost city with the Ethiopian army fortified in the center. In 1970 most of the west and north Eritrea and part of the coast controlled by ELF and large scale of the military offensives were appeared they attempted to pacify the coast and also the second largest city of Keren, but at first they were failed (Roy Pateman 1990, p.120).

The Eritrean armed struggle in 1970's was progressive comparing to the first decade of the armed struggle. The main development was liberation of towns that was under the Ethiopian control especially after the second half of the 1970s many towns and villages were liberated from the Ethiopian control. As a result of this the fighters and the people get a chance to meet and the political concessions become at the pick, and all the peoples participation become in follow not only in the fields but also supports inside the Ethiopian controlled area. Both the fronts' were developed in their number of soldiers and equipments. The EPLA (Eritrean people's liberation army) including twelve infantry brigade, each with three battalions having 450 fighters at full strength. There are a number of semi-regularly regional armies and some 20,000 fighters in militant unities. There was a heavy weapons brigade artillery unites, the EPLA can mobilize over 200 tanks and armored vehicles, and all captured from the Ethiopian, there are also two tank battalions. In naval operations are carried out by a fleet of fast attack speedboats. The EPLA ranks eleventh in size among African armies. (ibid, p.121).

The Ethiopian new leadership was a continuation of the emperor regime but they follow pro socialist ideology. The cold war was going on at that time which is the east and west block the two camps and the new Ethiopian regime unlike the emperor started to follow socialist ideology by being on the side of east camp and immediately they nationalize everything Even though Ethiopia change their ideology the help from the westerners was still continued, Israel is also helping Ethiopia claiming that black Christian state and thus with the help of great powers Ethiopian army were flourished Ethiopia was able to be ranked first in size among Africa.

The EPLF focused on its internal organizational structure and the first organizational congress held on January 31 1977 this was based on the reassessment of the first seven years of its existence. National democratic programmer adopted by the congress represented distillation of the ideological conceptions

that had led the founders of the EPLF earlier to leave the ELF their experience with the realities of Eritrean society and the nationalist struggle EPLF also follow the idea of Marxist. In 1977 EPLF officially announced NDP (National Development Program) with eleven objectives. Some of the main points were to establish a people's democratic states, building an independent self-reliant and planned national economy, building strong people's army, safeguard social rights (workers and women). (Ruth Iyob 1995, p.129). Both fronts were advanced in liberation of towns, in 1977 almost 90 percent of the towns and villages were liberated by both fronts; this development brought with it's a new phenomenon and a new challenge to both fronts to administer the liberated towns. On January 5 1977 the Eritrean border garrison town of Karora was captured by the EPLF. The Ethiopians had been overwhelmed for several months but had not mined the defenses. In February 840 Ethiopian were killed during the EPLF blockade of Nakfa and April Afabet was liberated and Elabered. Nakfa was finally overrun by the EPLF on march 23. Followed by the ELF capture of Tessenai and the strategic hill overlooking the airstrip at Barentu and the fall of Keren and Agordat (ibid p.135). By the end of 1977 almost all the main towns were liberated up to Decemhare (Tekeste Fukadu 2011, p.60). For many Eritreans it was the first time seeing their flag in addition the fears and insecurities, night curfew the threat of languishing in prison or the possibility of being executed for minor offences such as singing the nationalist song possessing a pamphlet. It was a revolutionary change and its sustainability required revolutionary ways. One of the methods used to nurture national identity was to glorify and commemorate the victories through music pomes and songs. Many popular songs rehearsed in those days reflected the changes that were taking place, in particular the liberation of towns and went like "Eritrea, Eritrea towns become our comp." (Radie Bereketeab 2000, p.198). The EPLF needed to strengthen its links with the countryside and still push through reforms while fighting the Ethiopian occupation army.

While this was continued and the people as well as the fighters expected to liberate the capital Asmara but unlike the wishes of the people the fronts start to retreat from the liberated towns. This strategic retreat was shocked the people behind that there were many reasons. The main reason was the Soviet Union bloc intervention, Ethiopia acquires help from different soviet countries and also America and Israel offered extensive aid in 1977. United States \$109.4 million was denoted and other in the form of arms. However soviet assistance became far more significant. Starting from May 1977 soviet supplies were valued \$1 million these included sixty MIG-21 and twelve MIG-23 planes and other heavy military equipment and also aided gave lessons in military tactics how to attack the guerilla. (Ruth iyob 1995, p.129). The ELF and EPLF withdrew from the captured area that was the only option. The other reasons that lead to retreat back were the failure of unity efforts in the rank of the national liberation movement. Subsequently an internecine war erupted between the two organizations that eventually led to the demise of the ELF. Finally they retreated to their base which was Sahel and *Dergue* recaptured the liberated area. (Redie Bereketeab 2000, p.201). And the organizations were limited for years in the main front of Sahel. The *Dergue* was suppressed harder and somehow the people of Eritrea morally

depressed. In January 1 1979 *DemsiHafash* which is radio of the fighters aired their voice from Sahel in Fahi the people of Eritrean raise their hopes once again.

Western print media coverage in the second decade (1971-1980)

Western print media coverage in the first three years of second decade of Eritrean armed struggle was continued just like in the first decade but relatively changed with advancement of the fronts. Foreign support to Ethiopian continued in all sectors. Emperor Haileselesie was given much privilege and whatever he did was highly covered in the newspapers of the west as he was a senior African state man and his good relation with the western countries. "The times news" interviewed under the title of the "we want to live in peace" "this was a personal interview in relation to the Ethiopian politics and he explained the relations with the western countries he said" Ethiopia only asks for assistance to be able to defend itself we must have the capability to defend our homeland, we merely want to develop as fast as possible and live in peace in our own land." (The Times Dec 3, 1973). Until the end Haileselesie regime his relation was always smooth. Even though the Eritrean fighters were advanced but they couldn't get much coverage rather they only concentrate on Ethiopian relation.

In many western newspapers the Emperors Biography was available and his special personal event like "the year Haileselesie 80th birthday. To his own people almost he seen as a god, when his car appears on the side of the streets traffic pulls in to the side of the road and pedestrian fall on the knee." (The Daily Telegraph, Sep 2, 1972). Rapidly similar articles written in relation to recognition of his 80th birthday anniversary celebrate throughout the continent of Africa special postage stamp was issued to OAU members. Haileselesie described as "sage of African wise counselor to eminent heads of the state government and one of the outstanding architects of African unity and solidarity, exponent of world peace and human understanding." In the newspapers emperors covered highly and mostly posted in the first page of the papers as father of African unity.

The Eritrean armed struggle articulated in their pages of western newspapers in the beginning of 1970s as "the Eritrean war fought by a tiny secessionist Muslim minority against the black Christian state of Ethiopia suddenly exploded threatening to jet for greater outside forces in to motion." (New York Times, Jan, 2, 1971) In the first years of second decade of Eritrean war of independence were getting coverage only if there happened any breaking issues like hijacking or attempted to hijack Ethiopian airplanes as exclusive news "two members of the Eritrean liberation front were shot dead by security guards during an abortive attempt to hijack an Ethiopia airline on a flight from Madrid to Addis Ababa." (Daily telegraph, Jan 23, 1971) Other many hijackings was done to Ethiopian air planes and this incidents were highly covered by the westerners, in December 1972 Boeing 707 Ethiopian airline was hijacked by the fighters but unfortunately they failed and killed seven hijackers including a woman. Inside the field the first civil war started between two fronts ELF and EPLF from 1972 till the *Dergue* regime came to exist. This was a big issue to be discussed or to be published.

Even though the coverage of the Eritrean armed struggle by the western relatively increases comparing to that of 1960's but still they described as Muslim separatist movement.

The advancement of the struggle expressed as “Eritrea road to another Vietnam.” (the times, Dec 15, 1972) After eleven years of the armed struggle the movement has extended embrace the entire countryside of Eritrea in fact the movement was so strong, the ELF start the movement with three rifles and few guerillas after eleven years they equipped with relatively modern weapons from different socialist and Arab sources. (New York Times, May 1, 1971)

The two fronts of the armed struggle where protecting their natural resources besides their struggle and through the kidnapping of foreigners that work for Ethiopia. Those were getting coverage as the foreigners were from the west and was posted in many newspapers as “five westerner seeking oil are captured in Ethiopia, guerrilla seeking independence for the northern most Ethiopian province of Eritrean have captured three American and two Canadian exploring for oil informed source.” They exposed in different newspapers until the agreement has reached to release the foreigners which had been kidnapped “Eritrean liberation front promised to release the five captives American and agreed to close the oil company in Eritrea around Massawa and the general manager of the company said Ethiopian authority to cooperating fully to win the release of the captives.” (Sunday Times, Apr 1, 1974) Eritrean rebel leaders on the Eritrean front free two American kidnapped in Asmara July 14, Osman salih sabbe secretary general of the rival ELF said “it is the principle of the Eritrean front not to hurt any foreigner residents of Eritrean who have caused the revolution no harm” he added that the kidnapping reflected Eritrean displeasure with alleged America military support for Eritrean sons killed by American bombs and guns (Daily Telegraph, Aug 7, 1975).

New regime's role in changing nature and frequency of coverage

The year 1974 was a significant year for the Eritrean and Ethiopian people because the Ethiopian emperor was collapsed. Obviously that all newspapers were engaged in work to address the event as emperor Haileselas was well-known leader in the world. Under the title of the end of the lion of Judah less than a year ago he was one of the last absolute monarchs on earth he appointed government made laws and held life and death power over his 26 million subjected. (The Guardian, Sep 23, 1974) The same content in different western newspapers highly covered like “the lion caged” and “lion of Judah out like a lamp” “farewell to the lion” and in other many as exclusive news.

In relation to the decline of the old monarchical government and the raise of the new socialist government there was hope to settle the disagreement between Ethiopian government and the Eritrean fighters this was given coverage because it was a different event in the history of the both countries. When the coup was done the leadership was under general Amanemicheal Andom and he stand to change the existed situation. He invited to talk with both the fronts This came to be printed almost in every newspaper with different articulation as “Eritrean rebels declared today that they are willing to negotiate a peaceful settlement with Ethiopian new military rule in a neutral country but the Ethiopian must first make a public recognition that the Eritrean liberation front is the sole legitimate in representative of the Eritrean people”. (International Herald, Aug 27, 1974).

In Washington post describe as “Ethiopian plan to talks with rebels” in their front pages as follows Ethiopian government indicated today for the first time its readiness to open a “peaceful dialogue with the Eritrean liberation front.” The guerrilla movement secession of the country's strategic Northern Province. “General Aman Michel Andom said in the Washington post “we seek peaceful dialogue and negotiations but not with force and a new era has begun and we should go forward together, we as a nationals seek the cooperation of the Eritrea.” (Washington Post, Aug 21, 1974).

General Aman who flew to Asmara in Monday morning in air force plane also expressed his conviction that peace and security would be restored in the governorate of Eritrea. During his stay in Eritrea he intended to meet as many people as possible to exchange views that may help to restore peace and security in the area, even though he stand for peace negotiation he didn't agree Eritrea to be independent, he express his felling in financial times London “he said such oppression and injustices which existed in Eritrea had also occurred in other fourteen provinces of Ethiopia and Eritrea was a necessary and vital part of Ethiopian” (International Herald, Apr 29, 1974). The pattern and frequency of the western print media on Eritrean armed struggle was seen with the coming of new Ethiopian regime *Dergue* the Eritrean war for independence was highly covered in a few newspapers as the Ethiopian question to negotiate with Eritrean fighters was a fear of Eritrean powers to support this in New York Times “the guerrilla are everywhere around and they have infiltrated Asmara as well if the military movement doesn't manage to appease the rebels now they simply will move to Asmara one day very soon and take over.” (the new york times, aug 8, 1974).

The western newspapers for long time covered the “Ethiopian and Eritrean talks” which means the *Dergue* regime with the Eritrean fighters a peace negotiation at the last reported as “Eritrean guerilla rejected Ethiopian talk” the Eritrean liberation through a spokesman in Cairo reject all independence talks with the Ethiopian government and warned that it plans to extend its urban war. In addition ELF foreign affairs spokesman said talks could begin only when the Ethiopian governments recognize the provinces right to independence. Ethiopian government after attempting failed peace talks with Eritrean fighters the guardian posted it “Ethiopia declared all-out war on Eritrea rebels “they announced today that it had abandoned its policy of restraint and would eliminate the separates guerilla operation in northern province of Eritrea .In addition to that “from now on Ethiopia will demand the hands of her true and vigilant sons to suppress bandits elements” (The Times, Feb 2, 1975).

Many foreigners moving out with the coming of the *Dergue* regime many of them were living in Asmara for long years, those families left during the last few months and others are preparing to leave selling their houses and business moving to Addis Ababa or Europe this events were highly covered besides that the Eritrean armed struggle also covered because the foreigners were living claiming that a fear of attacks from the guerillas because Asmara was attacked several times by the them so they moved out from Asmara in relation to that they describe and covered the advancement of Eritrean armed struggle begun to prosper and start to liberate towns in this situation the

insecurity worsened the foreigners start to evacuate from Eritrea this describe by the newspapers in relation to the advancement of the armed struggle “90 years Italian link cut by Eritrean airlift” more than two thousand Italian colonial origin who consider themselves as Eritrean rather than Italians”.(Daily Telegraph, Feb6, 1975).InNew York Times also posted more than hundred American with their women and children flew out from Asmara to AddisAbaba for the sake of safety. (The NewYork Times, Feb5, 1973).The evacuation was continuous with shortage of food and water supply in Eritrea.

After some time officially announced that the two Eritrean rebel forces united in Daily Telegraph “the two fronts which had been divided along religious and ideological lines for years now agreed to form a common front”. After uniting they progressed and extensively attack Ethiopian troops and armed station exclusive they covered rebels attack on the new government mainly in capital of Asmara “rebels attack bases in northern Eritrea using weapons supplied by Libya Iraq, Syria and other Arab states.” Similar articles were posted highly in the west “Eritrean secessionist guerillas last night launch three attacked on military target in Asmara.” As they advanced they attack Ethiopian convey this including tanks, troops heavy artillery as this was getting coverage respectively Ethiopian government try to limit the reporters that had been flowed to Eritrea. Even though they try to reduce, the reporters continued to posted the clashes between government troops and combined forces of Eritrean fighters raged for over ten hours around the city immediately Ethiopian to control the situation they call for “curfew clamped on Eritrea capital” (The Times Paris, Feb6, 1975)..After the clashes broke out the military authorizes clamped a strict 6pm to 6am to restore law and order. Ethiopia was then asking for help from United States to handle the condition. The Eritrea leader propagated in the papers Osman SalihSabbe said “our forces are now in full control around Asmara and the declaration independence will come in a matter of weeks” In support of the progress on the Eritrean armed struggle Eritrean guerrilla release a thousand political prisoners from two jails this made them to realize the Ethiopians how much the guerrillas were advanced toward independence as are result of this Ethiopian government oppressed the people under the title of” Ethiopian declared emergency to stop a wave of walkout” (International Herald, Jan10, 1975)..the emergency actions gave policy and armed force the right to search and arrest suspected dissidents, and all elementary schools were ordered to closed except those operated by foreigners high schools and colleges had been closed before. Starting from 1975 Eritrean army struggle begun many operations like the Umhager, Assab, Tesseny and Adi- keih in short days, even the coverage was high almost all was similar.

Ethiopia asking for military aid for long time finally united states decided to help modernizing the 40,000 Ethiopian army force believing that more effective Ethiopian military can be a frustrate against soviet influence in neighboring Somalia despite the new input of weapons and resultant need for more technical assistant. In the second half of the decade reporters were flowing to see the truth but Ethiopian government was not allowed few was interred to Eritrea like an American free-lance journalist and photographer of Washington post Mr. Don Connell. He has been traveling for several weeks with the

Eritrean fighters under the title of “peasants learn truth about Eritrea” to change the perspectives of the west and he described his tour in the field “we were taken by rebel’s forces to see two quite different Ethiopian prisoners captured during the peasants’ campaign. The first group was from Wollo and Tigray provinces taken in raids and clashes and second was regular Ethiopian soldiers they were deeply depressed “Don Connell said Ethiopian government was notpermitted journals to visit Eritrea but now we were touring with EPLF, we travel by Toyota, Landcurser taken from the enemy. I met with prisoners and had interview asked them how they coming? And they answered that forcefully we are taken to raid in Eritrea but unfortunately EPLF captured us but we find unexpected thing Eritrean fighters had been good to us they provided our food water even they teach us in our native language”.(WashingtonPost, Feb8, 1971).

As a continuation of his writings don Connell briefly described the activity of the fighters in Washington post he write “behind rebels line in Eritrea” they were not only active in warfare inside the field many activity has been done like political education, repairing different staffs and cultural activity they have a special unit for 8-15 years old children organized touring to different liberated areas as group of entertaining. (Washington Post, Sep10, 1976). “Ethiopian losing in Eritrea “ the Ethiopian army in the strategic red sea province of Eritrea is being slowly driven out by secessionist and heavy fighting is reported around bases at Nakfa and Afabet and some 500 Ethiopian soldiers surrendered. The Dergue regime was radical socialist that came to power by coup d’état inside them there was power struggle as a result many execution have been done “nine men including major SisayHabte the third ruling consular had been executed for plotting to overthrow” (The NewYork Times, July27, 1976).

As the Eritrean advanced in the field they also seek for help. In Kuwait they participate at the Arab conference the representatives coated that “that only a minor part of Eritrea is still un liberated and predicated that the Ethiopian troops will collapsed” (The Times, Apr24, 1973).and they explain the aim of asking for help to seek moral humanitarian and financial support for Eritrean refugee and displaced Eritrean citizen who fled from the country because of the Ethiopian massacres and tyranny. They tour to almost all Arab countries was aimed for aid. The year 1977 is reported mainly as the fighters success in liberated important towns like Keren and Nakfa they massively attack toward the capital Asmara on the way their attacked and captured 100 prisoners from Ethiopian troops and some 50 military captives including number of tanks and cotton bales worth one million and Ethiopian bank in Tesseni The Times” Eritrean guerrilla claim capture of important towns” and financial times reported “the greater part of both the northern and southern territories had been liberated while more than 95% of the Eritrean lands had been regained from the Ethiopian forces”(The Times, Apr17, 1977)..In this war Ethiopian army faced a huge lost some 300 were killed and some 200 were surrendered including two colonels. Eritrean liberation advancement coverage by the westerners highly as Eritrean victorious against heavy fortified Ethiopian bases and built a momentum in Eritrean liberation that has carried them to the brink what they called final assault.

As a result of the socialist ideology Ethiopia was losing its western friends and ordered the evacuation of more than 300 Americans by the military junta that was reported as “American

ousted by Ethiopia". accompanied by mutual cooperation between Ethiopia and Russia that the Marxist regime in Ethiopia was closing American military communication center and other installation has been given further evidence it's switch to the Russian camp .big consignment of Russian tanks and armored troops (Daily Telegraph, Apr25,1977)..In relation to that Ethiopia was not only breaking its ties with America rather with all western countries like Britain, Italy, Belgium France and others those were ordered to close their councils in Ethiopia. (ibid,apr26,1977)....After 17 years the separatist forces virtually control the entire territory Ethiopian hold only three cities in Ethiopia "the guerrilla leaders said to reporter about the victory of towns "the real strength of Eritrean war for independence lays in the broad support by the civilian population but foreign assistance is little"(International Herald,Jan2,1978). The balance of forces within the Eritrea liberation movements had shifted dramatically in few months with the EPLF's growing in size, strength and the nationalist ELF apparently falling to confusion this reported as "Eritrean unhappy in victory" the reflecting on the increasing out spoken hostility among the Eritrean nationalist one leader said "our prime problems is not Ethiopia but our division"(The Guardian ,Aug10,1977).Thousands of Cuban puppet troops several of them worshippers of the soviet social imperialist ideology came to Eritrea and large quantities of the sophisticated soviet weapons brought and this massive help was highly reported "the junta has been busy preparing for dangerous large scale operations in Eritrea" other many newspapers articulated the support of Marxist similarly in the guardian "Cuban puppets troops have also arrived in Asmara to activate and take part in the jaunts counter revolutionary genocide war against the Eritrean people"(The Times, Apr2,1978).. The Ethiopian troops assisted by Cuban troops and by soviet advisors have recaptured all major Eritrean cites"(The Guardian, Apr4,1978). "The latest estimated is that 16,000 -17,000 Cubans are in the country with some of them based in Eritrea where the central government is trying to suppress a rebellion. This Cubans were assisted by about 1.000 soviet advisers". (The Guardian, Apr5,1978). This western support includes navy assistance in the red sea.

Ethiopian army was not only supported by Cubans and soviet but also other countries. "Like Israel, Cuba, south Yemen, East Germany, and USSR make strange bedfellows. It did not appear to face Zionist policymakers, who cite their national interest in the red sea region as more decisive than ideological differences with the Dergue's other allies". In the following year 1978 war was continued with more sophisticated military weapons of Ethiopian military government aided by westerners and other organizations. "World Bank funds and non-military aid from Western Europe are still flowing in to Ethiopia and there is increasing of renewing direct aid programs to Ethiopia"(Washington Post, Apr5,1978)..

As the Ethiopian military government and Cuban forces allied they try to destroy the Eritrean fighters they bombed over civil people. "Ethiopian fighter bombers have been dropping cluster and napalm bombs for most of this month on towns held by the separatist guerrillas in the strategic red sea province of Eritrea". (Daily America, Apr20,1978). "Due to ongoing battles and for strategic military reasons we resolved to make a tactical withdrawal from our eastern front and started from their

positions on the Asmara Massawa road". "massive foreign assistance changes nature of Ethiopian war "after the fall of Kerenon the hands of Ethiopian army the Eritrean forces totally retreat to Sahel and they explained their withdrawal according to EPLF "we opened a new phase in a long and bitter struggle and it was large scale direct soviet perception in Keren campaign and Ethiopia retaking the major towns "the assistant secretary general Issyasaforki said "we are not fighting the Dergue any more" we fought with the Cuba and soviet.(The Guardian, Feb20, 1978). the Eritrean fronts explain to their people about the withdrawal that Ethiopia accompanied by Russian advisors we strategically retreat to avoid heavy losses and due to our ambush and retreat tactics the losses was minor and we will recapture the towns and start to work raising slogans "self-reliance" and "today's small factories are tomorrow big industries"(The Guardian ,Jan31,1979).

Even though the Eritrean fronts retreated back to their base they continued their programs in the fields mainly they protect the people who fled fearing from Ethiopian attack during the retaking the liberated towns because Ethiopia was attacking the people of Eritrea "100,000 Eritreans flee to the mountains to protect from Ethiopian heavy artilleries bombard and military air" Ethiopian damaged around 40 villages was wiped out and 120 badly damaged crops and animals had been burned .Eritrean forces still continued educating 2000 orphan pupils was continuing their school normally in area where class rooms were in the cave in order to hide from Ethiopian air attacks. The Ethiopian bombing attack in the ordinary people estimated to have displaced more than 140,000 people but it has failed to deprive the EPLF's popular support according to the Red Cross official report "the overwhelming majority of these displaced people chose to stay in EPLF controlled or semi controlled area flee to neighboring Sudan."(The Guardian, Aug4, 1980).

The main objective of the Ethiopian government was to reach Sahel which is the center of the Eritrean fronts and to demise the fighters totally the war was characterized by the introduction of an increasing sophisticated military technology with large scale of soviet involvement. At the end of second decade colonel MengistuHailemariam seekfor diplomatic relation with Sudan to cut the relationship between the Eritrean liberation front's and Sudan as it was the base for Eritrean supply like food Medicine and other logistics. That was highly covered in the west and "colonel Mengistu failed to maintain the relations with Sudan".

III. DECADE THAT ENDS THE ERITREAN ARMED STRUGGLE (1981-1991)

The last decade of Eritrean armed struggle extends from 1981 up to Eritrean Independence Day 1991. This decade was characterized by many events and incidents and also Eritrean independence was achieved in this decade. In those years the EPLF became the sole political and military dominant over its rival ELF. After ten years of competition between the two liberation front's and the culmination of the national liberation movement in the independence of Eritrea. The circumstances leading to the ELF demise was first the military defeat by EPLF in the civil war and the flow of the Eritreans joining to fronts grew the proportion of this increase coming from the highland

part of Eritrea was particularly large thereby the socio political composition of the front dramatically change in particular of ELF begun dramatically shift. EPLF belief that ELF had not changed from the behavior of 1960s and that was not conducive to unity under this conditions once again they engaged in second civil war broke by 1981 the ELF had been pushed to Sudan which put an end to its military existence inside Eritrea. This marked the end of civil war and paved the way for the domination of EPLF. The victory of EPLF widely attributed to its organizational strength, centralization and unity of the leadership.

After the strategically withdrawal had been taken place by the Eritrean fronts the Dergue regime was propagate as the Eritrean fronts will collapsed soon. Unlike the Dergue wishes at the end of second decade five offensives had been taken place and in almost all the offensive Eritrean fronts had upper hands. By the mid 1980 the EPLF could boast of an impressive record of mobilizing the various ethnic groups and classes including Eritrean women in to a single goal "liberation" and they gave priority to the idea of a secular nationalism and emphasized education and culture as a vehicle for political organization. Immediately after ELF driven out from the field the only remained front was EPLF. Dergue highly advertised and meticulously designed military campaign was launched by February 15 1982 called as Red Star campaign. They intended to crush the front once forever and for all EPLF frustrated the Dergue plan thereby asserting its determination and capacity to survive. The Dergue regime preparing for about six months and the war continued for 95 days .the Red Star was launched on four major fronts and 90,000 Ethiopian troops involved with advanced soviet helicopter, gunship were used for first time in this way the soviet support was continued and 400 advisers in the front lines .soviet become the responsible for the war strategy under the direction of field Marshal Dimitrov. The red star campaign end with the EPLF victory over Dergue and lost many troops and surrendered even the soviet advisors. The victory of the sixth offensive was highly covered by the Eritrean radio broad cast that was opened in the last 1979 at the field this encouraged the Eritrean fighters and the people under the Dergue regime. The "radio voice of mass" plays a great role in giving information about the condition of the fields generally and the offensives. The radio was very influential in the Eritrean armed struggle and in initiating Eritrean youngsters as a result many students and workers flowed to the fields to fight beside their brothers and sisters.

In this decade the advantage seemed to be in the hands of the EPLF a year after the red star campaign in August 1983 EPLF pushed the Ethiopian troops out of karora after they had held for two years. The Ethiopian were also forced out of Kerkebet and Barka valley area. At the last August the Ethiopian lost key position on the roads from Agurdet- keren-Afabet and lost so many men. Later the EPLF continued the counter offensives in 1984 which resulted liberation of Tessenai and the rich farming settlement of Ali Ghidir. In May 1984 successful EPLF command operation in Asmara international airport 33 fighting jets were destroyed in the mission this was shock to the Ethiopian government. At the second half of the third decade the flow of people to the fields rapidly changed especially women. In the field the women's equality was ensured, they participate as

equally as man in every offensive. Their role was not only limited in military but also in each and every works that has been done in the field like making trench and other staffs. The EPLF was progressed and liberation of towns was their main aim .They recaptured the towns this was done with the massive help of the masses, after the EPLF recapture the towns the fighter and the masses moral was at the highest stage they believe that their victory would be very soon.

A number of meeting aimed at finding a peaceful solution to a conflict succeeded one another, undertaking by US president Jimmy Carter. However during the peace conference in London in 1991, the negotiations collapsed due to the breakdown of the first largest army in Africa and capture of Asmara and Addis Ababa the negotiation showing no sign of a solution. The EPLF successfully entered Asmara in May 1991, the war was over and Eritrea was liberated.

IV. COVERAGE OF THE WESTERN NEWSPAPER (1980-1991)

The last decade of Eritrean armed struggle was a decade of victory, which came to get highly coverage by the westerners and this help to get attention world widely. After the strategically withdrawal of the two fronts in the second decade they concentrate only inside the field to developed their internal power for the next attack which comes from Ethiopia and its backer soviet union . Suddenly the Dergue prepared to launch the sixth offensive they called as the "Red Star campaign" they prepared for about six months with the help of the soviet and Cuba and they seek to totally damage the EPLF it's obvious the coverage was huge as the propaganda of the Mengstu regime, he also called "the end of guerilla war" . The western newspapers describe this situation "the Eritrean war Africa's longest battle seems to be heading toward a bloody climaxe" and added operation Red Star is what Mengustu hopes will be his trump cards in tragic and death strewn Eritrean situation. The operation expressed in other newspapers mainly the propaganda of the dergue regime in the Guardian post as "Eritrea the next assault" and MengustuHailemariam has launched his biggest offensive against the EPLF and promising to crush the guerrilla forces and Mengustu said "Dergue has mobilized an estimate 130,000 troops to concentrate attack in Eritrea "the military offensives has been accomplished by Red Star describe as by some Ethiopian as "an all-purpose revolution any complain."

The Ethiopian head of state colonel Mengstu was in Asmara taking charge of planning the red star campaign with four Russians generals and 2000 Russian military experts. While EPLF attack unexpectedly by entering to the enemy lines in Asmara this was done by the Eritrean commando that has been trained for long time to attack the international airport this get coverage in relation to the red star campaign. This was posted as "guerrilla go on the offensive in Eritrea" In this red star campaign against guerilla fighters "Ethiopian force have launched a massive offensive against Eritrea liberation fighters and have used deadly nerve gas .A spokesman for the Eritrea reported" the age when EPLF clams the world come to look after "a telegraph sent a to Mr. perezUN secretary general by SalimAzzam secretary general of the Islam council of Europe, said that supplies of Lethal gas were being held by the Ethiopian at Afabet .In Asmara and "in the south" the number of casualties

was not known, but survivors were suffering from acute poisoning. The western print media briefly describe the propaganda that has been given by the dergue regime .when the war ends with the victory of EPLF the coverage was not as much as the Dergue propagated it.

V. CONCLUSION

Eritrean armed struggle was started with few and ill-equipped youngsters. Western print media coverage in the Eritrean war for independence was very limited in the first stage of the armed struggle this is because Ethiopian domination in the region and throughout Africa. At the beginning of armed struggle western print media was not given coverage. Because the struggle was not well known in the world. In the first half of the first decade the westerners didn't covered about the struggle, dominantly they were covered about emperor Haileseless as charismatic African leader and his diplomatic relationship almost with all countries especially with western countries and his invitation to visit many countries in the world even they covered about his detail personal life. At the end of the first decade Eritrean armed struggle started to get little coverage.

In the second decade of the armed struggle the western print media was coverage relatively increased in relation to the first decade especially with the collapse of emperor haileseless by coup diet and the coming of dergue regime they covered mainly about the charismatic leader haileslasie. Western printed media start to give concern about Eritrean armed struggle when the new regime asked for peace negotiation with Eritrean fighter but still they covered them as separatist' Muslims and they struggled to separate from their mother country Ethiopia. In the western newspapers the call for peace negotiation was highly covered. At the end of the second decade the Eritrean armed struggle started to liberate towns and advanced toward Asmara .The strategically withdrawal of the fronts this was getting highly coverage in relation with the soviet support to Ethiopia. Western reporters begun to flow, even though the coverage was increased they didn't consider them as freedom fighters. In the second decade the coverage was generally about the new regime. Most of the newspapers didn't cover what was going on inside the field.

In the third decade the coverage was increased in quality and quantity. The sixth offensive highly covered in the west because this offensive was done with great soviet help and Ethiopian leaders exposed or propagate in international arena. Almost in every newspaper in the west posted about the Red Star campaign and described as the soviet and Cuba help to Ethiopia, the guerrilla will suffer. Through time the Eritrean war for independence get coverage from different western newspapers especially in 1988 the operation of Afabet and liberation of towns in Eritrea covered a lot. fenkile Operation covered as the huge Ethiopian naval base was destroyed by Eritrean fighters .many reporters covered about the Eritrean development in the field outside the military success and programs that launched by

EPLF and the support of the Eritrean people to the fighters and the women's role in the struggle.

REFERENCES

- [1] Roy pateman, "Eritrea even the stones are burning" the red sea printing press
- [2] Ruth iyob "the Eritrean struggle for independence" Cambridge university press britan 1995.
- [3] Alemsegedtesfay, 'kabmatinzokesabelda" 2005.
- [4] Zdenekcervenka "Eritrean struggle for self-determination".Unpublished 2009.
- [5] Tekestefukadu, "kabOromay Nab Oromay" Hidri pub, Asmara.2011.
- [6] Rediebereketeab, "Eritrea making of a nation 1890-1991, UppsalaUniversity 2000.
- [7] Don Connell, "Against all Odds",Trentonn.j. the red sea printing press.
- [8] David Pool, "From guerilla to government",Cubrria university 2001..

Newspapers;

- [1] The Guardian newspaper, owned by "Guardian Media Group, founded in 1821 kings palace,90 way London n19 gu, issn 0261-3077.
- [2] The Times "owned by news corporation, founded jan 1, 1785, atwapping London, U.K.,issn 0140-0460.
- [3] The NewyorkTimes. "Owned by Newyork Times Company, founded 1851, at620 eight avenue manhattannewyork, issn 0362-4331.
- [4] Sunday times, "owned by news international, founded 1864, issn 0956-1382.
- [5] London times, pub. dec 15, 1960.
- [6] The observer (newspaper), pubon june 27, 1969.
- [7] The Daily Telegraph, "owned by telegraph media group, founded 1855, at 111 buckingham palace road London.
- [8] International Herald Tribune (newspaper), pub on dec 20, 1970.
- [9] washington post "owned by Washington post company" founded1877,at 1150 ,15thstreet, Washington DC,US, ISSN 0190-8286.
- [10] Daily America "owned by daily mail and general trust, founded 4 may 1896.
- [11] The News Analysts, pub on apr 1, 1982.
- [12] Toronto Star "owned by Torstar, founded1892, at yongstreet, Toronto,Ontarioissn0319-0781.
- [13] International Daily Newspaper, pub. on july7,1983.
- [14] The Miami Herald, "owned by The McClatchy company, founded 1903, florida 33132 ,issn 0898-8656.
- [15] The News Week, "Pub Sidney Harman, first issue feb 17, 1933 US, issn 0028-9604.
- [16] The Atlantic monthly, pub on Aug2, 1988.
- [17] The Independence, pub on Aug 30, 1988.

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Assessment of life-skills of adolescents in relation to selected variables

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Abstract- Life-skills can be best understood as the abilities for positive and adaptive behaviour, which enable individuals to deal effectively with day to day needs and challenges. Major life skills include problem solving, decision making, creative and critical thinking, effective communication, interpersonal skills, empathy, and self-awareness, coping with stress and emotions. These Life-skills have further been clustered as; Thinking skills, Social skills, and Emotional skills. Adolescence is the period in human growth and development that occurs after childhood and before adulthood, from ages 10 to 19. It represents one of the critical transitions in the life span and is marked by a tremendous pace of physical and psychological human development. Recognizing the importance of life-skills, in the lives of Adolescents the present research was undertaken with the following objectives: To assess the life-skills of the selected adolescents and to determine the variation in their life-skills with their SES and education of parents. School going boys and girls (14-16 years) of classes VII, IX & X were randomly selected from randomly selected schools of five Zones of Delhi Municipal council. SES scale by Tiwari et.al (2010) and Life-Skills Assessment Scale by Subasree and Nair (2010) were used for collection of data. On statistical analysis it was found that Sample adolescents had average level of life skills. Dimension wise analysis revealed that they scored least in the dimension of coping with stress, pointing to the need for more emphasis on acquisition of this skill to deal with the ever demanding requirements of everyday life. A highly significant correlation found between parental education and levels of life-skills of adolescents, further fortify the notion that education plays a crucial role in making parents aware of the needs of their children.

Index Terms- Adolescents, Coping with Stress, Life-Skills, Parental Education.

• Introduction

The notion of Life-Skills draws its roots from the inherent desire of mankind to live a fulfilling and happy life in coherence with the environment. Human beings tend to learn skills for life from a very young age and keep evolving with passage of time, learning to deal with the complexities of life. This need is enhanced during certain phases of life. Adolescence is one of them. Adolescence is the period in human growth and development that occurs after childhood and before adulthood, from ages 10 to 19. It represents one of the critical transitions in the life span and is marked by a tremendous pace of [physical](#) and [psychological human development](#) and change that is second only to that of infancy (WHO, 2009) www.who.int. [Adolescent health](#). The adolescents are in a state of confusion, stress and uncertainty about coping with their lives due to mood disturbances brought on by hormones and the immaturity of the “impulse control” centre in their brains (Kastner & Wyatt, 2002).

Today's fast & materialistic life have left out the emotional part of humans. The society is considered a more conducive place for the cultivation of certain non-academic goals that are more needed in the present day adjustment to the environment. It is very much evident that adolescents are undergoing tremendous turmoil during

this stage (Damle, 2013). Adolescents are unable to understand the emotional turmoil happening within themselves and thus are unable to tackle effectively emotional pain, conflicts, frustrations and anxieties about the future which are often the driving force for high risk behaviour (Chhadva & Kacker, 2013). With a tremendous shift in the structure of society, there is reported rise in teen stress, which can be because of disturbed family dynamics, peer pressure, inability to cope with studies, drug abuse, lack of competence etc. leading to maladaptive behaviour (Singh & Kaur, 2015).

There is a pressing need to understand the factors that give rise to and maintain aggressive behaviour across childhood and adolescence, (Reebye & Moretti, 2005). According to Nair et. al (2005), the family Life education and Life-Skill training Programmes are good support systems for adolescents, as it is a well-known fact that family plays a crucial role in shaping the personality of an individual. In a study conducted by Arati, (2016) to find out the influence of personal variables on core affective life skills of adolescents, it was shown that order of birth and family income has significant influence on interpersonal relationship dimension of life skills. Gender, number of siblings and family type has no significant influence on core affective life skills. Good support from the family can equip the children with skills for life. If adolescents can learn how to deal positively with their problems, they are less prone to becoming victims of any social or personal evils (Chhadva & Kacker, 2013).

With cultures and lifestyles in transition, many young people are not adequately equipped with life skills to help them deal with the augmented demands and stresses they experience. Effective use of Life-Skills can influence the way children feel about others and themselves which in turn can add to the children's self confidence and self-esteem (Life-Skills Education and CCE Manual CBSE, 2010). Productivity, self-esteem, self-confidence interpersonal relationships are also affected (Subashree & Nair, 2014). Improvement in Life skills can result in individuals making informed choices to serve the interests of self and others, becoming "proactive" and change agents. They are able to resolve conflicts, cope with stress and develop negotiating skills for personal and social interests. Life-Skills play an important role in the promotion of mental well-being which contributes to our motivation to look after ourselves and others. It helps one to understand and deal with relationships, friends, parents, teachers, etc. People who do not have a clear definition of life are never happy and content. They will not be able to move ahead in life. If a child is empowered to bring an understanding and balance in life, he will grow up to be more satisfied (Khwaja, 2011).

Life-skills can be best understood as the abilities for positive and adaptive behaviour, which enable individuals to deal effectively with day to day needs and challenges. "Adaptive" means that a person is flexible in approach and is able to adjust to difficult circumstances. "Positive" behaviour implies that a person is capable of handling adverse situations and can find a ray of hope and opportunities to find solutions (WHO, 1993). Life skills means the everyday skills that people need to live a liberated life and the skills that they need to relate to other people. In paying attention to skills learning, it is important that we remember the vital role that life skills play and that we develop them in everyone. Life skills are those skills that are not related to a certain intellectual or vocational discipline, but they describe the basic competencies for maintaining a fulfilling and independent existence (www.ialse.in). Actually no life skill is used alone; there is always a combination of more than one. Major

life skills include problem solving, decision making, creative and critical thinking, effective communication, interpersonal skills, empathy, and self-awareness, coping with stress and emotions. These Life-skills have further been clustered by WHO (1995) as; Thinking skill, Social skills, and Emotional skills. Effective acquisition and application of life skills can impact the way we sense things about ourselves and others, and equally influence the way we are perceived by others. They contribute to our perceptions of self-efficacy, self-confidence and self-esteem (www.jsscon.org) and can be acquired by instruction and also by personal experience.

Emphasis on the development of Life-Skills draws its roots from the Vedic Education system in which main objective was to develop the physical, moral and intellectual powers of men. It was not merely theoretical but related to realities of life. The pupils comprehended the various problems of life through listening, intellection, reflection and meditation (Disha -Education, 2015). Life-Skills Based Education is now recognized as a methodology to address a variety of issues of child and youth development and thematic responses including HIV/AIDS, violence against children and status of women (World Development Report, 2007). Life skills are operationalised in specific situations. Opportunities have to be provided for developing these skills. The basic institutions laying the foundation of these skills are the family and school. The Skill India Campaign-2015 initiated by the Government of India places emphasis on development of Life skills and other tailor made, need based programmes for specific age groups like language & communication skills, personality development and, management skills, behavioural skills and job and employability skills (skillindia.gov.in/). The Discussion document on the National Curriculum Framework for School Education (NCERT, 2000) has recognised the importance of linking education with life skills: “it is through these skills that pupils can fight the challenges of drug violence, teenage pregnancy, AIDS and many other health related problems. In the Indian context, UNESCO study on Life skills (UNESCO, 2000) in non-formal education has identified self-awareness as the first necessary life skill especially for the disadvantaged and the disabled who need a self-image. The twin of self-awareness is empathy. Awareness of self should be counterbalanced by awareness of others, their different feelings, desires (www.iosrjournals.org).

Central to life-skills philosophy are the concept of self-empowerment and a belief that skills can be learnt, modified and improved as a person develops and adjusts to life’s challenges. Khera and Khosla (2012) in their study investigated the relationship between self-concept and core life skills in randomly selected 500 adolescents studying in secondary classes of Sarvodaya schools situated in south Delhi who had undergone YUVA School Life-Skills Programme (SLP). They suggested that there is a positive correlation between core affective Life-Skills and self-concept of adolescents which means those who possess these essential skills have better confidence in all aspects. Life-skills Education helps in building self-concept, self-esteem and self-efficacy in adolescents and enables them to translate knowledge and attitudes into actual abilities thereby improving the quality of life and emotional regulation ability to make good lifestyle decisions. Life-skills training plays crucial role in bringing about a behaviour change of adolescents in general and in crisis, it protects them from negative behaviours like drug abuse, risky sexual practices and suicide ideation.

From the above discussion, it thus emerges that life-skills are essential for betterment of life in general and improvement of personality in personal, social, cognitive and other domains. Recognizing the importance of life-

skills, the present research was planned to focus on life-skills of adolescent school going children (14-16 years) and assess their relationship with selected variables.

Research Methodology / Elaborations

The present study was undertaken with a view to explore the life-skills of adolescents of CBSE schools in Delhi Municipal Council Zones. The sample of the study comprised adolescents in the age range of 14-16 years (class VIII, IX & X students). D M C is divided in 11 zones. Multistage Sampling technique was used to select the schools (5 schools were randomly taken from randomly selected 5 zones of Delhi). For the selection of respondents, lottery method was employed to take students from particular schools. From a list of all the students of classes VIII, IX & X, twelve students from each school were taken thus making up a total of 60 students. Both boys and girls were taken. The present research was undertaken with following objectives:

- To assess the life-skills of the selected adolescents.
- To determine the variation in life-skills of respondents with their SES and education of parents.

In order to collect the data for the study, two tools were used.

- SES scale by S. C. Tiwari, Aditya Kumar & Ambrish Kumar (2010), updated version 2013, was taken. Through this scale, Education of parents and Socio Economic status of the respondents was assessed.
- Life –Skills Assessment Scale by R. Subasree, & A. Radhakrishnan Nair (2010) is a multi-dimensional Life Skills Assessment Scale consisting of 100 items (one hundred only) in the form of statements in-built with a 5-point scale for the respondent to check the appropriate response which is most descriptive of him/her viz., Always true of me, Very true of me, Sometimes true of me, Occasionally true of me and Not at all true of me. It has both positive and negative items. The Life Skills Assessment Scale (LSAS) measures ten (10) dimensions of Life Skills. The scores obtained under each dimension represent the level of life skills in the respective domain and summation of all the score obtained under each of the 10 dimensions would evolve as a global score for life skills. Cronbach's coefficient alpha, test retest and split half method was used to establish the reliability while face and content validity was tested for the Life Skills Assessment Scale.

The researchers visited each school and collected the data. LSAS was administered individually to the students, it took 45-50 minutes for one respondent to complete the scale questions. Appropriate statistical techniques to derive the results of the present study like mean, Standard deviation, t test, and Pearson's correlation were applied.

RESULTS AND DISCUSSION

Respondents for this study comprised boys and girls in the age group of 14 to 16 years belonging to the upper middle (9), middle (23) and lower middle (28) socio economic strata of the society. As for the education of parents, all of them were educated at least up to class XII (20 mothers & 10 fathers). 19 mothers and 20 fathers had completed graduation. 20 fathers and 15 mothers had done post-graduation, while only 10 fathers and 6 mothers had pursued higher degrees. The sample comprised 29 girls and 31 boys.

As depicted in table 1, the frequency of raw scores of the respondents presented a normal distribution whereby very few respondents fell in the very high and few in low category. Maximum scores were obtained in the average category, thus indicating that sample adolescents have average level of life-skills. Respondents fell more in low scores as compared to high scores category. In the research conducted by Sharma (2003), on 347 adolescents of classes VIII, IX & X of a public school in Kathmandu, 51% respondents depicted Life-Skill scores above the mean, termed as having “high level” of life-skills and 171(49%) , “low level” of life-skills scores.

Table 1. Frequency distribution of the scores of the respondents (in brackets) as per the scale interpretation of raw scores. (N=60)

Dimensions / Scores	Very High	High	Average	Low	Very Low
Self -Awareness	Above 48 (1)	44-48 (11)	34-43 (34)	29-33 (12)	Below 29 (2)
Effective Communication	Above 40 (0)	36-40 (5)	26-35 (37)	20-25 (15)	Below 20 (3)
Interpersonal Relations	Above 49 (2)	45-49 (3)	35-44 (39)	30-34 (12)	Below 30 (4)
Creative Thinking	Above 38 (0)	35-38 (3)	26-34 (37)	20-25 (19)	Below 20 (1)
Critical Thinking	Above 52 (0)	48-52 (5)	36-47 (36)	30-35 (15)	Below 30 (4)
Decision Making	Above 48 (0)	44-48 (9)	34-43 (39)	28-33 (11)	Below 28 (1)
Problem Solving	Above 45(0)	41-45 (4)	31-40 (37)	25-30 (15)	Below 25 (4)
Coping With Emotions	Above 47 (0)	43-47 (4)	32-42 (34)	26-31 (15)	Below 26 (7)
Coping With Stress	Above 35 (0)	31-35 (7)	22-30 (26)	16-21 (16)	Below 16 (11)
Global Score	Above 417 (0)	387-417 (4)	325-386 (28)	293-324 (10)	Below 293 (8)

On further analysis of the data it was found that out of the 10 dimensions (Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, Problem Solving, Effective communication ,Interpersonal relationship, Coping with stress and Coping with emotion, adolescents in the age group of 14 to 15 years scored highest in the dimensions of Effective Communication, and Critical thinking, while in dimensions of Self-Awareness and Decision Making, they scored in the high score category (Fig 1.) In the dimensions of Coping with Stress, these adolescents fell in the average category with lowest scores for their age.

Fig.1 Age-wise Distribution of dimensions of Life-Skills.

Further, adolescents in the age group of 15 to 16 years depicted a different trend, they scored highest in the dimensions of, Critical thinking and Effective Communication. Whereas in dimensions of, Self-Awareness, Decision Making and Interpersonal Relationship they fell in the high score category. In the dimensions of Empathy, Creative Thinking and Coping with Stress most adolescents of this age group fell in the average category. It has been suggested by Blakemore & Choudhury (2006) that empathy development undergoes a temporary decline due to cognitive and physiological changes that go together with puberty. Adolescents of both age groups scored least in the dimension of coping with stress, pointing to the need for more emphasis on acquisition of this skill to deal with the ever demanding requirements of everyday life.

Table 2 depicts the age wise scores of adolescents on the ten dimensions of life-skills. Here it is evident that there is highly significant difference between the scores of the two groups in the dimension of Self-awareness and decision making. It may be attributed to the fact that as the adolescents grow there is an enhancement in their abilities. In the dimensions of Empathy and Interpersonal relations significant difference is found. Not much difference between the means of the two groups was found in other dimensions. This could be because a span of one year is not a very long time to observe drastic changes in life skills of adolescents who are still in their growing phase. As such acquisition of life-skills is a continuous process.

Table 2. Age-wise comparison of LSAS scores of the respondents (N=60)

Dimensions	Mean ± S.D. 14to 15 years (N=30)	Mean ± S.D. 15to 16 years (N=30)	t- VALUE	p- value
Self -Awareness	36.0 ± 5.4	40. ± 5.4	-3.28**	0.00
Effective Communication	27.9 ± 4.1	28.3 ± 6.1	-0.28	.774

Empathy	37.2 ± 7.2	40.8 ± 5.1	-2.00*	.054
Interpersonal Relations	35.6 ± 5.5	39.0 ± 4.7	-2.68*	.012
Creative Thinking	27.2 ± 4.1	28.0 ± 4.2	0.69	.495
Critical Thinking	38.7 ± 6.2	39.5 ± 6.7	-0.47	.640
Decision Making	36.1 ± 5.0	39.3 ± 3.8	-2.87**	.008
Problem Solving	31.9 ± 5.8	33.8 ± 5.9	-1.26	.216
Coping With Emotions	34. ± 5.5	32.7 ± 6.2	0.87	.389
Coping With Stress	23.3 ± 6.0	21.2 ± 6.6	1.53	.135

Furthermore, (Fig. 2) when students were compared for their score on the different dimensions of Life-Skills on the basis of sex, it was revealed that both girls and boys had average scores in Self-Awareness, Effective communication, Critical Thinking, Interpersonal Relations and Decision Making. On one hand, scores of girls were less in former three, while on the other, more on latter two. In the dimensions of Problem Solving and Coping with Stress, both sexes scored low, though girls had lower scores in both. Very low scores were attained in rest of the dimensions. Although girls had equal scores as that of boys in Empathy, they had an edge over boys in coping with Stress (both boys and girls fell in the very low category of scores as per the LSAS).

Fig. 2 Sex-wise comparison of Dimensions of LSAS

As per the illustration in table 3, it can be seen that there is no significant difference between the scores of boys and girls on the ten dimensions of life-skills. However mean scores of girls are higher than boys in dimensions of Self-

awareness, Effective communication, Critical thinking, Creative thinking, Problem solving and Coping with emotions. In rest of the dimensions boys have scored higher.

Table 3. Sex-Wise Comparison of LSAS Scores of the Respondents (N=60)

Dimensions	Mean \pm S.D (Girls) N=29	Mean \pm S.D (Boys) N=31	t- value	p- value
Self -Awareness	38.3 \pm 6.6	37.7 \pm 4.8	0.89	0.37
Effective Communication	40.3 \pm 6.4	37.9 \pm 6.4	1.26	0.21
Empathy	28.0 \pm 4.5	28.2 \pm 5.8	1.62	0.11
Interpersonal Relations	37.0 \pm 4.8	37.6 \pm 5.9	0.20	0.83
Creative Thinking	28.1 \pm 4.3	27.2 \pm 4.0	0.19	0.84
Critical Thinking	39.7 \pm 6.6	38.5 \pm 6.3	1.65	0.10
Decision Making	37.5 \pm 4.9	37.9 \pm 4.6	0.49	0.62
Problem Solving	34.1 \pm 6.7	31.7 \pm 4.9	0.28	0.77
Coping With Emotions	33.8 \pm 6.2	32.9 \pm 5.6	0.57	0.57
Coping With Stress	21.3 \pm 7.0	23.0 \pm 5.7	1.2	0.23

As given in Table 4. Mean and Standard Deviations of the selected adolescents (N=60) were compared with those of the scores obtained by standardization sample (890 adolescents of age ranging 12 years to 19 years having 360 girls and 530 boys) of Life-Skills Assessment Scale (Subasree and Nair, 2010). It was noted that the values for the dimensions of Self-Awareness and Decision Making were similar to the LSAS scales in terms of both Mean and SD. In the case of Critical thinking significant difference between the two scores ($p > 0.05$) was found. In the case of all other dimensions, highly significant ($p > 0.01$) difference was found between the scores of the respondents and the LSAS scores, whereby sample adolescents of the present study had higher average in dimension of Empathy and lower scores in rest of the dimensions.

Table 4. Mean and Standard Deviation of all Respondents as compared with those of the Standardised Scale Scores (N=60)

Dimensions	Mean \pm S.D. (Sample)	Mean \pm S.D. (LSAS Scale)	t- VALUE	p- value
Self-Awareness	38.03 \pm 5.75	38.84 \pm 4.91	.004	0.99
Effective Communication	28.17 \pm 5.22	40.77 \pm 5.15	18.71**	0.00
Empathy	39.05 \pm 6.52	30.31 \pm 4.77	10.38**	0.00
Interpersonal Relations	37.35 \pm 5.37	39.43 \pm 4.89	3.00**	0.00
Creative Thinking	27.63 \pm 4.18	29.22 \pm 4.37	2.93**	0.00
Critical Thinking	39.15 \pm 6.43	40.99 \pm 5.56	2.21*	0.03
Decision Making	37.75 \pm 4.78	38.34 \pm 5.05	0.95	0.34

Problem Solving	32.88±5.92	35.04±4.77	2.82**	0.00
Coping With Emotions	33.35±5.91	36.51±5.24	4.13**	0.00
Coping With Stress	22.25±6.39	25.74±4.59	4.23**	0.00

** Difference between means is significant at the 0.01 level (2-tailed).

*Difference between means is significant at the 0.05 level (2-tailed).

The ten dimensions of Life-Skills were correlated with the education of mother and father, and also with that of the Socio economic status of the respondents (Table 5), using Pearson’s Correlation. Results depicted that there was a highly significant correlation between father’s education and the Global score of the adolescents, highly significant relation was found between father’s education and all the dimensions of life-skills except coping with stress. Similarly Socio Economic Status had highly significant correlation with Global Score (p>0.01). Comparable results were found by Anuradha (2012) in her study of adolescents studying in 9th standard in Tirupati town (India) whereby moderate association was found between life-skills and father’s education; self-concept score and family income. Parents are in a unique position to affect the behavior of their children. Indeed, children develop skills such as communication, problem solving, and critical thinking through modelling at home (Velasco, 2017).

Except for coping with stress and coping with emotions, highly significant correlation was found with mother’s education. SES was also significantly correlated with Self-awareness of adolescents (p>0.05).

Table 5. CORRELATION OF DIMENSIONS OF LIFE-SKILLS WITH EDUCATION OF PARENTS AND SOCIO-ECONOMIC STATUS

Dimensions Of Life-Skills	Mother’s Education	Father’s Education	SES
Coping With Stress	.188	.161	.030
Coping With Emotions	.313*	.423**	.009
Problem Solving	.535**	.496**	.082
Decision Making	.485**	.436**	.195
Critical Thinking	.631**	.533**	.119
Creative Thinking	.521**	.613**	.207
Interpersonal Relations	.536**	.413**	.086
Effective Communication	.493**	.397**	.017
Empathy	.483**	.464**	.211
Self-Awareness	.592**	.531**	.299*
Global Score	.083*	.728**	.836**

** Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

When the ten dimensions were clubbed together as the three core life skills (Table 6), results depicted that there was a highly significant correlation of Global score of the adolescents with their SES and education of the parents ($p > 0.01$). These findings are in line with the study by Sharma (2003) in which maternal education was significantly associated with higher life skill levels in adolescents. Connectedness and family support were other important factors influencing the level of life skills in the adolescents.

Table 6. **Correlation of Core Life-Skills with Background Variables**

	Thinking Skills	Emotional Skills	Social Skills	Global Score
Age	.237	.002	.276	183
Sex	.145	.068	.059	079
Mother's Education	.083	.166	.160	.783**
Father's Education	.132	.035	.097	.728**
Socio Economic Status	.073	.122	.136	.836**

** . Correlation is significant at the 0.01 level (2-tailed).

CONCLUSION

On the basis of the findings it can be concluded that the Life-skills of adolescents are effected by various factors, socio economic status and education of parents being some of them.

Majority of the respondents who participated in this study had average levels of life-skills as compared with the standard LSAS scores. Lowest scores obtained by the adolescents in the dimension of 'coping with stress', boys and girls alike points to an urgent need for better life-skills training opportunities for them so that they can deal with the stress and strain of their growing years. The turbulent teen years whereby they are confronted by challenges on the personal, emotional, social and academic front. A highly significant correlation found between parental education and levels of life-skills of adolescents, further fortify the notion that education plays a crucial role in making parents aware of the needs of their children. Educated parents are more conscious about the growth opportunities for their children, hence they can provide a conducive environment to their children to learn and grow well.

REFERENCES

Anuradha, K. (2012). Life Skills and Self-Concept of Adolescents. *International Journal of Science and Research*, 3(11). Retrieved from <http://www.ijsr.net>

Arati. C., (2016). Influence of Personal Variables on Core Affective Life Skills of Adolescents. *Research Journal of Family, Community and Consumer Sciences*, 4 (4). 1-6.

Blakemore, S.J., & Choudhury, S. (2006). Development of the adolescent brain: implications for executive function and social cognition. *Journal of Child Psychology and Psychiatry*, 47 (314), 296-312.

Central Board of Secondary Education, *Life Skill Education and CCE Manual*, (2010). from www.cbse.nic.in

Chhadva, D., & Kacker, P. (2013). Effectiveness of life Skill Education on Adolescents. *International Journal of Research in Education Methodology*, 3 (1), 213. Retrieved from http://cirworld.org/journals/index.php/ijrem/article/download/1506/pdf_5.

Damle, A., (2013). Emotional intelligence as a function of overall Adjustment (life-skills) in adolescents. *Indian Streams Research Journal*, 3 (5).

Kalaiyaran. M. (2016). Importance of Self-Awareness in Adolescence – A Thematic Research Paper. *IOSR Journal of Humanities And Social Science*, 21(1), 19-22.

Kastner, L., & Wyatt, J. (2002). *The Launching Years: From senior year to college life*. New York: Random House.

Khera S., & Khosla S. (2012). A study of core life skills of adolescents in relation to their self-concept developed through Yuva school life skill programme. *Journal of Social Science & Interdisciplinary Research*, 1(11). Retrieved from <http://Www.Indianresearchjournals.Com/Pdf/IJSSIR/2012/November/12.Pdf>

Khwaja, A. (2011). Retrieved from: <http://banjaraacademy.org/workshops/teaching-life-skills-to-adolescents>

Nair, M.K.C. (2005). Family Life Skills and Life Skills Education for Adolescents: Trivandrum Experience. *Journal of Indian Adolescence for child and Adolescence Mental Health*, 1(2) Retrieved from http://cogprints.org/4490/1/Jiacam05_2_3.pdf.

Reebye, P., & Moretti, M. (2005). Perspectives on childhood and adolescent aggression. *Journal of the Canadian academy of child and Adolescent Psychiatry*, 14(1), 2. Retrieved from <http://www.adolescenthealth.ca/wp-content/uploads/2014/10/Reebye-P.-Moretti-M.-M.-2005..pdf>

Sharma, S. (2003). Measuring life skills of adolescents in a secondary school of Kathmandu: an experience. *Kathmandu University Medical Journal*, 1(3), 170-176. Retrieved from <https://www.researchgate.net/publication/7383589>

Singh, D., & Kaur, J. (2015). Role of family in Developing Life-Skills and Psychological Hardiness among adolescents. *International Journal of Life –skills education*, 1(1), 10-18. Retrieved from <http://www.ialse.in/oldsite/index54ff.html?q=content/journal1-vol1>

Subasree, R., & Nair, A. R. (2014). The Life Skills Assessment Scale: the construction and validation of a new comprehensive scale for measuring Life Skills. *IOSR Journal of Humanities and Social Science*, 19(1), 50-58. Retrieved from <http://iosrjournals.org/iosr-jhss/papers/Vol19-issue1/>

Tiwari, S. C., Kumar, A., & Kumar, A. (2010). Development & standardization of a scale to measure socio-economic status in urban & rural communities in India. *Indian Journal of Medical Research*, 122, 309-314.

Velasco V., Griffin, K.W., Botvin, G.J., and Corrado C. L., (2017). Preventing Adolescent Substance Use Through an Evidence-Based Program: Effects of the Italian Adaptation of Life Skills Training. *Prevention Science*. https://lifeskillstraining.com/evaluation_detail.php?id=45

World Health Organization (1993). *Life Skills Education in schools* (WHO/MNH/PSF/93.ARev.1). Geneva. Retrieved from http://www.asksource.info/pdf/31181_lifeskillsed_1994.pdf

World Health Organization. (2007). World report on violence and Health, Geneva. Retrieved from www.who.int/violence_injury_prevention/publications/violence/en/

World Health Organization. (2009). *Violence Prevention, the evidence: Preventing Violence by developing Life Skills in Children and adolescents*. Geneva, pgs. 4-18.

INTERNET SITES

Skill India Mission www.skilldevelopment.gov.in/pmkv.html

<http://www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf>

<http://www.jsscon.org/ejournal/pdf/artical5.pdf>

www.apa.org/news/press/releases/2014/02/teen-stress.aspx

<http://banjaraacademy.org/workshops/teaching-life-skills-to-adolescents>

<http://www.authorstream.com/Presentation/vittal-1215514-lifeskills-4-adolescents/>

www.ialse.in

www.iosrjournals.org.

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Computer assisted drug designing : Quantitative structure Activity Relationship studies on mono- and Bis- Thiazolium salts having Potent antimalarial activity

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Abstract :-

Quantitative structure-activity Relationship QSAR model is based on changes in molecular structure that would reflect changes in observed biological activity or physicochemical property. In the present work QSAR studies have been performed on 18 compounds of mono and Bis-Thiazolium salts and valuable correlations are obtained. Three new series of 24 novel cationic choline analogues and consisting of mono or bis (N-Or C-5 duplicated) thiazolium salts. Thiazolium salts showed potent antimalarial activity (Much Superior to monothiazoliums). Various QSAR models have been developed by using multiple linear regression analysis methodology. Randic index have been calculated for analysis. Valuable correlation equations showed the relation between physicochemical parameters (specially with Parachor and Vander Walls Volume) and antimalarial activity. This model has been validated by calculating R and R² Value. Various models were developed based on different combinations of descriptors to analysis which contribute best in predicting good antimalarial activity. The best model for n = 18 shows Value for R = .071. When electron donation group taken as outlier the QSAR model improved. Presence of (-CH₂O) group enhances the antimalarial activity.

Key words :- Antimalarial activity : (*IC*₅₀) (nM), Protozoan : *P. falciparum* ; mono and Bis-Thiazolium; QSAR,

INTRODUCTION

QSAR is widely used in drug designing .This method saves money, time, animal killing as well as gives less toxic and less expensive drugs which can be used for humanity. In the present work I have used QSAR for getting more potent antimalarial drug.

Malaria is found throughout the tropical and subtropical regions of the world. It causes more than 300 million deaths annually⁽¹⁻²⁾. Due to drug-resistant parasites⁽³⁾, Chloroquine (CQ) and Sulfadoxime pyrimethamine have become ineffective although these are inexpensive. Artemisinin another alternative have limited use due to high cost and toxicity⁽⁴⁻⁵⁾ so new drugs with novel mechanism of action⁽⁶⁾ and low cost are urgently required to overcome this problem. In the present work QSAR model have been developed for three new series of 24 novel cationic choline analogous and consisting of mono-or bis (N) or (C-5 duplicated) thiazolium salts. These salts synthesized by Abdallah⁽⁷⁾ Hamze, Eric Ruler et.al. which showed antimalarial activity (much superior to monothiazolium). The compounds mono-and bis-ammonium salts have a long lipophilic alkyl chain at the N-position. These are very active compounds against Plasmodium falciparum. These antimalarial compounds target the plasmodial phospholipid (PL) metabolim. The quantitative structure activity relationships have been performed on 18 compounds out of 24. The structure and the activity as IC₅₀(nM) on P. falciparum are used from the data reported by Abdallah Hamze et.al. Steric parameters ($^1\chi^V$) molecular connectivity index (Randic index) are calculated from these substituted compounds as described by Kier and Hall⁽⁸⁻¹¹⁾. In the same manner Vander Walls Volume (Vw)¹² and Parachor(P)¹³ is also calculated for the correlation. For the purpose of developing QSA R model the multiple linear regression analysis methodology is adopted and finally the correlation equations were developed and analysed. The analysis of these equations and the data thus obtained enables for the synthesis of some new drugs of the future.

MATERIAL AND METHODS:

(i) **Antimalarial activity - (IC₅₀)-** The antimalarial activity (IC₅₀) (nM) of thiazolium salts against *P. faliparum* were adopted from the literature⁽⁷⁾.

(ii) **Physicochemical Parameters -**

(a) **[Molecular Connectivity Index (¹χ^V)]** Randic Index-

Molecular connectivity is a method of molecular structure quantitation in which weighted counts of substructure fragment are incorporated into numerical indices, structural features such as size, branching, unsaturation, heteroatom content and cyclicity are encoded.

The connectivity Index, also known as Randic Index (Milan Randic), so the randic Index, of a graph is the sum of bond contributions, $(1/d_i d_j)^{1/2}$ where d_i and d_j are the degrees of the vertices making bond i-j. This graph invariant was introduced by Milan randic in 1975.⁽¹⁵⁾ It is often used in chemoinformatics for investigations of organic compounds.

The first order molecular connectivity index (¹χ^V) term was calculated as given by Kier and Hall⁽⁸⁻¹¹⁾, (¹χ^V) is calculated as-

$${}^1\chi^V = (\delta_i \cdot \delta_j)^{-1/2}$$

The first order valence molecular connectivity (¹χ^V) when extended over all the connections or edges in the hydrogen suppressed graph for a molecule then the first order molecular connectivity for a molecule is expressed with the help of following summation term-

$${}^1\chi^V = \sum_n^v (\delta_i^v \cdot \delta_j^v)^{-1/2}$$

(b) **Vander Walls Volume (Vw)**

The Vander Walls volume is (V_w) also known as atomic volume or molecular volume. It is an atomic property which is directly related to the Vander Waals radius. It is a volume which is occupied by an individual atom or molecule. It can be calculated with the help of Vander Waals radii of atoms and the inter atomic distance and angles in the given molecule.

For spherical single atom, it is the volume of the sphere whose radius is the Vander Waals radius of the atoms.

$$V_w = \frac{4}{3} \pi r_w^3$$

Or

$$r_w = \sqrt[3]{\frac{3}{4\pi} \cdot V_w}$$

For a molecule it is the volume enclosed by Vander Waals surfaces. The Vander Waals volume of a molecule is always smaller than the sum of Vander Waals volume of constituent atoms. The reason behind this difference is due to the atoms that overlap when they form chemical bonds.

For determination of the Vander Waals volume of a single atom or molecule, it is necessary to divide by Avogadro's no. N_A .

The Vander Waals Volume is one of the most fundamental characteristic of the drug structure controlling the biological activity.

The shape and size of the molecule can be determined by the Vander Walls volume (Vw), which is important part of drug receptor interactions. Various biological activities of drug molecules can be decided with the help of Vander Waals Volume.

The Vw term was calculated as given by Moriguchi et. al.⁽¹²⁻¹³⁾ and Bondii⁽¹⁴⁾.

Parachor (P)

The parachor (P)⁽¹⁵⁾ may be defined as the molar volume of a liquid at a temperature that its surface tension is unity. It is both an additive and constitutive property

according to Macleod⁽¹⁶⁻¹⁸⁾

$$\frac{\gamma^{1/4}}{D-d} = C \quad \text{-----(1)}$$

Where γ is the surface tension, D its density and d the density of vapour at the same temperature, C is a constant. Sugden (1924)¹⁹ modified this equation by multiplying both sides by M, the molecular weight of the liquid.

$$\frac{M.\gamma^{1/4}}{D-d} = MC = [P] \quad \text{-----(2)}$$

The quantity [P], which was constant for liquid, was given the name parachor. As d is negligible compared to D the equation (2).

reduces to

$$\frac{M}{D} \cdot \gamma^{1/4} = [P]$$

or

$$V_M \cdot \gamma^{1/4} = [P] \text{ -----(3)}$$

Where V_m is the molar volume of the liquid. If surface tension (γ) is unity, from equation (3), we may write

$$[P] = V_m$$

The parachor of an individual compound can be expressed as a sum of:

- (1) Atomic parachors: They are contributions of each of the atoms present in the molecule.
- (2) Structural Parachors. They are the contributions of the various bonds and rings present in the molecule.

Parachor(P) was calculated by the values of structural bond rings and atoms given by vogel.⁽²⁰⁾

Indicator Parameter (I)

The indicator parameter (I_{-CH_2O}) has been adopted for the presence of $-CH_2O$ group as substituents and has given the value 1 for their presence

and zero for their absence.

Statistical analysis-

The Multiple linear regression analysis methodology was adopted to obtain the significant correlation, and developing best QSAR model, SPSS-13 programme is also used to obtain the degree of correlation (r), regression coefficient value of degree of freedom (F), standard error of estimate(s) and finally correlation equations are obtained.

QSAR Methodology-

QSAR⁽²¹⁾ involves chemistry, biology and statistics fields for analysis. It has been widely accepted model for predicting association between molecular structure and its activity. Over the years many algorithms have been proposed and applied in QSAR studies, framework of model involves molecular structure (graph) representation, calculation of molecular descriptors (graph invariants) and multiple linear regression method is applied for analysis. Model has been validated through statistical parameters (R and R²) Quantitative structure activity relationship (QSAR) represents an attempt to correlate structural or property descriptors of compounds with activities. These physicochemical descriptors which include parameters to account for hydrophobicity, topology, electronic properties and steric effects are determined empirically or more recently by computational methods activities used in QSAR include chemical measurements and biological assay.

The physicochemical descriptors used in this paper are molecular connectivity index (${}^1\chi^V$), Vander waals volume (Vw), and indicator parameter (I_{CH_2O}) and Anti malarial activity related with these parameters

review on methods involved in prediction analysis has enlightened that model with reduced molecular descriptor subset and outlier detector method shows better performance by improving quality of the dataset. Main application of QSAR analysis in drug discovery process. QSAR currently widely used in drug designing⁽²²⁻²³⁾.

Here QSAR is used for predicting better anti malarial drug.

Regression Methodology Method⁽²⁴⁻³⁰⁾

It determines the strength of the relationship between changing variable called independent variables and dependent variables. Changing variables here used are Randic Index (${}^1\chi^V$) Vander walls volume (Vw) and Parachor (P) Indicator Parameter (I) dependent variable is antimalarial activity (IC_{50}) (nM) values.

Regression models involve the following variables:

- The unknown parameters denoted as β ; this may be a scalar or a vector.
- The independent variables, X.
- The dependent variable, Y.

In various fields of application, different terminologies are used in place of dependent and independent variables.

A regression model relates Y to a function of X and β .

$$Y \approx f (X, \beta)$$

The approximation is usually formalized as $E(Y | X) = f (X, \beta)$. To carry out regression analysis, the form of the function f must be specified.

Multiple Regression

This is first used by Pearson, (1908) In this method we can use two or more variables. It can be represented as follows:-

$$Y = a + b_1X_1 + b_2X_2 + B_3X_3 + \dots + B_tX_t + \mu$$

Where

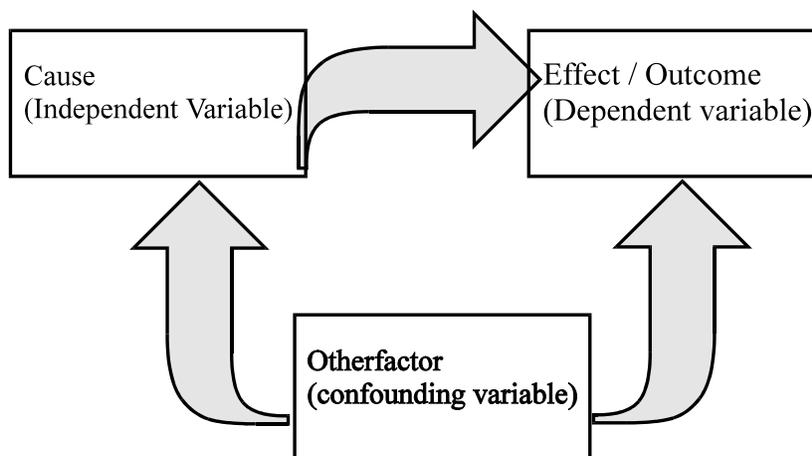
Y = the variable that we are trying to predict.

X = the variable that are using to predict Y.

a = The intercept

b = slope (regression coefficient)

μ = the regression residual.



Result and Discussion:

QSAR studies have been carried out on 18 compounds using regression analysis methodology. The structure and the activity as IC₅₀(nM) on *P. falciparum* are used from the data reported by Abdallah Hamze et. al.⁽⁷⁾ Steric parameters molecular connectivity index ($^1\chi^V$), Vander Walls Volume (Vw) and Parachor (P) have been calculated. A series of correlation equations are obtained showing a moderate correlation between antimalarial activity (IC₅₀nM) and ($^1\chi^V$), Vw and Parachor (P) along with indicator parameter I(-CH₂O-). All the compounds with different substituent Z, R₂ and R₃ are given in table I. Here (-CH₂O-) group is working as indicator parameter, which is a part of substituent R₃. The presence of I(-CH₂O-) has value 1 and for the absence it is taken as 0.

Initially the correlation between antimalarial activity (Log IC₅₀) and molecular connectivity index ($^1\chi^V$) are obtained which yielded the equation-

Model-1

$$\text{Log IC}_{50} = -0.23 \ ^1\chi^V + 1.55 \text{ -----(1)}$$

$$n=18, r=.034, r^2=.001, F=.019, s=1.27$$

The model equation (1) show a very poor correlation.

The introduction of Indicator parameter I(-CH₂O-) changes the equation as follows-

Model-2

$$\text{Log IC}_{50} = -0.30^1 \chi^V + .036 \text{ I } (-\text{CH}_2\text{O-}) + 1.618 \text{-----}(2)$$

$$n=18, r=.036, r^2=.001, F=.010, S=1.31$$

The value of r shows a little improvement in the correlation. Further correlation with Vw against IC₅₀(nM) gives following value-

Model-3

$$\text{Log IC}_{50} = -.083 \text{ Vw} + .914 \text{-----}(3)$$

$$n=18, r=.053, r^2=.003, F=.046, S=1.26$$

Equation (3) again show slight enhancement in the degree of correlation.

A good correlation is observed between Parachor(P) and (IC₅₀) value as follows-

Model-4

$$\text{Log IC}_{50} = -.001 \text{ P} + 1.834 \text{-----}(4)$$

$$n=18, r=.071, r^2=.005, F=.082, S=1.26$$

In all these the value of r increases but still good correlation is not obtained .On taking compund (9), (15), (16) as outlier the value of correlation improved very much and in the process following correlation equations are obtained.

Model-5

$$\text{Log IC}_{50} = -.246^1 \chi^V + .405 \text{ I } (-\text{CH}_2\text{O-}) + 3.657 \text{-----}(5)$$

$$n=15, r=.52, r^2=.270, F=2.22, S=.657$$

Model-6

and

$$\text{Log IC}_{50} = -.466 V_w + 2.727 \text{-----} (6)$$

$$n=.5, r=.54, r^2=.54, F=5.359, S=.62$$

Thus correlation increases with less error. When V_w is taken with $I(-CH_2O-)$

The equation (6) becomes-

Model-7

$$\text{Log IC}_{50} = -.549 V_w + .245 I(-CH_2O-) + 2.954 \text{-----} (7)$$

$$n=15, r=.56, r^2=.314, F=2.75, S=.63$$

So the value of correlation increased (56%).

Thus indicator parameter enhanced the antimalarial activity.

Later on when $^1\chi^V$ is correlated with V_w along with $I(-CH_2O-)$ it gave a good correlation equation which is represented as-

Model-8

$$\text{Log IC}_{50} = -.06 ^1\chi^V - .443 V_w + .308 I(-CH_2O-) \text{-----} (8)$$

$$n=15, r=.564, r^2=.318, F=1.71, S=.66$$

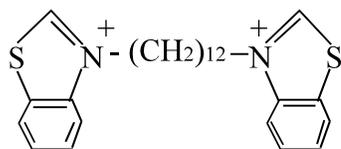
Equation (8) shows a moderate value of correlation (56%).

Thus model equation (4), (6), (7) and (8) shows a good correlation about (71%), (54%), (56%), between antimalarial activity and steric parameters along with indicator parameter $I(-CH_2O-)$

On observing all these equations it is very much clear that (eq 4,6 and 8) is much significant.

Table II represents the comparison of the calculated antimalarial activity with the respective experimental values obtained with the help of equations (4),(5), (6), (7) and (8).

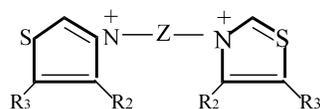
Compound no. (9), (15) and (16) are taken as outlier to improve correlation. The compound (9) have $(\text{CH}_2)_2\text{OCH}_3$ molecule as substituent R_3 , compound (15) has a phenyl ring as substituent R_2 and Compound (16) has



molecule as substituent, R_2 the phenyl group in compound (15) and the benzothiazolium head in compound (16) have ability of π electron donation whereas the R-O-4 group in compound (9) has some electronegative effect.

TABLE - 1

Mono-and Bis-Thiazolium Salts have Potent Antimalarial Activity.



Compound Number	Z	R_2	R_3
1	$-(\text{CH}_2)_8$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OH}$
2	$-(\text{CH}_2)_8$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OCH}^3$

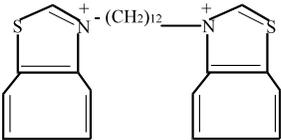
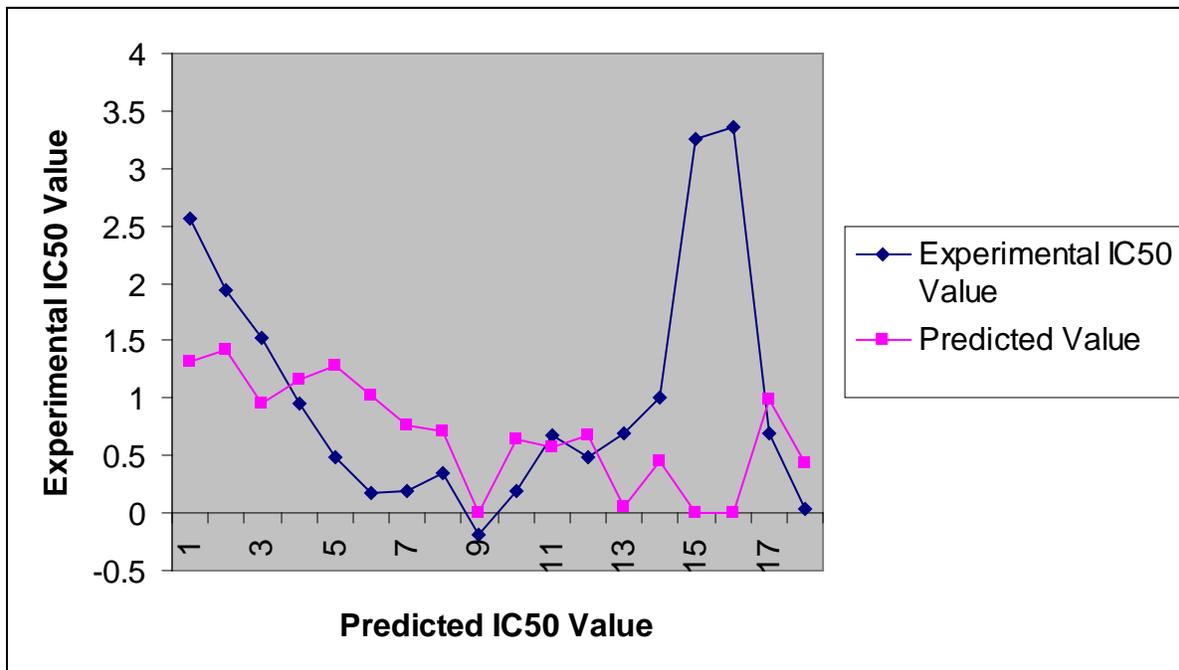
3	$-(\text{CH}_2)_{10}$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OH}$
4	$-(\text{CH}_2)_{10}$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OCH}_3$
5	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-\text{H}$
6	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-\text{CH}_3$
7	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-\text{C}_2\text{H}_5$
8	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OH}$
9	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OCH}_3$
10	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OC}_2\text{H}_5$
11	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OCH}(\text{CH}_3)_2$
12	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OCOCH}_3$
13	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-(\text{CH}_2)\text{OCH}(\text{CH}_2)_2\text{CO}_2\text{CH}_3$
14	$-(\text{CH}_2)_{12}$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{Cl}$
15	$-(\text{CH}_2)_{12}$	$-\text{C}_6\text{H}_5$	$-\text{H}-$
16	-		
17	$-(\text{CH}_2)_4\text{-Ph}$ $\quad \quad \quad $ $\quad \quad \quad (\text{CH}_2)_4$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OCH}_3$
18	$-(\text{CH}_2)_{16}$	$-\text{CH}_3$	$-(\text{CH}_2)_2\text{OCH}_3$

Table - II

Comp. Number	$^1\chi^v$	Vw	P	ICH ₂ O	IC ₅₀ nM (P.falciparum)						
					Observed		Calculated				
					IC ₅₀	log IC ₅₀	eq.4	eq.5	eq.6	eq.7	eq.8
1	9.5	3.48	969	0	362	2.56	1.32	1.18	1.04	1.37	1.12
2	10.77	2.69	958.2	1	87.5	1.94	1.42	1.53	1.72	1.38	1.70

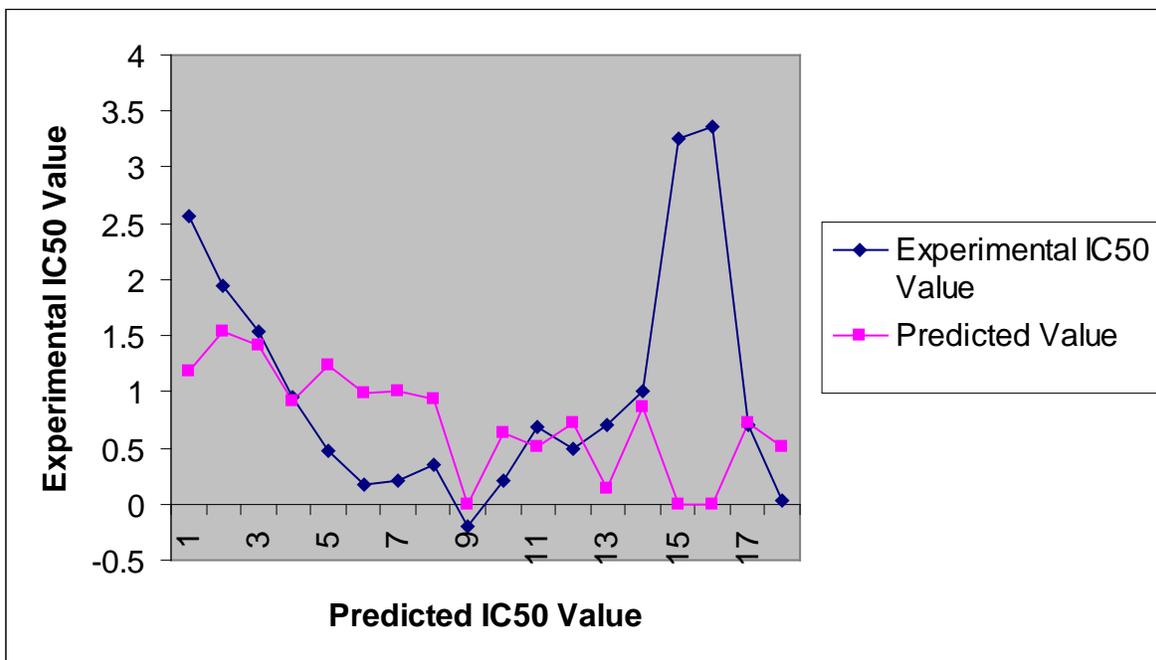
3	11.00	2.94	1047	0	34	1.53	.95	1.42	1.34	1.29	1.27
4	11.77	4.08	1104.6	1	8.9	.95	1.17	.91	.96	1.23	1.02
5	9.67	3.34	908.6	0	3.0	.48	1.28	1.24	1.12	1.43	1.17
6	10.67	3.9	986.6	0	1.5	.18	1.03	.99	.81	1.35	.86
7	11.78	3.87	1064.6	0	1.6	.20	.76	1	.82	1.27	.81
8	12.00	4.04	998	0	2.25	.35	.71	.93	.73	1.34	.72
9	11.77	4.37	1182.6	0	.65	-.19	-	-	-	-	-
10	13.93	4.68	1260.6	1	1.6	.20	.64	.64	.63	1.08	.63
11	14.22	4.97	1338.6	1	4.8	.68	.57	.51	.47	1.00	.49
12	13.76	4.5	1281	1	3.1	.49	.68	.72	.73	1.06	.72
13	16.31	5.83	1575.4	1	5.0	.70	.06	.13	0	.76	-.02
14	13.06	4.18	1087.4	0	10.0	1	.45	.87	.65	1.25	.6
15	12.55	5.15	1169.1	0	1800	3.26	-	-	-	-	-
16	11.24	4.24	949.6	0	2300	3.36	-	-	-	-	-
17	12.52	4.49	1199.5	1	5.0	.70	.99	.73	.73	1.14	.8
18	14.77	4.97	1338.2	1	1.1	.04	.44	.51	.47	1.0	.45

GRAPH NO.1-
REPRESENTATION SHOWS RELATION BETWEEN EXPERIMENTAL
AND PREDICTED IC₅₀ VALUES WITH MODEL EQUATION-4



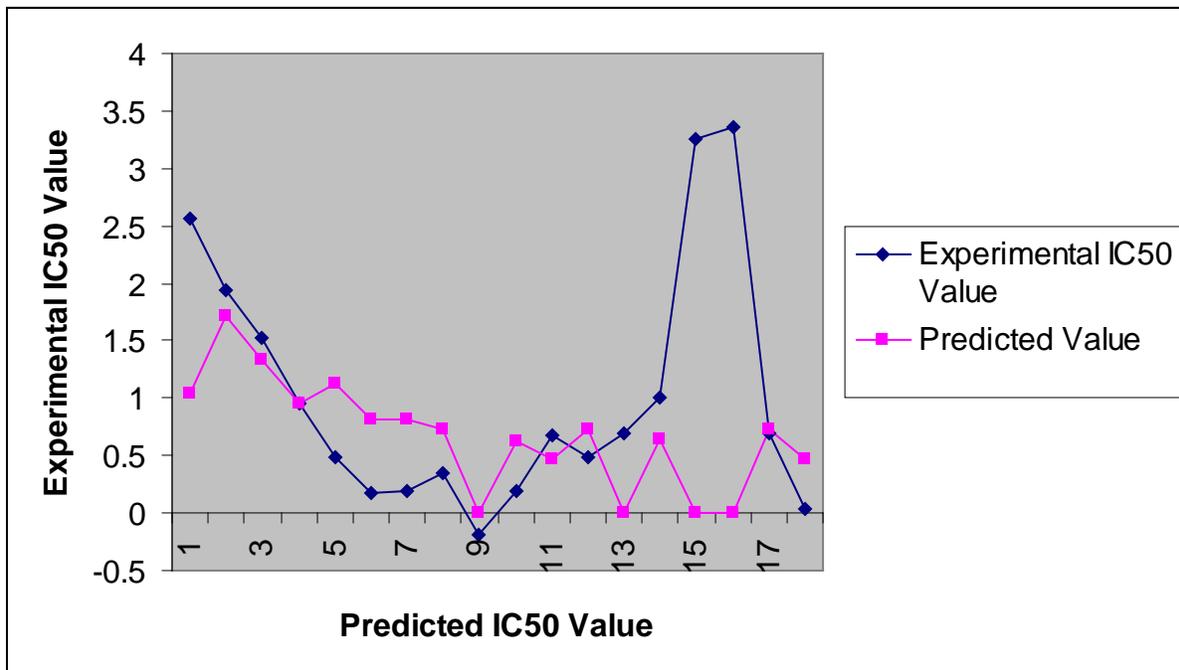
GRAPH NO.2

REPRESENTATION SHOWS RELATION BETWEEN EXPERIMENTAL AND PREDICTED IC₅₀ VALUES WITH MODEL EQUATION-5

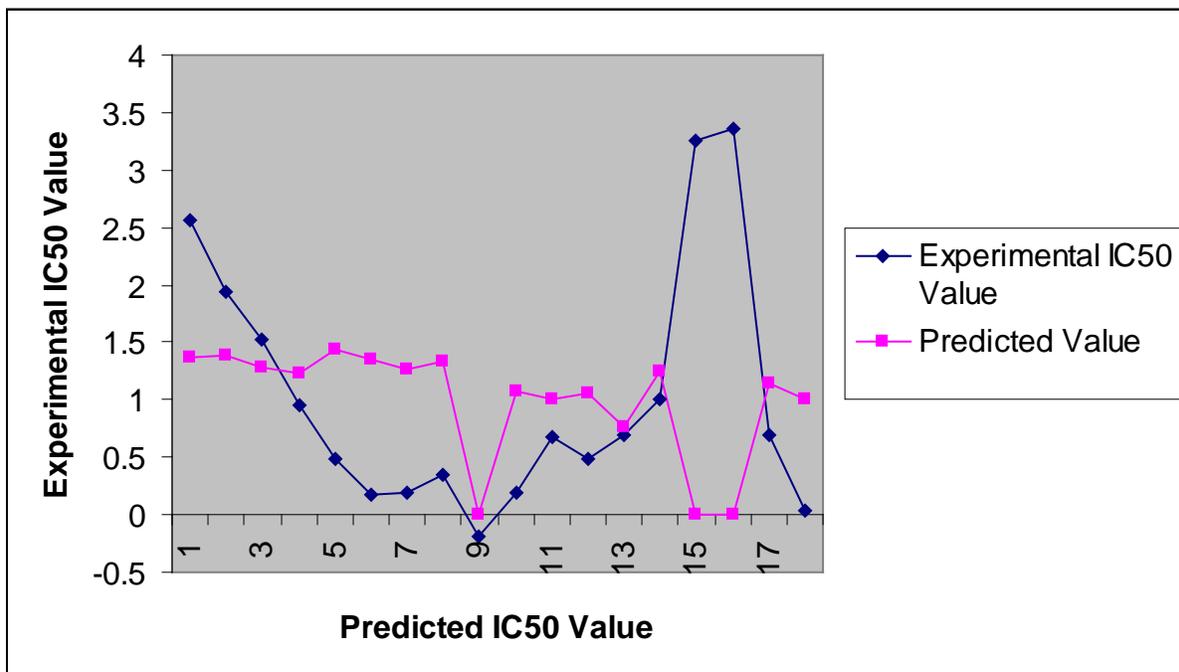


GRAPH NO.3

REPRESENTATION SHOWS RELATION BETWEEN EXPERIMENTAL AND PREDICTED IC₅₀ VALUES WITH MODEL EQUATION-6

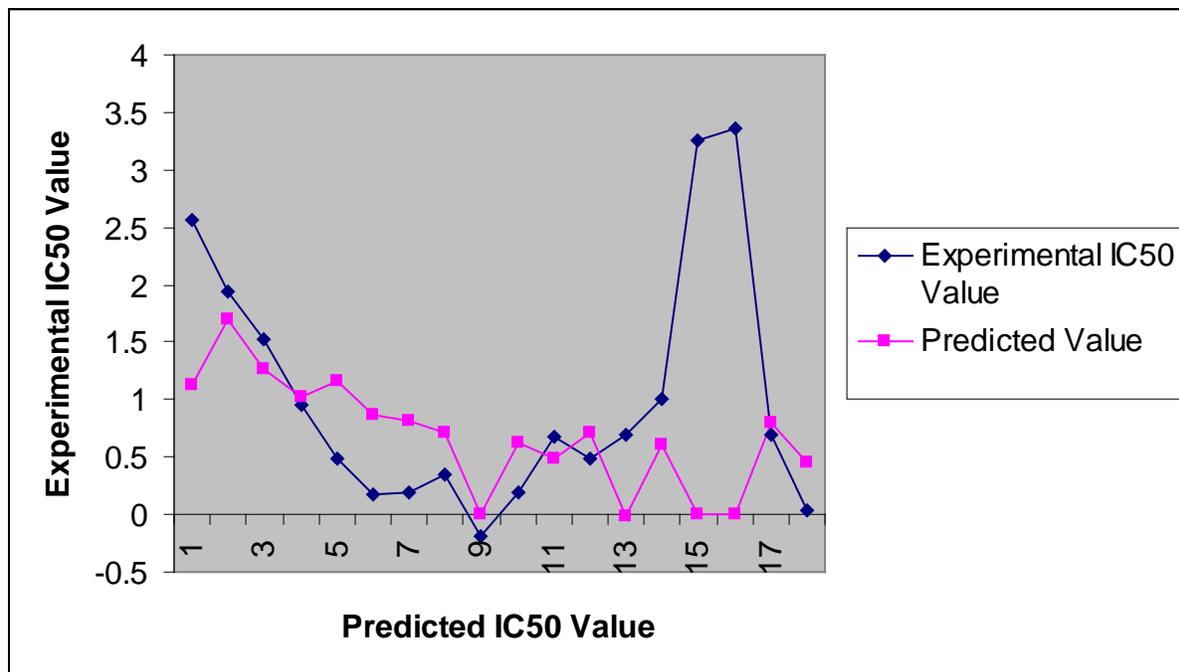


GRAPH NO.4
REPRESENTATION SHOWS RELATION BETWEEN EXPERIMENTAL AND PREDICTED IC₅₀ VALUES WITH MODEL EQUATION-7



GRAPH NO.5

REPRESENTATION SHOWS RELATION BETWEEN EXPERIMENTAL AND PREDICTED IC₅₀ VALUES WITH MODEL EQUATION-8



CONCLUSION-

From the above discussions and observations with the help of different regression equations it is very much clear that these equations have negative values of correlation coefficient for ${}^1\chi^V$ and V_w . At the same time Indicator parameter $I(-CH_2O-)$ has positive value of correlation coefficient.

Thus on increase in the value of these steric parameters will retard the antimalarial activity i.e. the molecules having smaller volume will decrease the antimalarial activity at the same time big molecules with more branching enhances the antimalarial activity whereas the presence of $I(-CH_2O-)$ group in place of substituent (R3) groups enhances the antimalarial activity. At the same time compound (9), (15) and (16) which have π electron donation and

electronegative effect also retard the value of correlation and hence the antimalarial activity. Thus by decreasing the size of molecule and selecting substituents which provide (-CH₂O-) group can synthesize a new series of Mono and Bis-Thiazolium salts with enhanced antimalarial activity which may be helpful for curing a dangerous disease and may be the drugs of future.

Supporting Information available

General materials, methods, analytical data of all compounds. The biological activity. This material is available free of charge through the internet some literature is available through CDRI INDIA.

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References:

- 1- Hay, S.I.; Guerra, C.A.; Tatem, A.J.; Noor, A.M.; Snow, R.W. The global distribution and population at risk of malaria", past, present, and future. *Lancet Infect. Dis* 2004, 4, 327-336.
- 2- (a) Africa Malaria report, WHO/ 3325 April 2003.
(b) Mount, A.M.; Mw-apasa, V.; Elliott, S.R.; Beeson, J.G.; Tadesse, E; Lema, V.M.; Molyneux, M.E.; Meshnick, S.R.; Rogerson, S.J. Impairment of humoral immunity to plasmodium folciparum malaria in pregnancy by HIV infection, *Lancet* 2004, 363, 1860-1870.

- 3- (a) White, N.J. Antimalarial drug resistance. *J. Clin. Invest.* 2004, 113, 1084-1092. (b) Biagini, G.A.; O' Neill, P.M.; Nzila, A.; Ward, S.A.; Bray, P.G. Antimalarial chemotherapy: young guns or back to the future? *Trends in Parasitology* 2003, 19, 479-487.
- 4- Haynes, R.K. Artemisinin and derivatives: the future for malaria treatment? *Curr. Opin. Infec. Dis* 2001, 14, 719-726.
- 5- (a) Fidock, D.A.; Rosenthal, P.J.; Croft, S.L.; Brun, R.; Nwaka, S. Antimalarial drug drug discovery efficacy models for compound screening *Nat. Rev. Drug Dis cov.* 2004, 3, 509-520.
- 6- Mono-and Bis-Thiazolium Salts have potent Antimalarial Activity: Abdullah Namze, Eric Rubi et al. : *J. Med. Chem.* 2005, 48, 3639-3643.
- 7- L.B. Kier and L.H. Hall, "Molecular connectivity in structure-Activity Analysis," John Wiley and Sons, New York, (1986).
- 8- L.B. Kier and L.H. Hall, *Eur. J. Med. Chem.*, 12, 307 (1977).
- 9- L.B. Kier and L.H. Hall, *J. Pharm. Sci.*, 70, 583 (1981).
- 10- Randic, M. (1975), "Characterization of molecular branching," *Journal of the American Chemical Society* 97 (23): 6609-6615.
- 11- Moriguchi, I. Kanada, Y. and Komatsu, K. (1976), Vander Waals and the related parameters for hydrophobicity in structure activity studies *chem. Pharm. Bull.* 24, 1799 (1976).
- 12- Sugden, S., "The variation of surface tension with temperature and some related functions." *J. Chem. Soc.*, 125, 32 (1924).

- 13- Y.C. Martin, 'Quantitative Drug Design; A critical Introduction: Dckker, New York, 1978.
- 14- A.A. Afifi and S.P. Azen 'Statistical Analyst, A computer oriented approach; academic press 2nd end. New York, 1979.
- 15- Vogel, A.I., et al, J. Chem. Soc., 570 (1961), and preceeding papers.
- 16- G.E.P. Box, W.G. Hunter and J.S. Hunter, Statistics for experimenters Wiley, New York, 1978.
- 17- P.E. Green, Analysing Multivariate Data, The Dryden Press, Hinsdale IL, 1978.
- 18- N.R. Draper and H. Smith 'Applied Regression Analysis', 2nd edn. Wiley, New York, 1981.
- 19- D.G. Kleinbaum and L.L. Kupper, 'Applied Regression analysis and other Multivariate method' Duxbury Press, North Scituate, M.A., 1978.
- 20- R.R. Sokal and F.J. Rohlf, 'Biometry', The Principales and practice of statistics in biological research; 2nd end. W.H.,Freeman, San. Fransisco, 1981.
- 21- A.A. Afifi and S.P. Azen 'Statistical Analyst A computer oriented approach', acadamic press 2nd ed. New York, 1979.
- 22- C. Daniel and F.S Wood, Fitting equations to data; 2nd edn Wiley, New York, 1980.

- 23- R.R. Sokal and F.J. Rohlf, 'Biometry', The principles and practice of statistics in biological research; 2nd edn, W.H., Freeman, San Fransisco, 1981.
- 24- T.H. Wonnacott and R.J. Wonnacott' Regression: A Second coarse in statistics', Wiley New York' 1981.
- 25- W.J. Dixon and F.J. Massey Jr.; Introduction to statistical Analysis', 3rd edn, Mc Graw-Hill, New York, 1969.
- 26- R.H. Myers 'Classical and Modern Regression with Applications: Duxbury Press Boston, 1986.
- 27- Y.C. Martin, 'Quantitative Drug Design', A critical Introduction, Deckker New York, 1978.
- 28- R. Franke, "Theoretical Drug Design Method', Akademic- Verlag, Berlin, 1984 (This is the revised english translation of optimieorungsmethoden inder wirkstofforschung- quantitative structure- wirkungs- analyse: published in 1980)
- 29- J.K. Seydel and K.J. Schaper, 'Chemische Struktur and Biologische Aktivitat Van Wirkstoffen' Verlog chemie, Weinheim 1979.
- 30- A.A. Afifi and S.P. Azen 'Statistical Analyst, A computer oriented approach; academic press 2nd end. New York, 1979.

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Mediating Role of Learning Performance in The Relationship Between Learning Processes and Competitive Advantage of State Corporations In Kenya

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Abstract-Despite overwhelming theoretical propositions that organizational learning is strong positive determinant of competitive advantage, little empirical work exists to substantiate these theoretical suggestions. The few empirical studies available have not shown the role that learning performance plays in the attainment of competitive advantage. The relative absence of empirical research does not persuade leaders, managers and employees to adopt learning initiatives or measure learning performance. This study examined the mediating role of learning performance in the relationship between learning processes and competitive advantage among state corporations in Kenya. The study employed a descriptive, cross-sectional research design and used both quantitative and qualitative methods to gather data from 198 staff from 35 state corporations comprising of senior managers, middle manager and non-management staff. Regression analysis was used to make inference on the associations between the dependent and independent variables using SPSS Version 22. Structural Equation Modeling (SEM) helped assess the mediating role of learning performance. Results from both simple and multiple linear regression revealed that each of independent variables was positively mediated the relationship between systems thinking and competitive advantage and learning processes and competitive advantage. Both formal and informal learning processes that maximize utilization-focused knowledge acquisition and sharing approach are encouraged. Organizations are encouraged to invest in building capacity of new and existing employees to encourage reflective practices within the organization. Leaders are encouraged to overcome barrier to creating and utilizing learning processes in organizations. Organizations need to increase rate of single loop and double loop learning to increase chances of attaining competitive advantage.

Index Terms- Organizational Learning, Learning Processes, Competitive Advantage, Learning Performance

I. INTRODUCTION

Organizational learning is largely theorized for its role in improving performance and competitiveness of organizations. Senge (1990) argued that the speed of organizational learning may become the only sustainable source of competitive advantage in the future. Garvin, Edmondson, & Gino, (2008) concurred by noting that higher rate of learning is positively associated with competitive advantage. In essence, a learning organization purposefully designs and constructs its

structure, culture and strategy to enhance and maximize the potential for organizational learning to take place (Dodgson, 1993; Fang et al., 2010). Learning organizations are seen to adapt to unpredictable environments more quickly than their competitors. "how difficult the learning process is, even with built-in intent (Kransdorff, 2006)". Organizational Learning efforts are no longer merely an option but rather a core necessity for organizations anywhere in the world (Singh and Kant, 2008).

Empirical studies have demonstrated the significant role that learning processes plays in fostering performance in various industries and sectors. For example, the public sector (Ferguson et al., 2013), non-governmental organizations (Corfield et al., 2013), banking industry, (Oluikpe, 2012), small- to medium-sized enterprises, (Durst and Edvardsson, 2012), manufacturing organizations (Birasnav and Rangnekar, 2010), and human service and professional services firms (Palte et al., 2011); and life insurance business (Huang et al., 2011). These studies have clearly shown that learning is an important determinant of organizational success measured by superior performance and competitive advantage. Other studies have shown that organizational learning processes are important parts of the innovation processes and organizational performance (Kiziloglu, 2015). Slater & Narver, (1995), in turbulent markets, organizations must use learning processes to create behavior change that leads to performance improvement. Chandler & Hwang, (2015) notes that being able to understand the detail the innovation, as well as the implications of adoption require a complex range of learning processes that drive organizational adoption behavior. Search for innovative practices are more successful through more active learning processes.

Despite the clarity and consensus that organizational learning processes is associated with performance and competitive advantage, learning practices are still weak among organizations, particularly for state corporations. This low adoption is partly due to gaps in previous studies which have not sufficiently furnish managers with concrete suggestions on how to entrench learning processes within the organization (Bapuji & Crossan, 2004). Furthermore, the studies have targeted the partial audience by focusing only chief executives and excluded departmental managers and non-managerial staff. Notably, state corporations have been left out of most research even though they are tasked to drive economic growth in highly dynamic and unpredictable environments, that requires them to compete. therefore, this study aims to contribute to the literature by examining the relationship between organization learning processes and

competitive advantage. It will build on the work of other authors, (Garvin et al., 2008; P. Senge, Art, & Roberts, 2001; P. M. Senge, 1990), by exploring the pathway taken by organizational learning processes to influence competitiveness of state corporations. The study addresses the following objectives:

- a) To examine the effectiveness of learning processes in fostering competitive advantage?
- b) To assess mediating role of learning performance in the relationship between organizational learning and competitive advantage?

This paper follows the following structure: Section 2 presents literature reviewed and research hypotheses. Section 3 contains research methodology to test hypotheses and sets results of data analyses. Section 4 brings together the implications, limitations, and directions for future research.

II. LITERATURE REVIEW

2.1. Theoretical Review

2.1.1. Competitive Advantage

Rationale for state corporations to seek and gain competitive advantage is deeply rooted in the dynamic and challenging environment under which they operated. Increasingly, state corporations are facing fierce competition from each other, and from a vibrant and innovation-minded private and civil society organizations (Buheji, n.d.). A highly educated and quality driven public continues to demand more efficient and effective goods and services from all business actors in equal measure. The legal and political environment has become less favorable for state corporations as they no longer operate as monopolies. They compete under relatively the same legal context as the private and civil society sectors.

Furthermore, the perception or negative reporting on corruption has worsened among public institutions during the past decade making it difficult for state corporations to assure the public of quality services and fair cost. For example, in 2016 Kenya was ranked 139 out of 168 indicating a high perception of bribery within the country. These corruption perception indices further erode public trust and complicate efforts of state corporations to grow their market share. These circumstances have triggered state corporations to actively engage in the search of a solution that will accord them a competitive advantage to guarantee their success in the market place.

In pursuit of competitive advantage, researchers offer useful theoretical propositions. The resource-based view theory of competitive advantage posits that firms are bundles of resources and capabilities and that a firm can gain competitive advantage based on its unique set of resources (Barney, 1991). Those resources are valuable, rare, perfectly inimitable and non-substitutable and a firm's potential for competitive advantage also requires a firm be organized to exploit its resources and capabilities (Barney, 2007). The fact that resources must enable the creation of value and must also resist the duplicative efforts of competitors suggests that firms are bundles of resources and

capabilities. In conditions of open competition, rival firms will seek to imitate, acquire or try to substitute for the resources that are a source of advantage. Organizations facing uncertain, changing or ambiguous market conditions similar to those experienced by state corporations need to be able to learn. Theories posit that organizational learning can help firms amass and use these kinds of resources and capabilities. For example, Karash (2002) identified the organizational learning concept as a resource-oriented approach that is based on the ability of the organization to turn standard resources that are available to all into competences that are unique and non-imitable by competitors.

2.1.2. Organizational Learning

The concept of organizational learning is a well-researched topic in a range of academic disciplines from economics, management science, psychology and sociology to anthropology (Easterby-Smith and Lyles, 2011). Senge, (2006) describes organizational learning as 'the changing of organizational behavior' which occurs through a collective learning process. Organizational learning is a unique resource that is critical in today's dynamic and discontinuous environment of change and a crucial determinant of competitive advantage (Garvin, Edmondson, & Gino, 2008). Organizational learning emphasizes the development and application of new knowledge that has the potential to change employees' behavior which is ultimately tipped to strengthen the organization's competitive position. A learning organization uses management philosophy based on knowledge and understanding, as opposed to fear, for the complexity of the real world. Therefore, organizational learning has the potential to promote a sense of empowerment in the workforce that motivates them for continuous learning (Bryson et al., 2006).

For learning to be fully entrenched in the organization, it has to happen at multiple levels. Argyris and Schön, (1978) notes that organizations learn through individuals acting as agents for them and individuals' learning activities, which in turn are facilitated or inhibited by an ecological system of factors. Gareth Morgan, (1986) points out that organizations cannot, themselves, learn; it is the individuals within them who learn. Evidently, there is more to a learning organization than simply a collection of individuals who are learning. Swieringa and Wierdsma (1992) define organizational learning as 'the changing of organizational behavior' which occurs through a collective learning process. They note that individual learning is a necessary but not a sufficient condition for organizational learning. Learning organizations are organized in such a way that learning is a prominent feature at a number of different levels: individual learning; team or work group learning; cross-functional learning; operational organizational learning; and strategic organizational learning (Britton, 1998).

Organizational learning manifests itself in various ways depending on the focus of learning. Single loop learning focuses on fixing errors in the current system while double loop learning which goes a level here to question the policies and procedure rather than focusing only on error correction (Linz & Resch, 2010; Witherspoon, 2014). Single-loop learning involves

detecting and correcting 'errors' so that the organization can continue to achieve its present policies or objectives in more efficient ways. In single-loop learning, outcomes are measured against organizational norms and expectations. According to Senge, (1990), Single-loop learning focuses on doing things in the right way without necessarily questioning whether they are the right things to be done. It explores more productive ways, doing it cheaper, using alternative methods or approaches for the same objectives. On the other hand, double loop learning not only requires changes in the rules and procedures of the organization but may also question the underlying assumptions and principles that form the basis of the rules and procedures. The implications of double loop learning are possibly far-reaching and may even lead to what has been called triple loop learning which involves challenging the organization's principles and assumptions, requiring an open and often robust exchange of views (Peeters & Robinson, 2015).

2.1.3. Relationship Between Learning Processes and Competitive Advantage

A learning organization is cultivated through a series of concrete steps and widely distributed activities, (Sokhanvar, Matthews, &Yarlagadda, 2014). Theorists have made efforts at explicating the learning processes essential to influencing learning and attaining competitive advantage. Garvin et al., (2008) consider learning processes to involve the generation, collection, interpretation, and dissemination of information. Learning processes include experimentation to develop and test new products and services; intelligence gathering to keep track of competitive, customer, and technological trends; disciplined analysis and interpretation to identify and solve problems; and education and training to develop both new and established employees. USAID, (2016) presented a more comprehensive model, collaborating learning and adapting (CLA) model, which considers learning processes to include knowledge management, institutional memory and decision making. According to the CLA model, KM processes include the process of acquiring knowledge internally and externally, distilling the knowledge and sharing knowledge internally and externally. Institutional memory includes the processes of accessing institutional knowledge, and managing of staff transitions. Decision-making include the awareness of decision-making processes, autonomy to make decisions and appropriate stakeholder involvement in decision making processes.

Empirical studies have been conducted and shown results in support of theory. Due to globalization and growing competition, organizations are using learning processes to achieve competitive advantage (Mahajan &Chaturvedi, 2013). Learning processes ensure that an organization and employees continually create, acquire, and transfer knowledge and use it to adapt to the ever-changing internal and external environment.To achieve maximum impact, Garvin, (2008) suggests that knowledge should be shared in systematic and clearly defined ways among individuals, groups, or whole organizations. Knowledge can move laterally or vertically within a firm. By implementing knowledge management processes as part of daily business activities, organizations can confidently compete and sustain in the competitive markets (Daud and Yusuf, 2008).Sangari,

Hosnavi, & Zahedi, (2015)results also showed that knowledge management processes have a significant impact on supply chain performance.Other studies found a positive relationship between organizational learning processes and business performance (Vijande, Pérez, González, &Casielles, 2005).Considering the theoretical underpinning and the empirical support, the study predicts that learning processes will have a positive effect on competitive advantage of state corporations. The study poses the following hypotheses:

H₀₁: There is no relationship between learning processes and competitive advantage of state corporations in Kenya.

2.1.4. Mediating Effect of Learning Performance

Organizational learning has gained prominence among researchers as a crucial determinant of performance and a source of sustained competitive advantage for organizations, (Linz & Resch, 2010; Salmador&Florín, 2012). A learning organization is seen to be an organization, which is 'skilled at creating, acquiring, and transferring knowledge, and at modifying behavior to reflect new knowledge and insights.' Learning happens when errors are detected and corrected, and practices changed within the organization, (Peeters& Robinson, 2015; Witherspoon, 2014).

Organizational learning performance is measured by assessing the rate of learning which refers to the frequency at which the organizations take decisions address their challenges in alignmentto new knowledge and insights. This study will look at decisions or actions at two levels: Single loop learning, which occurs when the mismatch gets corrected by altering behavior or actions and double loop learning, which happens when the organizations change their underlying values and adopts new actions, (Mitchell et al., 2012). Single loop is about efficiency and answers the question, are we doing things in the right way? In single-loop learning, outcomes are measured against organizational norms and expectations (Peeters& Robinson, 2015). The overwhelming amount of learning in organizations is single-loop because organizations are designed to identify and correct errors, (Witherspoon, 2014). On the other hand, double loop is concerned with effectiveness and answers the question, are we doing the right things? Learning performance is predicted to be higher among organizations that have entrenched a strong learning culture. The rate at which organizations apply both single-loop and double-loop learning are expected positively to mediate the relationship between the combined effect of the independent variables and competitive advantage, (Peeters& Robinson, 2015).

Even though empirical studies have had limited focus in assessing the Learning performance in organizations, various authors have conducted useful studies in laying the foundation. Sorenson (2003) found that interdependence engendered by vertical integration slowed the rate of learning in firms in stable environments and speeded learning in volatile environments. Lieberman (1984) found that investment in Research and Development increased the rate of learning among firms in the chemical processing industry. Similarly, Sinclair, Klepper, and Cohen (2000) found that Research and Development contributed

to the productivity gains observed in a chemical firm. Social capital is an important factor that affects the organizational learning performance (Wu, Ay, & Lien, 2009). Based on findings from self-regulated learning research that control of learning and learning orientation are positively related to learning performance (Boekaerts&Corno, 2005). Even though authors have suggested firms that learn faster than others are likely to gain competitive advantage, there is limited research that have assessed this hypothesized mediating role learning performance on the achievement of competitive advantage(Garvin et al., 2008; Senge, 2006). In line with the identified research gap, the study will test the mediating role of learning performance through the following null hypotheses:

H₀₂: Learning performance does not mediate relationship between learning processes and competitive advantage of state corporations in Kenya.

III. RESEARCH METHODS

3.1. Research Design

The study employed descriptive and cross-sectional research design to address the research questions. Descriptive designs provide answers to the questions of who, what, when, where, and how they are associated with a particular research (Cooper & Schindler, 2008; Saunders et al., 2015). To evaluate the relationships between the learning performance and competitive advantage, the study employed a correlational design. This type of design is recommended and has been used by various authors to determine whether or not variables are correlated by studying the joint variation of the hypothesized relationships, (Džini, 2015; Reich, Gemino, & Sauer, 2014; Saunders et al., 2015).

3.2. Target Population and Sample

The study population comprised of all 139 state corporations operating in Kenya as identified by that state corporations' advisory committee (SCAC). The SCAC is the official body mandated to advise on all matters pertaining state corporations by section 27 of the State Corporations Act, Chapter 446, (Government of Kenya, 2012, 2015). From the list of 139 state corporations, 53 fulfilled the selection criteria (operating in a competitive landscape, selling goods or services public, and mandated to make profits or surplus). Sample size determination formula by Cochran (1977), and procedures for categorical data was used to calculate a sample size of 40 state corporation. Table 3.1 shows the population, sampled organizations and number of staff targeted by sector. Three staff were targeted from every state corporation including one senior manager, one middle level manager and one non-management staff leading to a total of 240 staff.

Table 1: Population and Sample

Sector	Population	Sample	Staff
Finance	9	7	42
Tertiary Education and Training	5	4	24
Public Universities	7	5	30

Commercial and Manufacturing	32	24	144
Total	53	40	240

3.3. Data Collection Instruments

Two instruments were used to collect data from the study respondents; semi-structured questionnaire, and qualitative interview guide. A semi-structured questionnaire gathered data on the dependent variable (competitive advantage), independent variables (learning culture, learning processes and systems thinking). The qualitative interview gathered in-depth information from the 16 employees on the existing leadership and management practices and their implication for organizational culture, learning performance and competitive advantage within state corporations. Furthermore, the researchers reviewed available state corporation records including fiscal year audited reports of 2013, 2014 and 2015 and organization's annual progress reports. These documents helped to provide additional triangulation information on profitability, sales growth, operating context as well performance trends of the state corporations.

3.4. Statistical Measurement Models

Pearson's correlation analysis was used to assess linear relationships between the independent variables and competitive advantage Saunders, Lewis, & Thornhill., (2015). To examining the effect of organizational learning on competitive advantage, step-wise multiple regression models which is commonly used to measure the linear relationship that exists between variables was used (Kanji, 2006). This was done by assessing the role of each of the independent variable on competitive advantage. To test the mediation hypotheses, the study employed structural equation modeling (SEM), which comprised of confirmatory factor analysis and a series of multiple regression equations (Kothari, 2004). For the structural equation model, the study examined two level of analysis – the measurement model and the structure model using Statistical Package for Social Scientists (SPSS) and Amos.

3.5. Measures

The study drew items from different studies from the literature review to measure the constructs for the independent variables. The study adapted scales from various researcher to design the learning processes variable (Donate & Sánchez de Pablo, 2015; Garvin et al., 2008; María Martínez-León & Martínez-García, 2011). The final scale comprised of 11 items assessing processes for generating, collecting, interpreting, and disseminating information; experimenting with new offerings; identifying and solving problems and developing employee knowledge, skills and attitude.

To measure the hypothesized mediating variable, learning performance, the study build on the work of Andreou, Louca, & Petrou, (2016), who measured learning performance by looking at the mode of diversification as an indicator of resource relatedness; internal growth versus acquisition and Witherspoon (2014) who assessed double loop and single loop learning in the various organization. In this regard, learning performance was

measured by assessing the rate of learning within state corporation. Rate of learning comprised of frequency with which state corporations closed feedback loops using knowledge acquired from formal and informal feedback processes. The actions and decisions included selling products and services more efficiently, using alternative approaches to offer same products and services, modifying rules and policies, creative and innovative products and services and changing customer or client base. Similar to previous studies, competitive advantage was measured by assessing profitability, sales growth, market share and customer satisfaction, (Hardeep & Bakshi, 2014; Porter, 2008). The study used a scale comprising of 6 items to measure competitive advantage through Likert scale.

IV. RESULTS AND DISCUSSION

4.1 Response Rate

Even though the study sample comprised of 240 staff from 40 state corporations, only 198 (83%) staff from 35 (88%) state corporations responded to the study. The relatively response rateresulted from structured follow-up by the trained research team.

Table 2: Response Rate

Sector	Sample	Actual	Response Rate
Finance	7	7	100%
Tertiary Education and Training	4	4	100%
Public Universities	5	5	100%
Commercial and Manufacturing	24	19	79%
Total	40	35	88%

4.2 Background Information

4.2.1 Respondent Background Information

A simple majority of the respondents were female 52.5% as shown in Table 3. This distribution depicts a fair balance of gender in the sampled state corporations. Considering that majority of the responses are perceptual in nature, this kind of distribution helps to accommodate opinions and views from either gender. On another note, this balance in gender in state corporations' points to the progress achieved by the ongoing efforts in Kenya's public service to mainstream gender in response to the constitutional threshold on gender which requires at least a third representation from either gender in recruitment and appointments in the public-sector organizations. Majority of the respondents (64.1%) indicated that they had at least a degree level of education while a relatively high percentage (42.4%) possessed a higher degree at postgraduate level. This was expected due to high levels of tertiary education in the country and considering that 62% of respondent were middle or senior managers who are required to have higher academic credentials to qualify for their roles.

Table 3: Summary of student demographics

	Frequency	Percent
Gender		
Male	94	47.5

Female	104	52.5
Total	198	100.0
<i>Respondent Job Level</i>		
Senior Manager	22	11.1
Middle-level Management	101	51.0
Non-Management staff	75	37.9
Total	198	100.0
<i>Department or unit</i>		
Production/Services	46	23.2
Purchasing	20	10.1
Human Resource Management	54	27.3
Research and Development	21	10.6
Sales and Marketing	15	7.6
Accounting and Finance	42	21.2
Total	198	100.0

Majority of the respondents were middle-level managers (51%) and the least were senior managers (11%). This distribution shows the staffing situation in state corporations which indicates that the span of control within the firms allowed approximately 4 middle managers per senior manager in the targeted departments. Additionally, learning occurs at all levels of the organizations hence it is important to capture opinions and facts from all key staffing categories. Furthermore, over-reliance on the opinion of senior managers was noted in the literature as a limitation of most organizational learning studies. High responses were received from the 36-45 and 26-35 age brackets giving 33.33% and 28.8% respectively. The mean age was 39.6 years with a standard deviation of 10.9 years. These results are consistent with the fact that majority of the respondents were middle managers and the non-management staff whose age ranged from 25-45 years. This is a common phenomenon in public organizations in Kenya where employees move up the professional ladder with time hence the length of service often reflect a growth in job-levels. Lastly, these results demonstrate that the workforce in the public service is young which aligns to the country's population dynamic that is dominated by a young working population aged 25-45.

To determine the length of service in years by employees, majority (78.8%) had worked for less than 11 years with 60% having worked for five years or less. The mean years of service for the employees was 7.3 with a standard deviation of 7.6 years. This presents diversity of experience that enriches the analysis of the study variables. Similarly, these results show that majority of the staff were hired in their current organizations or roles within the past ten years which is also around the same time that organizational learning and the knowledge economy became a 'household' concepts in state corporations in Kenya and also the time Kenya was launching its economic transformation blue print, Vision 2030 (Government of Kenya, 2007). State corporations typically consist of a number of departments or functions and organizational learning may be more pronounced in some departments than others for various contextual reasons. With this background, the study was keen to identify the departments in which the respondents worked. Majority of the respondents were from human resources (27%), and the production departments (23%). Cumulatively, departments

dealing with the core business including production, service, purchasing, research and development and marketing were 51% while those associated with support functions including accounting, finance and human resources were 49%. This departmental diversity accords the study an opportunity to assess the role of some organizational learning variables like systems thinking which partly looks at relationships between various departments in the organization.

4.2.2 Background of State Corporations

Majority (54%) of the sectors were classified as commercial and manufacturing while 24% were from either training, tertiary education or public universities. The finance sector was represented by 20% of the sample state corporations. The high proportion of the commercial and manufacturing sector was expected and planned during sample selection since they form the highest proportion of state corporations. The representation from all key sectors that met the selection criterion is key in assessing differences within sectors.

Table 4: Sectors of state corporations

Sector	Frequency	Percent
Finance	7	20%
Tertiary Education and Training	4	11%
Public Universities	5	14%
Commercial and Manufacturing	19	54%
Total	35	100%

4.3 Descriptive Statistics Results

4.3.1 Learning Processes

In assessing learning processes, the study found that 61% of the respondent agreed or strongly agreed that learning processes were implemented within their state corporations. Despite this appreciation of the learning processes within their institutions, it was clear that learning processes associated with training were weak within state corporations. There were 44% of respondents who indicated that experienced employees were provided with training when switching to new positions. This has been attributed to the fact that they are seen or considered to know their work hence limited investment in their knowledge and skills. In addition to the weak training systems, there were limited mechanisms within the organization to guarantee sharing of emerging, good, and best practices across departments which essentially compromised inter-departmental learning within the state corporations. Other areas that employees scored low included seeking out dissenting views during discussions (57%), revisiting well-established perspectives during discussions (58%), and employees joining formal or informal networks made up of people from outside the organization (58%).

4.3.2 Learning Performance

In order to establish level performance within state corporations, the study focused on establishing the frequency with which state corporations acted on feedback from formal and informal sources including staff, customers and others stakeholders. Particularly, the study was interested in capturing and handling of suggestions associated with changes in strategies and methods, requests to offer different products, modification to policies or procedures

and reaching a different set of clients or customers. Table 5 shows the descriptive statistics for learning performance which indicate that average learning performance, measured by the number of learning action taken over the past year was 14.28 (SD = 3.85). The state corporations that reported the least number of learning actions had four while the highest had 24 making a range of 20. As expected there were higher rates of learning for the single loop when compared to double loop.

Table 5: Percentage statistics for learning performance

Used feedback to take action or decide on:	Learning performance per year				
	0/1	2/3	4/5	6+	Total
Use alternative methods/strategies to offer same products or services.	1%	22%	59%	18%	100%
Start offering more creative and innovative products or services	2%	23%	60%	15%	100%
Modify our policies or procedures to help us offer better products or services	14%	52%	30%	4%	100%
Decide or take action to reach a different client or customer base	12%	46%	37%	6%	100%
Average	7%	36%	46%	11%	100%

4.4 Factor Analysis

4.4.1 Normality of the Dependent Variable

To test the assumption of normality of the dependent variable, the study employed three normality tests. These included the observation of histogram, normal probability plot and statistical test using the Shapiro-Wilki test. The Shapiro-Wilki test is commonly used by statisticians and is typically tested at the $\alpha = .005$ level of significance. This is a statistical test of the hypothesis that sample data have been drawn from a normally distributed population (Conover, 1999; Shapiro and Wilk, 1965; Royston, 1995). The formula for the test is as follows: Table 6 shows the Shapiro-Wilk results obtained by this test for the dependent variable, competitive advantage. Considering that the null-hypothesis of the Shapiro-Wilki test is that the population is normally distributed, if p-value is less than the chosen alpha level, then the null hypothesis is rejected and there is evidence that the data tested are not from a normally distributed population; in other words, the data are not normal. On the contrary, if the p-value is greater than the chosen alpha level, then the null hypothesis that the data came from a normally distributed population cannot be rejected (e.g., for an alpha level of 0.05, a data set with a p-value of 0.02 rejects the null hypothesis that the data are from a normally distributed population). Given that p-value was 0.128 for competitive advantage which is greater than the α of 0.05, the null hypothesis was accepted and the study concluded that the samples were drawn from a normally distributed population.

Table 6: Shapiro-Wilk test of Normality

Variable	Shapiro-Wilk
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	Statistic	df	Sig.
Competitive Advantage	.989	198	.128

4.4.2 Reliability and Validity Analysis

To conduct regression analysis for the purpose of testing the model, the study conducted a series of tests on the variables to improve reliability of the various constructs. Using SPSS version 21, the study employed Cronbach's Coefficient Alpha to test for internal consistency of the constructs within the six variables of study. The data on each of the variables were separately analyzed based on the values of coefficient of reliability and item total correlation as shown in table 7. For the purpose of analysis, each variable was abbreviated as follows: Competitive Advantage (CA.); Learning Culture (LC.); Learning Processes (LP.); and Systems Thinking (ST.). Items under variable were numbered accordingly. Since the coefficient alpha of individual scales indicated that the reliability estimate of three items were marginal, a secondary analysis was conducted after dropping these items. The reliability estimates and item-total correlations of the remaining items under learning process improved after dropping these items. The researchers decided to delete items to enhance Cronbach's coefficients. Table 5 shows a summary of the Cronbach's alpha coefficient for each of the variables. After the deletion process, all the four independent variables and dependent variable registered an acceptable Cronbach's alpha coefficient of above 0.7. This is line with findings by Saunders Lewis and Thornhill (2009) and Christensen, Johnson and Turner (2011) who noted that scales of 0.7 and higher, suggest satisfactory reliability. The study concluded that the constructs each of the variables in this study had sufficient internal consistency and hence, reliable for the analysis.

Table 7: Summary of Reliability Estimates and Item-Total Correlations

Competitive Advantage	Cronbach's Alpha	Item-Correlations
Competitive Advantage (CA)	.876	
CA1		.580**
CA2		.694**
CA3		.688**
CA4		.713**
CA5		.702**
CA6		.727**
Learning Processes (LP)	.848	
LP1		.606**
LP2		.559**
LP3		.639**
LP4		.593**
LP5		.505**
LP6		.564**
LP7		.477**
LP9		.411**
LP11		.416**
LP12		.529**
LP14		.558**

**item-total correlation is significant at $p < 0.05$ level (2-tailed).

4.4.3 Sampling Adequacy

To examine whether the data collected was adequate for further statistical tests, such as factor analysis, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity were performed on all the study variables. For a data set to be regarded as adequate and appropriate for statistical analysis, the value of KMO should be greater than 0.5 (Field, 2000). Results from table 6 show that all the KMO coefficients were above the critical level suggested of 0.5). Similarly, all the results of the Bartlett's Test of Sphericity were highly significant ($p < 0.05$). These two results confirm that the variables were suitable for planned analyses.

Table 8: Summary KMO and Bartlett's Chi-Square Tests for Sampling Adequacy

Variable Name	KMO	Bartlett's Chi-square	Df.	Sig.
LP	0.848	685.511	55.000	0.000**
OLP	0.671	246.960	6.000	0.000**
CA	0.860	567.388	15.000	0.000**

*= $P < 0.1$; **= $P < 0.05$

4.5 Inferential Analysis and Hypothesis Testing

The hypotheses associated with the relationship between the independent variables and the depending variable were tested through linear regression analysis using SPSS version 21 software.

4.5.1 Effectiveness of Learning Processes on Competitive Advantage

The study also sought to test the following null hypothesis in assessing the effects of learning processes on competitive advantage.

H_{01} : There is no relationship between learning processes and competitive advantage of State Corporations in Kenya.

Bivariate Pearson correlation analysis to determine the linear relationship between learning processes and competitive advantage established that learning processes and competitive advantage had a statistically significant positive linear relationship, $r = .683$, $p < .001$. The direction of the association suggested that a higher measure of learning processes score was associated with greater competitive advantage score. The strength of the association was high ($.5 < |r| < 1$). A simple linear regression was calculated to predict the influence of learning processes on competitive advantage of state corporations. From Results of linear regression indicated a significant regression equation ($F(1,197) = 155.22$, $p < .05$) with an R^2 of .442. The model had an R square value of 0.442 thus indicating that the model accounted for 44.2% of the change in the depending variable, competitive advantage, for every change in the independent variable, learning culture. This is a strong prediction model for the intended analysis. The results showed that $Y = .383(LP) + e$ where Y is the dependent variable (competitive advantage), LP is the dependent variable (learning processes) and e is the error term.

Table 9:Coefficients Table for Learning Processes and competitive advantage

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.835	.131		14.024	.000**
Learning Processes	.383	.031	.665	12.459	.000**

*=P<0.1; **P<0.05

Based on the analysis, the study rejected the null hypothesis and concluded that there exists a relationship between learning processes and competitive advantage of state corporations in Kenya. The means that competitive advantage of state corporations increased by .385 units for each unit increase in learning processes. The independent variable, learning processes, was a significant predictor of competitive advantage, p<.05.

Effect of Learning Performance on Competitive Advantage

Bivariate Pearson correlation analysis to determine the linear relationship between learning performance and competitive advantage established that learning performance and competitive advantage had a statistically significant positive linear relationship, $r = .609$, $p < .001$. The direction of the association suggests that a higher measure of learning processes score is associated with greater competitive advantage score. The strength of the association was high ($.5 < |r| < 1$). A simple linear regression was calculated to predict the influence of leadership on competitive advantage of state corporations. From table 10, the results of the regression indicated that a significant regression equation was found ($F(1,197)= 53.09$, $p<.05$) with an R^2 of .213. For the no-intercept model, R Square measures the proportion of the variability in the dependent variable about the origin explained by regression. The model had an R square value of 0.213 thus indicating that the model accounted for 21.3% of the change in the depending variable, competitive advantage, for every change in the independent variable, learning culture. This is a strong prediction model for the intended analysis.

Table 10:ANOVA Table for systems thinking and competitive advantage

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	28.566	1	28.566	53.090	.000
	Residual	105.462	196	.538		
	Total	134.029	197			

The results showed that $Y = 2.4 + 1.93(RL) + e$ where Y is the dependent variable (competitive advantage), RL is the dependent variable (rate of learning) and e is the error term. The means that competitive advantage of state corporations increased by .1.933 units for each unit increase in rate of learning. The independent variable, rate of learning, was a significant predictor of competitive advantage, p<.05.

Table 11: Coefficients Table for Systems Thinking and competitive advantage

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
Constant	2.400	.143		16.769	.000
Rate of learning	1.933	.265	.462	7.286	.000

4.5.2 Mediating Role of Learning Performance

The study tested the following null hypothesis by fitting a ‘learning process’ model by adding a path from learning processes to competitive advantage to the ‘no direct’ model.

H_{02} : Learning performance does not mediate the relationship between learning processes and competitive advantage of state corporations in Kenya.

The study tested the following null hypothesis by fitting a ‘learning process’ model by adding a path from learning processes to competitive advantage to the ‘no direct’ model.

H_{05c} : There is no mediating role of learning performance on the relationship between learning processes and competitive advantage of State Corporations in Kenya.

This model exhibited satisfactory fit indices [$X^2(19)=33.823$, n.s; GFI=0.964; CFI=0.982; RMSEA=0.063]. The fit indices were a large improvement to the ‘no direct’ model [$X^2(20) = 83.062$, $p < 0.01$; GFI = 0.922; CFI = 0.923; RMSEA = 0.127]. This implies that the direct effect of learning processes to competitive advantage was significant and indeed it was ($\beta_{yx.m} = 0.287$, $p<0.1$). After introduction of the mediating variable, the coefficient of learning process reduced, but the relationship remained significant showing signs of a partial mediation relationship.

Table 12:Regression for learning process, learning performance and competitive advantage

Relationship	Estimate	S.E.	S. Estimate	C.R.	P
OLP → LP	.014	.008	.189	1.686	.092*
CA → OLP	2.502	.667	.324	3.751	.000**
CA → LP	.287	.036	.498	8.065	.000**

*=P<0.1; **P<0.05

The significance of the indirect effect was further tested using a bootstrap estimation approach with 2000 samples (Shrout & Bolger, 2002) and the results affirmed that the indirect effect was not significant ($\beta = .035$, $SE = .023$, n.s). This shows that the mediated effect of learning process on competitive advantage was 0.035. That is, due to the mediated effect of learning process on competitive advantage, when learning process goes up by 1 unit, competitive advantage goes up by 0.035. This is in addition to any direct (unmediated) effect that learning process may have on competitive advantage. This mediation effect was not significant ($P<0.1$). In summary, the both the direct effect ($\beta_{yx.m}$) and the indirect effect (β_{mx_bym}) were significant leading to the rejection of the null hypothesis, therefore concluding that learning performance partially mediates the effect

of learning processes on competitive advantage of state corporations ($p < 0.10$).

Table 13: Test of significance of direct and indirect effects

Relationship	Direct	Indirect	Comment
OLP→LP→CA	0.287**	0.035*	Partial Mediation

*= $P < 0.1$; ** $P < 0.05$

4.6 Discussion of Major Findings

This study examined the mediating role of learning performance learning in the relationship between learning processes and competitive advantage among state corporations in Kenya. The study employed a descriptive, cross-sectional research design and used both quantitative and qualitative methods to gather data from 198 staff from 35 state corporations comprising of senior managers, middle manager and non-management staff.

In determining the effectiveness of learning processes in fostering competitive advantage, regression analysis results showed a positive and significant relationship. This affirms the positive and significant role that concrete learning processes play in influencing the performance and competitive advantage of state corporations. Similar result were found by Turner & Minonne, (2010), and are consistent with the building blocks of a learning organization opined by Garvin et al., (2008), who found that for organizations to learn effectively and attain the desired competitive advantage, they need to have more effective and comprehensive knowledge management processes than their competitors.

The study also found that learning performance positively mediates the relationship between learning processes and competitive advantage. This shows that learning processes positively influences competitive advantage by increasing learning performance within organizations. These results reinforce the need for growing the rate of learning within organizations and ensuring that concrete learning processes are available and functioning optimally.

The results of the study emphasize the importance of state corporations nurturing concrete formal processes for generating, collecting, interpreting, and disseminating information. Concrete learning processes and practices ensures that the team and company values to experiment with new offerings, to gather intelligence on competitors, customers, and technological trends and solving problems. State corporations that attain competitive advantage prioritizes developing employees' skills because it appreciates that it is when employees grow that organizations grow. When an organization masters the processes and practices of generation, collection, interpretation, and dissemination of information, it sets itself up for successful competition.

Encouraging employees to join formal or informal networks made up of people from outside the organization ensures that there is continuous generation of information within and outside the organization and helps create forums for meeting with and learning from experts from outside the organization. Interpretation of information is essential and this can be achieved

by the conduct of regular post-audits, after-action reviews as well as executing formal mechanisms for sharing of best practices among the different activity fields. Learning processes offer opportunities for organizations to engage in productive conflict and debate during discussions and intentionally seek out dissenting views during discussions. The also help organizations to revisits well-established perspectives during discussions, identifies and discusses underlying assumptions that might affect key decisions.

Learning processes ensure capacity of employees is continuously strengthened to meet the work needs. These efforts targets both the experience employees, new employees, and employees switching to new positions. The study has demonstrated that when organizations consistently and systematically invests in training and growth of staff by availing time for education, training and mentorship activities of staff, they lay a strong foundation for competitiveness.

In ensuring correct utilization of learning processes, the study, through qualitative interviews identified what it considered as core barriers to concretizing learning processes in state corporations: unnecessary bureaucracy that largely excluded junior employees from reflection and decisions associated with goods and service provision; and perpetual victimization of employees based on finding from formal feedback mechanisms without intensive analysis and reflection to explore truth and root causes of feedback points. Bureaucracy and victimization limited the acquisition of objective and timely feedback from junior employees despite the widespread recognition that they were closest to the majority of the clients. Victimization makes it difficult for employees to support and promote the use of feedback mechanisms.

V. CONCLUSION

The study results have validated the theoretical underpinning that learning processes is positively associated with competitive advantage of state corporations. It is evident that state corporations that seek to outperform their opponents in the respective industries need to establish an enabling learning environment manifested in concrete learning processes. A learning organization arises from concrete steps and widely distributed activities that assure efficient and effective generation, collection, interpretation, and dissemination of information. Managers are advised and encouraged to make intentional efforts and invest in concrete learning processes for maximum impact in attaining competitive advantage. These include experimentation to develop and test new products and services; intelligence gathering to keep track of competitive, customer, technological and other contextual trends; rigorous analysis and interpretation of data to identify and address problems; and education, training and mentorship to develop both new and established employees.

APPENDIX

Appendix 1: Regression Results Tables

Code	Constructs
	Competitive Advantage

CA1	Profitability
CA2	Sales growth
CA3	Market share
CA4	Customer satisfaction
CA5	Offers value to customers
CA6	Customer retention
Learning Processes	
LP1	Collects information on technological trends
LP2	Employees participation in external formal or informal networks
LP3	Forums for meeting with and learning from external experts
LP4	Post-audits and after-action reviews
LP5	Formal mechanisms for sharing best practices
LP6	Engages in productive conflict and debate during discussions
LP7	Seeks out dissenting views during discussions
LP9	Identifies and discusses underlying assumptions
LP11	Training for experienced employees
LP12	Training when switching to a new position
LP14	Time is made available for education, training and mentorship
Organizational Learning Performance	
OLP1	My department used suggestions or information to use alternative methods to offer same products or services in better ways.
OLP2	My department used suggestions or information to start offering more creative and innovative products or services
OLP3	My department used suggestions or information to modify our policies or procedures to help us offer better products or services
OLP14	My department used suggestions or information to make decisions or take action to reach a different client or customer base

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REFERENCES

Andreou, P. C., Louca, C., & Petrou, A. P. (2016). Organizational learning and corporate diversification performance. *Journal of Business Research*, 69(9), 3270–3284. <http://doi.org/10.1016/j.jbusres.2016.02.022>

Britton, B. (1998). The Learning NGO. *International NGO Training and Research Centre*, (July).

Buheji, M. J. (n.d.). Knowledge Management Influence on Government Organisations Competitiveness. Mohamed Jasim Buheji, 305.

Donate, M. J., & Sánchez de Pablo, J. D. (2015). The role of knowledge-oriented leadership in knowledge management practices and innovation. *Journal of Business Research*, 68(2), 360–370.

<http://doi.org/10.1016/j.jbusres.2014.06.022>

Džini, J. (2015). Correlation between the administrative leadership style and inclination towards organizational learning in local administrative organizations, 3–27.

Garvin, D. A., Edmondson, A. C., & Gino, F. (2008). Is yours a learning organization? *Harvard Business Review*, 86(3). <http://doi.org/10.1037/e413842008-018>

Government of Kenya. (2007). Kenya Vision 2030 - A Globally Competitive and Prosperous Kenya, (October), 1–180.

Hardeep, P. C., & Bakshi. (2014). Examining intellectual capital and competitive advantage relationship: Role of innovation and organizational learning. *International Journal of Bank Marketing*, 33(3), 376–399. Retrieved from www.emeraldinsight.com/0265-2323.htm

Kanji, G. (2006). *100 Statistical Tests*. Sage Publications. California. <http://doi.org/10.1017/CBO9781107415324.004>

Kothari, C. (2004). *Research methodology: methods and techniques*. Vasa. Retrieved from <http://medcontent.metapress.com/index/A65RM03P4874243N.pdf%5Cnh> <http://books.google.com/books?hl=en&lr=&id=8c6gkbKi-F4C&oi=fnd&pg=PR7&dq=Research+Methodology++Methods+and+Techniques&ots=iGoAmVQ5mJ&sig=HDstqLuUosKAeZklgQUht4YnUg0%5Cnh> <http://books.google.com/book>

Lin, A., & Resch, O. (2010). Double loop learning in work based settings. *CEUR Workshop Proceedings*, 575, 57–65.

María Martínez-León, I., & Martínez-García, J. a. (2011). The influence of organizational structure on organizational learning. *International Journal of Manpower*, 32(5/6), 537–566. <http://doi.org/10.1108/01437721111158198>

Peeters, A., & Robinson, V. (2015). A Teacher Educator Learns How to Learn from Mistakes: Single and Double-loop Learning for Facilitators of In-service Teacher Education. *Studying Teacher Education*, 11(3), 213–227. <http://doi.org/10.1080/17425964.2015.1070728>

Porter, M. E. (2008). The Five Competitive Forces that Shape Strategy. *Harvard Business Review*, 86(January), 78–94. <http://doi.org/Article>

Sangari, M. S., Hosnavi, R., & Zahedi, M. R. (2015). The impact of knowledge management processes on supply chain performance. *The International Journal of Logistics Management*, 26(3), 603–626. <http://doi.org/10.1108/IJLM-09-2012-0100>

Saunders, M., Lewis, P., & Thornhill, A. (2015). *Research Methods for Business Students*. Research methods for business students.

Senge, P. (2006). *The Fifth Discipline: The Art and Practice of the Learning Organization*.

Turner, G., & Minonne, C. (2010). Measuring the Effects of Knowledge Management Practices. *Electronic Journal of Knowledge Management*, 8(1), 161–170. <http://doi.org/10.2753/JEC1086-4415150203>

USAID. (2016). Collaborating, Learning, and Adapting Framework and Key Concepts.

Witherspoon, R. (2014). Double-Loop Coaching for Leadership Development. *The Journal of Applied Behavioral Science*, 50(3), 261–283. <http://doi.org/10.1177/0021886313510032>

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The Impact of Child Marriage on Socioeconomic Aspects in Bangladesh

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Abstract-Child marriage is one of the vital problems for the socioeconomic development of Bangladesh. This problem was in the past and is still there. At present Bangladesh is the fifth highest rate of child marriage in the world while 18 percent of girls are married before age of 15 and 52 percent before age of 18. Bangladesh child marriage restraint act set up the minimum age of marriage is 18 years for women and 21 years for men. According to the present act, child marriage is illegal in Bangladesh. Although Bangladesh government took several initiatives against child marriage, the rate of child marriage has not been decreased at the satisfactory level. Now child marriage is significantly affecting the different socioeconomic aspects and hampering the national development of Bangladesh. The objectives of this study are to identify the major socioeconomic aspects of Bangladesh which are affected by child marriage. The findings of this study may help the concerned organizations to take necessary steps to reduce child marriage from the society for the national socioeconomic development of Bangladesh. All the data of this study was collected by the used of survey and direct interview research techniques. Both descriptive and inferential statistics were used to analyze the data. Descriptive statistics were used to give details about the child marriage as well as inferential statistics were used to identify the affected socioeconomic aspects and show the significant relationship between child marriage and identified socioeconomic aspects of Bangladesh. Factor analysis was used to identify the factors that are affected by child marriage. Multivariate analysis of variance was used to show that the overall and individual significant effect of child marriage on identified socioeconomic factors. Findings of the study show that there are eight factors which are reasonably affected by child marriage. The identified factors are Increased the rate of maternal and child mortality as well as women health hazard, Raised the family financial crisis and decreased the standard of living, Hampered the socioeconomic development, Increased the family and social conflict along with the rate of divorce, Increased the population growth and the rate of dependent population, Increased the rate of mental and physical violence against women, Increased the rate of suicide and transaction of dowry, and Enhanced the juvenile delinquency and downfall the women social status. In this study multivariate analysis of variance demonstrates that the identified socioeconomic aspects are significantly affected by the child marriage. Our research recommends that if the rate of child marriage decreases from Bangladesh, then the current situation of identified socioeconomic aspects of the society will be developed and the expected national development will accelerate.

Keywords : Bangladesh, Child Marriage, Impact, Socioeconomic Aspects.

1. INTRODUCTION

This study explains that the impact of child marriage on various social and economic aspects of Bangladesh. At the present world, child marriage is a crucial phenomenon. Bangladesh is the fifth highest position country of the world in child marriage while about 18 percent of girls got married before age of 15 and 52 percent before age of 18. (UNICEF Report. 2016). Besides this Bangladesh is holding the highest position in the world on the subject of the marriage of a girl under the age of 15. About 71 percent women got married before the age of 18 in the rural area and 54 percent women got married before the age of 18 in the urban areas in Bangladesh.(UNICEF. 2011). Bangladesh government took such initiatives against child marriage in different time. To follow the child marriage restraint act (1929), Bangladesh government constitutes child marriage act. According to child marriage restraint act of Bangladesh, the legal age of marriage is 18 years for a woman and 21 years for a man. Now child marriage is legally prohibited in Bangladesh. Bangladesh child marriage act has set several punishment and penalties such as imprisonment for one month or fine up to 1,000 BDT or both. When any guardian arranges and permits for the marriage of their daughter and son before the age of 18 and 21, can be convicted under the law. The punishment and penalty are not same for male and female while women cannot be sentenced to imprisonment. The other initiative against child marriage is birth registration act. According to the act, it is mandatory for the bride and groom to have a birth certificate before a marriage registration. Therefore, an improving trend has noticed after

taking such legal initiatives against child marriage in Bangladesh but the decreasing rate of child marriage is not satisfactory level. A wide range of social and economic aspects of Bangladesh are highly affecting as well as the overall socioeconomic development are hampering due to child marriage.

There are some study has conducted on the causes or determinants of child marriage in Bangladesh. Literature review demonstrates that Child marriage before age 16 (as compared with 18) leads to a higher rate of incomplete secondary education, and a lower rate of educational attainment for women.(Islam, M. M., et al, 2016). A further study focused on the determinants of child marriage and its effect on poor child health outcomes (shunting and Mortality) in Bangladesh, it is identified that the socioeconomic status (wealth status, education, place of residence) and religion are important determinants of child marriage.(Hammann, L.,2014). Another study focused on the geographic variation. This study has shown that both individual composition and contextual characteristics are important predictors of women's age at first marriage and demonstrates significant geographic variation in rates of early marriage in Bangladesh. the probability of getting married before age 18 was associated with the region, respondents' year of birth, year of marriage, educational attainment, religion and wealth index.(Kamal, S. M., 2010). Respondent's education, husband's education, place of residence, religion and respondent's work status are the factors for early marriage in Bangladesh. (Farzana, T.J., 2016). The vital causes for child marriage are poverty, superstition, lack of social security and lack of awareness. This study advice to ensure legal protection against child marriage.(Ferdousi, N., 2014). Traditional norms, issues of security, social pressure, Poverty, children interests, Education, aspirations, engagement in paid work, lack of child rights and child empowerment are the causes of child marriage in Bangladesh. (Plan Bangladesh, 2013). Poverty, superstition, and lack of awareness about laws are the most important causes of child marriage in Bangladesh. (Blomgren, L.,2013). There are some important determinants of child marriage in Bangladesh such as education of women and their husbands, women's occupation, place of residence and religion.(Kamal, S. M., et al, 2014). Another study focused on the influence of adolescent marriage opportunities on female schooling attainment and gives predictions of the impact of imposing universal age-of-consent laws. (Field, E., et al, 2006). Bangladesh has the fourth-highest rate of child marriage in the world while 29 percent of girls married before the age of 15 and 65 percent girls married before the age of 18 even 2 percent girls are married before the age of 11. (UNICEF, 2015). One more report focused on the normative and structural factors for child marriage in Bangladesh such as traditional, familial, economic, women facility and societal norms and values. (Plan Asia, 2013). Another study highlighted on the present situation of child marriage and identified the causes or factors of child marriage in Bangladesh. (icddr,b., 2013).

The above-stated studies focused on the effects of child marriage on the socioeconomic aspects and different causes or factors for child marriage in Bangladesh. A very few number of researcher studied one or two effects of child marriage and none of the researchers did not study the effect of child marriage on social and economic aspects in addition to more aspects at a time. Few researchers focused on only traditional causes of child marriage of Bangladesh. A little number of researcher discussed on the normative causes and some structural causes for child marriage. Some of the organizations stated that the present scenario of child marriage of Bangladesh. The most of the study focused on a few social and health issues as well as a little number of factors of child marriage. This study tries to find out the effects of child marriage on the wide range of social and economic aspects. The rest of the article is prepared as follows: In the initial, the objectives of the study will be affirmed, after that this is followed by an explanation of the research methods used in the study. Then the results of our study are discussed. In conclusion, the managerial implications and limitations of the study along with recommendations for the possible study will be offered.

2. OBJECTIVES OF THE STUDY

The overall objectives of this study are to investigate the impact of child marriage on socioeconomic aspects in Bangladesh. The specific objectives of the study are listed below:

- (i) To identify the socioeconomic aspects which are affected by child marriage.
- (ii) To show the significant relationship between child marriage and identified socioeconomic aspects.
- (iii) To give some recommendations against child marriage for socioeconomic development.

3. METHODOLOGY OF THE STUDY

This study attempt to investigate the impact of child marriage on socioeconomic aspects of Bangladesh. Primary sources of data were used to perform this study which was collected from respondents through direct interview.

3.1 DETERMINATION OF SAMPLE SIZE

This study includes the conscious peoples of Bangladesh for its population. At present, there have around 100000000 adult people in Bangladesh. We determined our sample size from approximate 50000000 conscious people of Bangladesh. Random sampling technique was used to select respondents for this inquiry. The sample can be determined by using the following formula suggested by Yamane (1967)¹ with 5 percent sampling error. The formula used in this study is given away below.

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

Where,

n = Sample Size

N= Population

e = Percentage of sampling error

- (i) Population² size is > 50000000 people
- (ii) Percentage of sampling error³ is 5%

In calculating the sample size⁴ the subsequent assumptions were made to find out, n = 399

3.2 SAMPLE SUFFICIENCY TEST AND SPHERICITY TEST

Table 1 (Table-1) gives information about to hypothesis of factor analysis. The sample sufficiency index KMO⁵ by Kaiser-Meyer-Olkin has identified which compares the sizes of the observes correlation coefficients to the sizes of the partial correlation coefficient for the sum of analysis variables is 81.8 percent and it is reliable because it is above 80 percent. In addition, supposition test of sphericity by the Bartlett's Test⁶ (H₀: All correlation coefficients are not quite far from zero) is rejected on a level of statistical significance p < 0.05 for approx. For these data, Bartlett's Test is highly significant (p < 0.001). As a result, both acceptances for the conduct of factor analysis are satisfied and we can continue it.

Table 1 KMO and Bartlett's Test

Kaiser-Meyer-Olkin measure of sampling adequacy		0.818
Bartlett's Test of Sphericity	Approx. Chi-Square	2.527
	df.	406
	Sig.	.000

3.3 SAMPLE DISTRIBUTION

To perform this study 399 respondents were interviewed from seven divisions of Bangladesh. We selected our respondents both male and female. Details of sample distribution are given in the following figures.

¹ Yamane, Taro. (1967). Statistics: An Introductory Analysis, 2nd Edition, New York: Harper and Row.

² Population is a complete set of items that information is desired.

³ Sampling error is the level of precision, is the range in which the true value of the population is estimated to be. This is range is expressed in percentage points.

⁴ Sample size is a part of the population which is systematically determined and that represent the characteristics of the population.

⁵ KMO is a measure of sampling adequacy and it is an index used to examine the appropriateness of factor analysis. Values below 0.5 imply that factor analysis may not be appropriate.

⁶ Bartlett's Test of Sphericity is a test statistic used to examine the hypothesis that the variables are uncorrelated in the population.

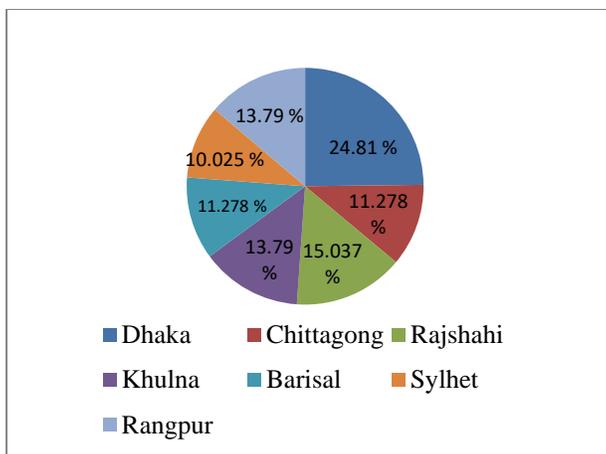


Figure 1 Division wise sample distribution

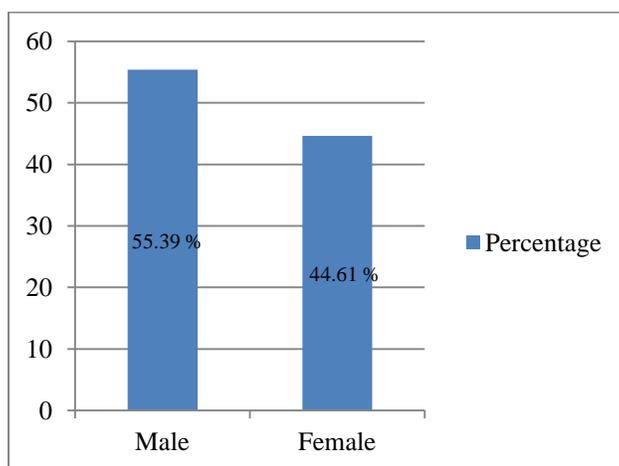


Figure 2 Gender wise sample distribution

3.4 QUESTIONNAIRE SETUP AND TEST OF RELIABILITY

The questionnaire of this study was considered with Likert scale⁷ method. Likert scale questionnaire was designed with 5 point scales which range from 5 to 1 where 5 is indicating strongly agree and 1 is indicating strongly disagree. Table 2 shows the reliability coefficient⁸ of the questionnaire. It shows that the Cronbach's alpha⁹ of the questionnaire is 0.846 which is excellently acceptable as per Nunnally (1978)¹⁰.

⁷ Likert scale is a five or seven point scale which is used to allow the individual to express how much they agree or disagree with a particular statement.

⁸ A measure of the accuracy of a test or measuring instrument obtained by measuring the same individuals twice and computing the correlation of the two sets of measures.

⁹ Cronbach's alpha is a measure of internal consistency that is how closely related a set of items are as a group. It is considered to be a measure of scale reliability.

¹⁰ Nunnally (1978) offered a rule of thumb of 0.7. More recently, one tends to see 0.8 cited as a minimum alpha. One thing to keep in mind is that alpha is heavily dependent on the number of items composing the scale. Even using items with poor internal consistency you can get a reliable scale if your scale is long enough.

Table 2 : Reliability¹¹ statistics

Cronbach's Alpha	Number of Items
0.846	29

The questionnaire of the study set up with following socioeconomic aspects of Bangladesh which are affected by child marriage. The considered aspects are physical and mental violence of women, transaction of dowry, divorce, family and social conflict, poverty, social crime, women health hazard, education, suicide, prostitution, population growth, child labor, maternal mortality, child mortality, born of immature baby, juvenile delinquency, women social status, working ability of male and female, dependent population, increase family expenditure on health sector, per capita production and income, standard of living, family financial crisis, indebtedness and socioeconomic development.

3.5 DATA COLLECTION TECHNIQUES

A survey has been performed on 221 male and 178 female respondents at the seven divisions of Bangladesh. All the data of this study were collected by interview through the questionnaire with random sampling technique. The interviewers were bachelor students of Sociology & Anthropology and Economics Department of Asian University of Bangladesh. Interviewers were appropriately trained on the matters representing the questionnaire for data collection before resuming the interview. This research was carried out from January 2016 to May 2017.

3.6 DATA ANALYSIS METHODS

This study was used some inferential statistical¹² method for data analysis. Factor analysis¹³ in SPSS (Statistical Package for Social Sciences) program was used to reduce the items or affected factors related to the child marriage of Bangladesh. Multivariate Analysis of Variance¹⁴ (MANOVA) was used to show the overall and individual significant effect of independent variable on dependent variables for developing a model of this study.

4. FINDINGS OF THE STUDY

The interpretations of this study have been divided into two divisions such as (i) Factor analysis and (ii) Multivariate analysis of variance (MANOVA). Factor analysis identified eight socioeconomic factors which are affected by child marriage in Bangladesh. The result shows that the communalities of the variables are reasonably high (The average communality is greater than 0.5) indicating that the variables used in the data set are reasonably cohesive in nature.(Appendix 1). The most influenced socio-economic factors are Increased the rate of maternal and child mortality as well as women health hazard (19.156%), Raised the family financial crisis and decreased the standard of living (7.935%), Hampered the socio-economic development (5.896%), Increased the family and social conflict along with the rate of divorce (5.087%), Increased the population growth and the rate of dependent population (4.739%), Increased the rate of mental and physical violence against women (3.960%), Increased the rate of suicide and transaction of dowry (3.773%) and Enhanced the juvenile delinquency and downfall the women social status (3.504%). (Table 3)

Table 3 : Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1. Increased the rate of maternal and child mortality as well as women health hazard	5.555	19.156	19.156
2. Raised the family financial crisis and decreased the standard of living	2.301	7.935	27.091
3. Hampered the socioeconomic development	1.710	5.896	32.987
4. Increased the family and social conflict along with the rate of divorce	1.475	5.087	38.074

¹¹ Reliability refers to the consistency or repeatability of an operationalized measure.

¹² Inferential statistics is concerned with making predictions or inferences about a population from observations and analysis of a sample.

¹³ Factor analysis is an explorative analysis. Factor Analysis reduces the information in a model by reducing the dimensions of the observations.

¹⁴In statistics, multivariate analysis of variance (MANOVA) is a procedure for comparing multivariate sample means. As a multivariate procedure, it is used when there are two or more dependent variables and is typically followed by significance test involving individual dependent variables separately.

5. Increased the population growth and the rate of dependent population	1.374	4.739	42.813
6. Increased the rate of mental and physical violence against women	1.149	3.960	46.774
7. Increased the rate of suicide and transaction of dowry	1.094	3.773	50.547
8. Enhanced the juvenile delinquency and downfall the women social status	1.016	3.504	54.051

Extraction Method: Principal Component Analysis

Multivariate analysis of variance (MANOVA) indicating that the factors identified through the factor analysis are altogether significantly influenced by child marriage in Bangladesh. The output of MANOVA has two segments. The first part is Multivariate tests.

Table 4 Multivariate Tests^d

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.949	7.791E2 ^a	8.000	332.000	.000	.949
	Wilks' Lambda	.051	7.791E2 ^a	8.000	332.000	.000	.949
	Hotelling's Trace	18.775	7.791E2 ^a	8.000	332.000	.000	.949
	Roy's Largest Root	18.775	7.791E2 ^a	8.000	332.000	.000	.949
Child Marriage	Pillai's Trace ¹⁵	2.064	1.998	472.000	2.712E3	.000	.258
	Wilks' Lambda ¹⁶	.000	9.735	472.000	2.653E3	.000	.631
	Hotelling's Trace ¹⁷	902.803	631.675	472.000	2.642E3	.000	.991
	Roy's Largest Root ¹⁸	901.516	5.180E3 ^c	59.000	339.000	.000	.999

a. Exact statistic

b. Computed using alpha = .05

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Design: Intercept + OVERALL

These results (from table 4) show that there is a significant effect of the child marriage on all of the socioeconomic factors. There is no one single multivariate test; there are four different ones. In this case, they are all significant ($p < 0.05$), as a result, we can conclude that child marriage have a significant effect on altogether of identified

¹⁵ Pillai's trace is a positive-valued statistic. Increasing values of the statistic indicate effects that contribute more to the model. The Pillai-M. S. Bartlett trace.

¹⁶ Wilks' Lambda is a positive-valued statistic that ranges from 0 to 1. Decreasing values of the statistic indicate effects that contribute more to the model.

¹⁷ Hotelling's trace is the sum of the eigenvalues of the test matrix. It is a positive-valued statistic for which increasing values indicate effects that contribute more to the model. Hotelling's trace is always larger than Pillai's trace, but when the eigenvalues of the test matrix are small, these two statistics will be nearly equal. This indicates that the effect probably does not contribute much to the model.

¹⁸ Roy's largest root is the largest eigenvalue of the test matrix. Thus, it is a positive-valued statistic for which increasing values indicate effects that contribute more to the model. Roy's largest root is always less than or equal to Hotelling's trace. When these two statistics are equal, the effect is predominantly associated with just one of the dependent variables, there is a strong correlation between the dependent variables, or the effect does not contribute much to the model.

socioeconomic factors of Bangladesh. The second part of the results is Univariate tests. The results of the univariate tests used for the effect of child marriage on individual identified socioeconomic factors.

Table 5: Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1. Increased the rate of maternal and child mortality as well as women health hazard	109.292 ^a	59	1.852	2.175	.000	.275
	2. Raised the family financial crisis and decreased the standard of living	153.949 ^c	59	2.609	3.624	.000	.387
	3. Hampered the socioeconomic development	106.263 ^d	59	1.801	2.093	.000	.267
	4. Increased the family and social conflict along with the rate of divorce	105.854 ^e	59	1.794	2.082	.000	.266
	5. Increased the population growth and the rate of dependent population	83.543 ^f	59	1.416	1.526	.012	.210
	6. Increased the rate of mental and physical violence against women	78.960 ^g	59	1.338	1.422	.030	.198
	7. Increased the rate of suicide and transaction of dowry	93.444 ^h	59	1.584	1.763	.001	.235
	8. Enhanced the juvenile delinquency and downfall the women social status	90.288 ⁱ	59	1.530	1.686	.002	.227
Intercept	1. Increased the rate of maternal and child mortality as well as women health hazard	7.619	1	7.619	8.947	.003	.026
	2. Raised the family financial crisis and decreased the standard of living	.000	1	.000	.000	.990	.000
	3. Hampered the socioeconomic development	.418	1	.418	.485	.487	.001
	4. Increased the family and social conflict along with the rate of divorce	2.058	1	2.058	2.388	.123	.007
	5. Increased the population growth and the rate of dependent population	.940	1	.940	1.014	.315	.003
	6. Increased the rate of mental and physical violence against women	.256	1	.256	.272	.602	.001
	7. Increased the rate of suicide and transaction of dowry	2.647	1	2.647	2.946	.087	.009
	8. Enhanced the juvenile delinquency and downfall the women social status	.194	1	.194	.214	.644	.001
Child Marriage	1. Increased the rate of maternal and child mortality as well as women health hazard	109.292	59	1.852	2.175	.000	.275
	2. Raised the family financial crisis and decreased the standard of living	153.949	59	2.609	3.624	.000	.387
	3. Hampered the socioeconomic development	106.263	59	1.801	2.093	.000	.267
	4. Increased the family and social conflict along with the rate of divorce	105.854	59	1.794	2.082	.000	.266
	5. Increased the population growth and the rate of dependent population	83.543	59	1.416	1.526	.012	.210
	6. Increased the rate of mental and physical violence against women	78.960	59	1.338	1.422	.030	.198
	7. Increased the rate of suicide and transaction of dowry	93.444	59	1.584	1.763	.001	.235
	8. Enhanced the juvenile delinquency and downfall the women social status	90.288	59	1.530	1.686	.002	.227

Error	1. Increased the rate of maternal and child mortality as well as women health hazard	288.708	339	.852			
	2. Raised the family financial crisis and decreased the standard of living	244.051	339	.720			
	3. Hampered the socioeconomic development	291.737	339	.861			
	4. Increased the family and social conflict along with the rate of divorce	292.146	339	.862			
	5. Increased the population growth and the rate of dependent population	314.457	339	.928			
	6. Increased the rate of mental and physical violence against women	319.040	339	.941			
	7. Increased the rate of suicide and transaction of dowry	304.556	339	.898			
	8. Enhanced the juvenile delinquency and downfall the women social status	307.712	339	.908			
Total	1. Increased the rate of maternal and child mortality as well as women health hazard	398.000	399				
	2. Raised the family financial crisis and decreased the standard of living	398.000	399				
	3. Hampered the socioeconomic development	398.000	399				
	4. Increased the family and social conflict along with the rate of divorce	398.000	399				
	5. Increased the population growth and the rate of dependent population	398.000	399				
	6. Increased the rate of mental and physical violence against women	398.000	399				
	7. Increased the rate of suicide and transaction of dowry	398.000	399				
	8. Enhanced the juvenile delinquency and downfall the women social status	398.000	399				
Corrected Total	1. Increased the rate of maternal and child mortality as well as women health hazard	398.000	398				
	2. Raised the family financial crisis and decreased the standard of living	398.000	398				
	3. Hampered the socioeconomic development	398.000	398				
	4. Increased the family and social conflict along with the rate of divorce	398.000	398				
	5. Increased the population growth and the rate of dependent population	398.000	398				
	6. Increased the rate of mental and physical violence against women	398.000	398				
	7. Increased the rate of suicide and transaction of dowry	398.000	398				
	8. Enhanced the juvenile delinquency and downfall the women social status	398.000	398				

- a. R Squared = .275 (Adjusted R Squared = .148)
- b. Computed using alpha = .05
- c. R Squared = .387 (Adjusted R Squared = .280)
- d. R Squared = .267 (Adjusted R Squared = .139)
- e. R Squared = .266 (Adjusted R Squared = .138)
- f. R Squared = .210 (Adjusted R Squared = .072)
- g. R Squared = .198 (Adjusted R Squared = .059)
- h. R Squared = .235 (Adjusted R Squared = .102)
- i. R Squared = .227 (Adjusted R Squared = .092)

These univariate tests (shown above table 5) indicated that child marriage has a significant effect on individual identified socioeconomic factors such as, are Increased the rate of maternal and child mortality as well as women health hazard {F (59,339) = 2.175, p = 0.000, $\eta^2 = .275$ }, Raised the family financial crisis and decreased the standard of living {F (59, 339) = 3.624, p = 0.000, $\eta^2 = .387$ }, Hampered the socioeconomic development {F (59, 339) = 2.093, p = 0.000, $\eta^2 = .267$ }, Increased the family and social conflict along with the rate of divorce {F (59, 339) = 2.082, p = 0.000, $\eta^2 = .266$ }, Increased the population growth and the rate of dependent population {F (59, 339) = 1.526, p = 0.012, $\eta^2 = .210$ }, Increased the rate of mental and physical violence against women {F (59, 339) = 1.422, p = 0.030, $\eta^2 = .198$ }, Increased the rate of suicide and transaction of dowry {F (59, 339) = 1.763, p = 0.001, $\eta^2 = .235$ }, and Enhanced the juvenile delinquency and downfall the women social status {F (59, 339) = 1.686, p = 0.002, $\eta^2 = .227$ }.

5. DISCUSSION AND RECOMMENDATION

The main purpose of this study was to identify the socioeconomic aspects which are affected by child marriage in Bangladesh.

5.1 Summary of the findings

After analyzing the data our study got some findings. Factor analysis has identified eight factors that affected by child marriage. The identified most important socioeconomic factors are Increased the rate of maternal and child mortality as well as women health hazard (19.156%), Raised the family financial crisis and decreased the standard of living (7.935%), Hampered the socioeconomic development (5.896%), Increased the family and social conflict along with the rate of divorce (5.087%), Increased the population growth and the rate of dependent population (4.739%), Increased the rate of mental and physical violence against women (3.960%), Increased the rate of suicide and transaction of dowry (3.773%) and Enhanced the juvenile delinquency and downfall the women social status (3.504%).The 8 factors as a whole 54.051% significantly influenced by the child marriage in Bangladesh. Multivariate analysis of variance (MANOVA) shows two types of results. The first one is Multivariate tests shows that child marriage have a significant effect on altogether of the identified eight socioeconomic factors in Bangladesh. The 2nd part is Univariate tests which indicated that child marriage has the significant effect on individual identified socioeconomic factors in Bangladesh.

5.2 Managerial Implications

Our study recommends that if it is possible to decrease the rate of child marriage, there will be improved the identified socioeconomic aspects of Bangladesh along with it will enhance the national development and it will help to achieve the sustainable development goals.

5.3 Limitations of the study

This study has some limitations. The first limitation of this study is that we include only 29 socioeconomic aspects of Bangladesh but did not include all of the socioeconomic aspects of Bangladesh. The second limitation is that we did not show the rural-urban comparison on the impact of child marriage. Another potential shortcoming is that this study did not discuss the reasons for child marriage in Bangladesh.

5.4 Recommendations for future research

This study has identified that the most important socioeconomic aspects which are affected by child marriage in Bangladesh. It also shows the significant relationship between identified socioeconomic aspects and child marriage in collectively and individually. But this study did not include all of the socioeconomic aspects which are affected by child marriage. Moreover, it did not show the rural-urban comparison in the same issue. Furthermore, this study did not concentrate on the reasons for child marriage in Bangladesh. These distinguish limitations could persuade future researchers for further research in this concern.

Appendices

Appendix 1 Communalities of the variables

Sl. No.	Name of the variables	Initial	Extraction
1.	Increased the rate of physical violence of women	1.000	.605
2.	Increased the rate of mental violence of women	1.000	.698
3.	Increased the transaction tendency of dowry	1.000	.435
4.	Increased the rate of divorce	1.000	.602
5.	Increased the family conflict	1.000	.655
6.	Increased the social conflict	1.000	.559
7.	Increased the rate of poverty	1.000	.339
8.	Increased the social crime	1.000	.605
9.	Increased the health hazard	1.000	.532
10.	Decreased the rate of education	1.000	.443
11.	Increased the rate of suicide	1.000	.623
12.	Increased the rate of prostitution	1.000	.550
13.	Increased the rate of population	1.000	.500
14.	Increased the rate of child labor	1.000	.499
15.	Increased the rate of maternal mortality	1.000	.629
16.	Increased the rate of child mortality	1.000	.645
17.	Increased the birth rate of immature baby	1.000	.499
18.	Increased the juvenile delinquency	1.000	.619
19.	Decreased the women social status	1.000	.572
20.	Decreased the working power of male	1.000	.509
21.	Increased the dependent population	1.000	.510
22.	Increased the family expenditure on health sector	1.000	.445
23.	Decreased the per capita production	1.000	.546
24.	Decreased the standard of living	1.000	.472
25.	Increased the family financial crisis	1.000	.484
26.	Increased the tendency of being indebtedness	1.000	.454
27.	Decreased the working power of female	1.000	.564
28.	Play negative role to decrease per capita income	1.000	.549
29.	Hamper the overall socioeconomic development	1.000	.534

Extraction Method: Principle Component Analysis

Appendix 2 Increased the rate of maternal and child mortality as well as women health hazard

Sl. No.	Name of the Variables	Factor Loadings
1.	Increased the rate of child mortality	.766
2.	Increased the rate of maternal mortality	.752
3.	Increased the health hazard	.572
4.	Increased the birth rate of immature baby	.564
5.	Decreased the rate of education	.377

Appendix 3 Raised the family financial crisis and decreased the standard of living

Sl. No.	Name of the Variables	Factor Loadings
1.	Increased the family financial crisis	.660
2.	Increased the tendency of being indebtedness	.628
3.	Decreased the standard of living	.597
4.	Decreased the per capita production	.538
5.	Increased the social crime	.478
6.	Increased the rate of poverty	.441

Appendix 4 Hampered the socioeconomic development

Sl. No.	Name of the Variables	Factor Loadings
1.	Decreased the working power of female	.679
2.	Hamper the overall socioeconomic development	.663
3.	Play negative role to decrease per capita income	.607
4.	Decreased the working power of male	.439

Appendix 5 Increased the family and social conflict along with the rate of divorce

Sl. No.	Name of the Variables	Factor Loadings
1.	Increased the family conflict	.753
2.	Increased the social conflict	.660
3.	Increased the rate of divorce	.515
4.	Increased the rate of child labor	.375

Appendix 6 Increased the population growth and the rate of dependent population

Sl. No.	Name of the Variables	Factor Loadings
1.	Increased the dependent population	.615
2.	Increased the rate of population	.522
3.	Increased the family expenditure on health sector	.510

Appendix 7 Increased the rate of mental and physical violence against women

Sl. No.	Name of the Variables	Factor Loadings
1.	Increased the rate of mental violence of women	.759
2.	Increased the rate of physical violence of women	.715

Appendix 8 Increased the rate of suicide and transaction of dowry

Sl. No.	Name of the Variables	Factor Loadings
1.	Increased the rate of suicide	.739
2.	Increased the transaction tendency of dowry	.483

Appendix 9 Enhanced the juvenile delinquency and downfall the women social status

Sl. No.	Name of the Variables	Factor Loadings
1.	Increased the juvenile delinquency	.710
2.	Decreased the women social status	.517
3.	Increased the rate of prostitution	.451

References

- [1] Islam, M. M., Islam, M. K., Hasan, M.S., Haque, M. A. (2016). Marriage Before 16 or 18 years: The Effect of Marital Age on Women's Educational Attainment in Bangladesh. *Journal of Population and Social Studies*, Volume 24 Number 1, pp. 117 – 132. Doi 10.14456/jps.2016.
- [2] Hammann, L. (2014). Effects of Child Marriage in Bangladesh. Master's Thesis, Erasmus School of Economics, Erasmus University Rotterdam. file:///C:/Users/User/Downloads/MA-thesis_Lucija-Hammann-370132%20(3).pdf
- [3] Kamal, S. M. (2010). Geographical Variations and contextual effect on child marriage in Bangladesh. *Pakistan Journal of Women's Studies: Alam-e-Niswan*, Vol. 17, No. 2, 2010, pp.37-57, ISSN: 1024-1256.
- [4] Farzana, T.J. (2016). Early Marriage of Women: The Case of Bangladesh. *World Journal of Social Sciences*, Vol. 6. No. 2. July 2016 Special Issue. pp. 51 – 61.
- [5] Ferdousi, N. (2014). Child marriage in Bangladesh: Socio-legal analysis. *International Journal of Sociology and Anthropology*, Vol. 6(1), pp. 1-7.
- [6] Plan Bangladesh. (2013). Child marriage in Bangladesh. <https://plan-international.org/publications/child-marriage-in-Bangladesh>.
- [7] Blomgren, L. (2013). Child Marriage in Bangladesh: Causes, Consequences, and Legal Framework. Memorandum, Avon Global Center for Women and Justice.
- [8] Kamal, S. M., Hassan, C. H., Alam, G. M., Ying, Y. (2014). Child Marriage in Bangladesh: Trends and Determinates. *Journal of Biosocial Science*, page 1-20, 6 Cambridge University Press, doi:10.1017/S0021932013000746.
- [9] Field, E., Ambrus, A. (2006). Early Marriage and Female Schooling in Bangladesh. Thesis, https://wcfia.harvard.edu/files/wcfia/files/field_early.pdf.

- [10] UNICEF. (2015). Child Marriage in Bangladesh. State of the world's children. Executive Summary, <https://www.hrw.org/view-mode/modal/269478>.
- [11] Plan Asia. (2013). Asia Child Marriage Initiative: Summary of Research in Bangladesh, India and Nepal. <https://www.icrw.org/wp-content/uploads/2016/10/PLAN-ASIA-Child-Marriage-3-Country-Study.pdf>.
- [12] icddr,b. (2013). National survey by icddr,b reveals prevalence of child marriage in Bangladesh. www.icddr.org/component/news/?id=622.

Crisis in Indian Steel Industry: Issues and Challenges

Shipra Bhatia

Abstract- Steel is one of the most important raw materials in the modern world and forms the backbone of every industrial economy. India being one of the fastest growing economies in the world cannot deny the strategic importance of the steel sector. Steel finds its extensive application right from construction, infrastructure, and power, aerospace and industrial machinery to consumer products. The Indian steel sector has grown exponentially over the past few years to be the third largest producer of steel in the world. However, the steel sector is currently going through tough times with domestic supply greater than demand and yet India largely being a net importer of steel for last couple of years. The steel producers are also facing challenging financial times, reflected in negative profit growth rates. As of March 2017, the steel industry accounts for almost 22 per cent of the total debt under CDR cases in India.

Index Terms- Steel industry, economic development, Infrastructure, Non-Performing Assets (NPA)

I. INTRODUCTION

Steel being a key input to the country's infrastructure sector, plays a major role in the growth of a developing economy. In India the steel sector contributes nearly 2 per cent to the country's gross domestic product (GDP) and employs over 0.6 million people. In 2015, India became the third largest producer of crude steel as against its eighth position in 2003. The country is also the third largest consumer of finished steel in the world after China and USA (Committee, Annual Performance 2015-16)¹. The demand for the steel is mainly driven by construction, infrastructure and automobile sectors. These three sectors together, account for over 75 per cent of the total steel consumed in the country.

The growth of steel sector between 2003-04 and 2007-08 was remarkable. During this period the production and consumption grew at a compounded annual growth rate (CAGR) of 8.3 per cent and 12 per cent respectively. With consumption over taking production, India became the net importer of steel during this period (Bansal, Dr. V.K. Saraswat and Ripunjaya)². However, during the last five years, the performance of the Indian steel sector was in the doldrums. The supply of steel has been more than the demand and yet India has largely remained a net importer of steel (except 2013-14). In 2014-15, imports increased by over 71 per cent, primarily due to sharper fall in International steel prices than domestic prices. Further, fall in Chinese steel consumption along with still significant production growth has led to increase in exports from China, putting pressure on steel prices in India and globally (Committee, Performance Highlight 2014-15)³. Due to this, the profits of the steel companies have declined rapidly in nominal terms and have experienced huge losses. A number of big players are also resorting to debt restructuring with a growing incidence of non-performing assets (NPA).

In order to protect the domestic steel industry, the government has taken various steps such as imposition of safeguard duty of 20 per cent in March 2016 on hot-rolled flat products, imposed an anti-dumping duty for five years on imports of certain variety of hot-rolled flat products from China, Korea and Malaysia. The government has also imposed anti-dumping duty on imports of cold rolled flat products originating in or exported from China, Korea, European Union, South Africa, Taiwan, Thailand and USA. A series of tariff barriers along with the new National Steel Policy (NSP), 2017 is expected to bring impetus to the steel sector.

II. OBJECTIVE

The paper aims to study the current status of Indian Steel Industry. The broad objectives of the paper are to study the following:

- i. Production and consumption trends, installed capacity and utilization,
- ii. Import/export trends in the steel market
- iii. Price movements
- iv. Impact of international demand and supply factors on the Indian steel industry

III. DEMAND-SUPPLY ANALYSIS

a) Production and Consumption

India's steel production and consumption stood at 100.8 mt and 83.9 mt respectively in 2016-17 as shown in Figure 1 (PIB)⁴. During 2012-13 to 2015-16, production growth has witnessed a downward trend with the lowest growth recorded in 2014-15. Subdued demand from the construction and automobile sectors as well as unavailability of iron ore with the ban of mining activities in

¹ <http://www.jpcindiansteel.nic.in>

² Need for a New Steel Policy, NitiAyog

³ Performance Highlight 2014-15, JPC

⁴ Lok Sabha questions

Karnataka, Goa and Odisha have been the main reasons for this decline. However, with the launch of new policies by the government the steel production increased by a year-on-year growth of over 10 per cent in 2016-17. During 2013-14, consumption growth was sluggish due to slow industrial growth, and dismal project execution in the infrastructure space. In terms of per capita consumption of steel, India stands at 63 kg as against the world average of 225 kg, indicating a huge potential in the industry.

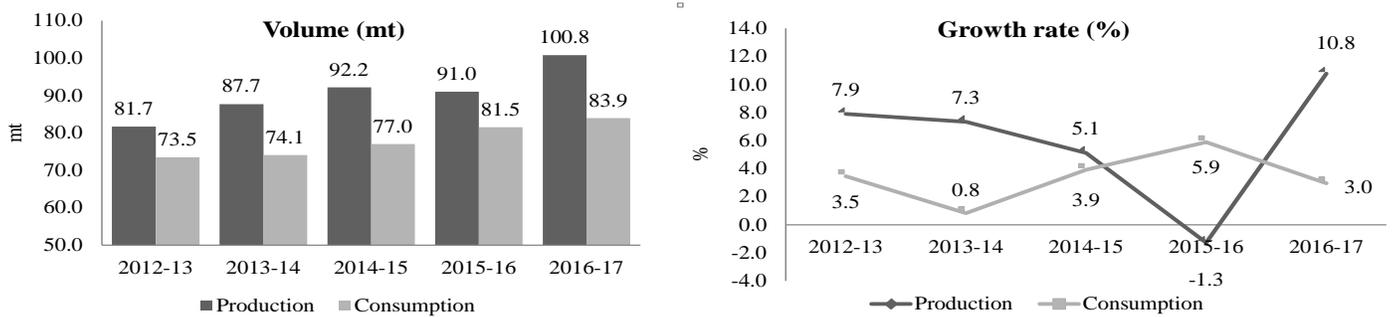


Figure1: Production and Consumption of Finished Steel in India

b) Import and Export

India has largely remained a net importer of steel in the last few years. In 2015-16, imports increased by over 71 per cent, primarily due to the global overcapacity leading to cheap exports into India, intermittent supply of raw materials, land acquisition etc. In 2016-17, India became net-exporter of steel after a gap of three years, aided by stiff tariff barriers restricting imports. In the last one year, steel exports from India increased by over 100 per cent to 8.2mt while imports fell by 36 per cent to 7.4 mt due to various trade protection measures including anti-dumping duty, safeguard duty and minimum import price imposed by the country(Steel)⁵. With many importing countries restricting shipments from China with high duties, exports from India are set to continue to rise for next few months also.

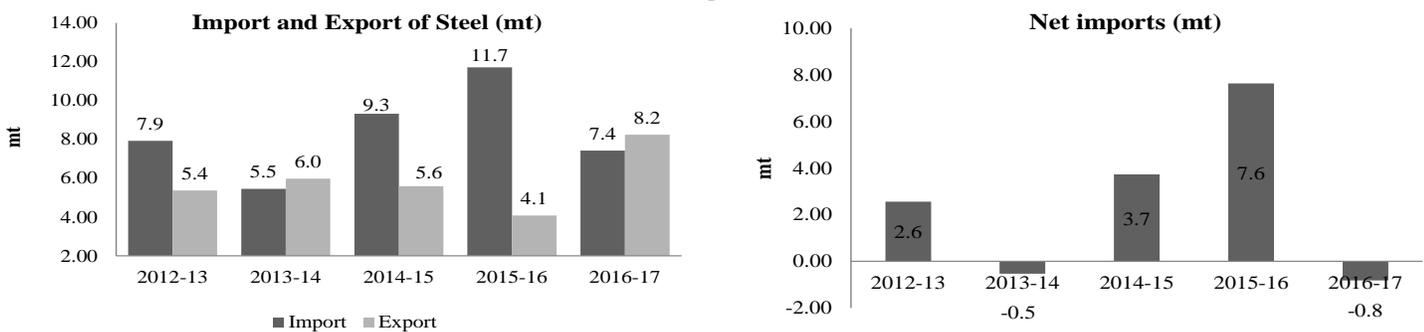


Figure2: Import and Export of Finished Steel in India

Country-wise analysis shows that China was the biggest importer of steel to India. More than 90 per cent of the total steel imports to India are from China, Korea and Japan. India has also been exporting steel to countries like Italy, Iran, UAE, USA, Vietnam and Belgium. During 2014-15 to 2016-17, the share of Iran and USA has fallen while the share of Belgium and Iran has increased(Commerce)⁶.The fall in the exports to USA from India can be attributed to greater tariff restrictions imposed by the former.

Table1: Change in Shares of Major Export Destinations of Indian Steel

Countries	Volume (000 tonnes)			Share in total exports (%)		Difference in share (A-B) %
	2014-15	2015-16	2016-17	(A) 2016-17	(B) 2014-15	
Belgium	198.39	287.42	1,112.31	13.5	3.5	9.9
Vietnam	163.12	38.11	961.26	11.7	2.9	8.7
Italy	470.86	345.41	942.92	11.4	8.4	3.0
USA	501.29	295.63	273.58	3.3	9.0	-5.6
Iran	495.8	321.43	144.01	1.7	8.9	-7.1

⁵Three years initiatives and achievements, Ministry of Steel, 2017

⁶Export Import Data Bank, Department of Commerce

A series of tariff barriers imposed by India to stop dumping of cheap steel and to provide level playing field to the domestic steel producers are (Steel)⁷:

- Imposed safeguard duty of 20 per cent in March 2016 on hot-rolled flat products of non-alloy steel, in coils of width of 600 mm or more.
- Levied the anti-dumping duty for five years on imports of certain variety of hot-rolled flat products of stainless steel from China (\$309 per tonne), Korea (\$180 per tonne) and Malaysia (\$316 per tonne).
- The government had earlier imposed anti-dumping duty ranging from 4.58 per cent to 57.39 per cent of landed value on cold rolled flat products of stainless steel from China, Korea, European Union, South Africa, Taiwan, Thailand and USA on 17.04.2014 as shown in Table 2.
- The anti-dumping duty on the above items was further extended by five more years on 11.12.2015 after it was found that there is continued dumping of these goods from above mentioned countries though the volume of imports has declined; the performance of the domestic industry has deteriorated in the current period due to the impact of the dumped imports from these countries; and the dumping is likely to continue if the duties are revoked.

Table 2: Anti-dumping duty imposed w.e.f. from 11.12.2015 (Bureau)⁸

Country	Anti-dumping duty (%)
China	57.39
European Union	29.41 - 52.56
South Africa	12.34 - 36.91
USA	9.47
Korea	5.39 - 13.44
Thailand	4.58 - 5.39

c) Capacity

The total installed capacity of steel industry increased to 125 mt in 2016-17, recording a year on year growth of 5.75 per cent. The capacity, however, has been higher than the off-take of the metal, resulting in under-utilization of the sector. During 2015-16, the capacity utilisation rate fell below 80 per cent from a high of about 84 per cent in 2014-15 due to ban on iron ore mining which led to a fall in the raw material available in the market. In 2016-17, the capacity utilization has increased with the reopening of iron ore mines in Goa and Odisha.

Table 3: Capacity installed and utilized

Particulars	2012-13	2013-14	2014-15	2015-16	2016-17
Capacity Installed (mt)	96.7	99.6	109.9	118.2	125.0
Capacity Utilization (%) ⁹	81.0	80.9	83.9	76.5	80.6

IV. PRICE MOVEMENTS

a) Wholesale Price Index (WPI)

During 2014 to 2017, domestic steel prices have exhibited a declining trend largely due to falling iron ore prices and pressure from depressed steel prices world-wide. The iron-ore prices have shown a drastic downfall during 2015-16, due to re-opening of iron-ore mines in Goa, Karnataka and Odisha. Further, fall in Chinese steel consumption along with still significant production growth has led to increase in exports from China, putting pressure on steel prices in India and globally.

Table 4: Movement in WPI of Steel and Iron ore (2004-05=Base Year) (Adviser)¹⁰

WPI	2012-13	2013-14	2014-15	2015-16	2016-17
Steel	126.2	126.2	130.6	127.9	125.0
Iron ore	623.7	523.1	517.6	343.4	315.2

⁷Three years initiatives and achievements, Ministry of Steel, 2017

⁸Anti-Dumping duty on steel imports, PIB

⁹Capacity utilization rate is calculated as (Production/Capacity installed)*100

¹⁰WPI Data, Base Year= 2004-05, Office of Economic Adviser

b) Retail Prices

The retail prices also exhibited a similar falling trend like WPI as shown in Table 5(Steel, Joint Plant Committee, Monthly Steel Scene).¹¹The retail price of almost all the varieties of steel had witnessed a downfall during April 2012 and April 2016. The Rs per tonne price of 12 mm rounds in Delhi market fell by more than 30 per cent in the five year period.

Table 5: Average Market Prices of Leading Items of Finished Steel (Rs per tonne)¹²

Category	Apr-12	Apr-13	Apr-14	Apr-15	Apr-16
Rounds (12 mm)	48,980	45,330	43,500	40,250	34,100
TMT (10 mm)	51,580	47,010	44,500	42,538	35,250
Plates (10 mm)	49,770	49,420	46,000	40,100	35,700
HR coils (2 mm)	49,070	48,770	46,000	39,100	36,000
CR coils (0.63 mm)	54,100	52,980	52,500	44,533	39,000

However, the retail prices have increased after the imposition of minimum import prices and other tariff barriers after observing a downward trend. The per tonne retail prices in January 2017, increased by 19.7 per cent and 29.3 per cent for TMT and HRC respectively in comparison to January 2016(Steel, Joint Plant Committee, Monthly Steel Scene). The increase in the retail prices in last one year can be attributed to series of measures taken to curb dumping of steel by few importing countries who adopted predatory pricing strategy.

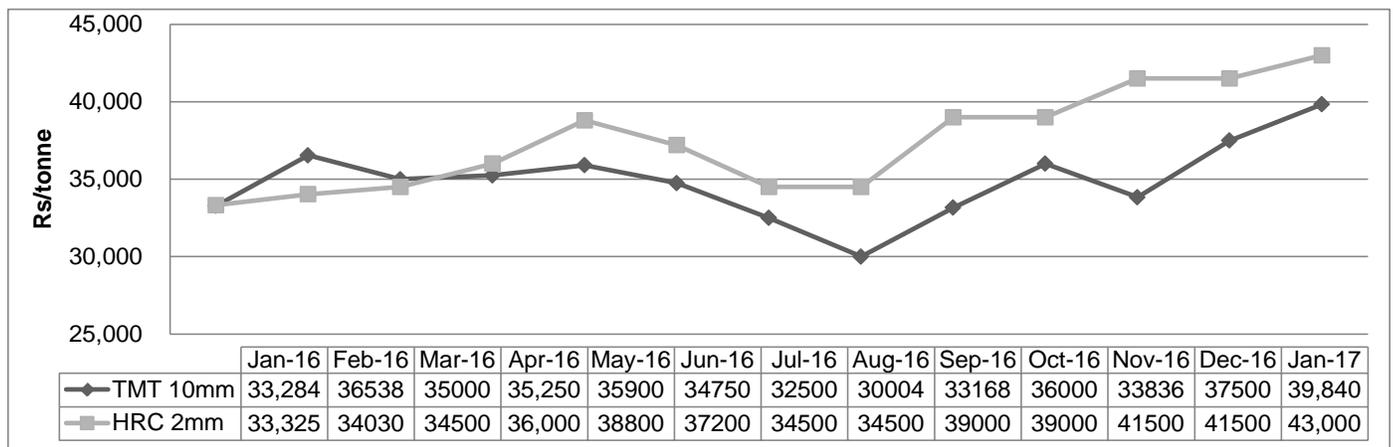


Figure 3: Retail steel prices in Delhi market (Rs per tonne)

V. CURRENT FINANCIAL DISTRESS IN THE STEEL SECTOR

The steel companies have put up a subdued financial performance in last couple of years. As shown in Table 6(Exchange)¹³profits after tax (PAT) have declined in nominal terms between 2014–15 and 2016–17 for all big steel producers. Falling profits have been associated with rapidly rising debt burden in the industry. During the period of boom in the economy many steel companies embarked on large expansion plans financed by debt predominantly bank loans. As noted in Figure 4 the growth of bank credit to the iron and steel industry peaked to over 30 per cent in 2011. Since, this coincided with a period when the Reserve Bank of India (RBI) was raising interest rates sharply in order to combat inflation the combination of rising debt burden and interest rate led to failure of debt service by major companies.

Table 6: PAT of leading players (Rs billion)

Company	Profit/Loss after Tax		
	2014-15	2015-16	2016-17
SAIL	21.6	-44.1	-29.5
JSW Steel	18.0	-8.50	34.50
Tata Steel	-39.3	-30.5	-41.68
JSPL	-12.8	-19.9	-25.40

¹¹ Monthly steel scene report by Ministry of Steel

¹² Prices are taken for Delhi Retail Market

¹³ PAT figures are taken from Consolidated financial results from Bombay Stock Exchange (BSE)

Under the dual pressure of rising debt-service burden and falling profit rate bank credit growth has been falling for years as banks get wary of lending to companies for fear of a spike in bad loans. As shown in figure 4, the growth of bank credit to iron and steel industry fell to an all-time low of 2.5 per cent in 2017 (India)¹⁴. As many players were unable to service their debt on time, this led to a large number of companies going for corporate debt restructuring (CDR) programme. With the total debt of Rs 39,770 crore the iron and steel industry accounted for 22 per cent of the total debt under CDR cases in the country as of March 31, 2017 (India, Corporate Debt Restructuring Mechanism)¹⁵. Moreover, according to the RBI's financial stability report, 2016, steel sector is the second most debt-ridden sector. It also highlights that the sector is expected to register highest gross NPAs by March 2018 (Financial Stability Report, December 2016)¹⁶.

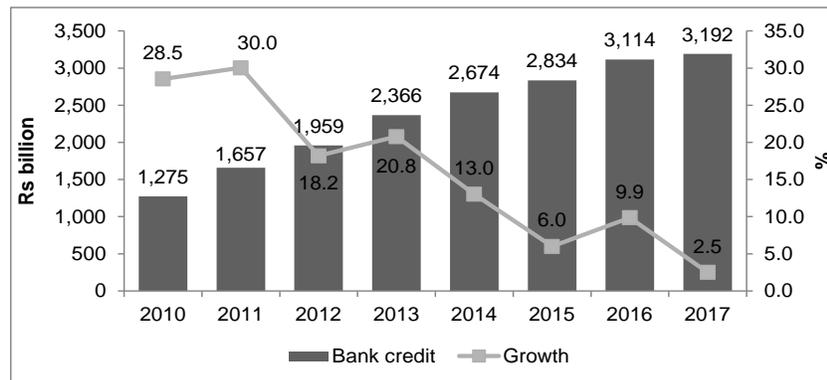


Figure 4: Bank Credit to iron and steel (Rs billion)

VI. CONCLUSION

According to the World Steel Association (WSA), India is expected to be one of the fastest growing markets in steel usage in the coming years. The demand for steel will surge with a revival in the economy. The re-opening of mines in Karnataka and Goa will also boost steel production in the country. With the imposition of tariff barriers the steel imports will further fall and alleviate pricing pressures in the coming months. Moreover, with the government's thrust on starting stalled projects followed by large infrastructure projects coming up in the country it is expected that the demand for steel will pick up. However, unless prompt measures are taken for debt relief and improving the profitability of the industry, there may be several cases of bankruptcies making it difficult to meet the demand for steel as the economy recovers.

REFERENCES

1. Adviser, Office of Economic. *WPI Data 2004-05*. n.d.
2. Bansal, Dr. V.K. Saraswat and Ripunjaya. *Need for a New Steel Policy*. 2017: Niti Aayog, 2017.
3. Bureau, Press Information. *Anti Dumping Duty on steel Imports*. n.d.
4. Commerce, Ministry of. *Export Import Data Bank*. n.d.
5. Committee, Joint Plant. "Annual Performance 2015-16." n.d. <http://www.jpcindiansteel.nic.in>. July 2017.
6. "Performance Highlight 2014-15." 2015. <http://www.jpcindiansteel.nic.in>. <<http://www.jpcindiansteel.nic.in>>.
7. Exchange, Bombay Stock. *Financial results*. n.d.
8. *Financial Stability Report, December 2016*. New Delhi: Reserve Bank of India, 2016.
9. India, Reserve Bank of. *Bank Credit by Sector*. n.d.
10. *Corporate Debt Restructuring Mechanism*. n.d.
11. PIB. *Parliament of India, Lok Sabha*. June 2017.
12. Steel, Ministry of. *3 years initiatives and achievements*. New Delhi: Ministry of steel, 2017.
13. *Joint Plant Committee, Monthly Steel Scene*. n.d.

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¹⁴ Bank Credit by sector, RBI

¹⁵ Corporate Debt Restructuring Mechanism, RBI

¹⁶ Financial Stability Report, RBI

A Survey of the use of Instructional Media in Teaching Oral Literature in Secondary Schools in Bungoma South Sub-County, Kenya

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Abstract- Use of instructional media in teaching and learning is of paramount importance. The purpose of this study was to find out the different types of instructional media that teachers use to teach oral literature in secondary schools in Bungoma South Sub-County. The main objective was to find out teachers' use of instructional media during oral literature lessons and students' response when they are taught using media. The study was based on Piaget's Theory of cognitive development which stresses that children through their experiences in the environment develop mental constructs. These stimulate their thinking and knowledge acquisition. Using purposive and simple random sampling techniques, a sample of 242 respondents was selected to participate in this study. Data was collected using self-developed questionnaires, classroom observation and interview schedule and analysed using frequencies and percentages. The study established that there are different types of media in schools but teachers mostly used textbooks and chalkboard. During lessons taught using media students were found to be motivated, active and interested in the lesson proceedings. Hence this study recommends that teachers should be encouraged to plan lessons that incorporate media and teach using different types of media in order to make learning more meaningful and interesting to students.

Index Terms- Instructional media, Oral literature

I. INTRODUCTION

Instructional media refers to any physical device which a teacher can use to clarify an idea arouse interest and enrich learners' imagination during a lesson ,(Wasiche,2006). They include resources like radio , television, computers , writing board pictures, maps, chats, resource places and people ,models ,books, dioramas, newspapers and films/shides. Patel and Mukwa (1993) say that instructional media are an inseparable element of teaching and learning process. They help the teacher to achieve the laid down objectives in a lesson.

The use of instructional media in education dates back to the days of Plato the Greek Scholar. Brown (1986) explains that ancient scholars believed in the effectiveness of visual illustrations which were used as teaching aids to enhance the learning experience. Tucker(1986) quotes a Chinese proverb which says:

"A thousand hearings are not as good as one seeing!"(Tucker 1986:24).

The ancient Chinese believed that what is heard is easily forgotten but what is seen can be easily remembered. When instructional media are combined with other methods of teaching they translate the learning experience into new forms making it interesting and memorable . Joyce (1992) agrees with this view when she says that careful design of learning conditions can increase its probability and make the entire process more sure ,predictable and efficient.

Krashen in his theory of second language learning says the role of the classroom teacher should be to create a situation that encourages a low filter which includes motivation, self-confidence and low level of anxiety.This can be done by use of different types of media (Krashen, 1985).According to Christenson(1989) ,students learn more when the school and class environment is supportive .He argues that if teachers use instructional resources and techniques , students' achievement and interest can be increased . It motivates them to actively participate in lesson proceedings and yearn to learn more . Romiszowski (1988) holds the view that instructional media can help the learners to remember what they have learnt and also perform other functions . For example media like drawings , pictures and maps can be used to represent real objects .Later , this learners can explain the concept , draw or read since they can visualize what they are being asked about .

Edge (1996) says:

"Using instructional media relating to the lives of students is not only good for the learning process, it also brings variety and freshness for the teacher " Edge, (1996:48) He adds that students can use their background , personal knowledge and creativity to produce learning materials. Doing this keeps them interested in learning process.

Oral literature refers to the collection of creative works of mankind expressed in the oral medium (Miruka 2003). It is also the study of creative works of merit with a view to understanding the cultural and philosophical foundation of people, appreciate history that is handed down through oral traditions and as a way of appreciating and creating more African arts.

Oral literature is also taught in secondary schools and is a component of English, a subject which is taught and examined in KCSE and is compulsory for all students in Kenya ,(KIE 2002).It is therefore imperative that teachers create a positive and supportive environment in class by using different types of instructional media in order to realize the benefits of oral literature.Farrant(1992)says,

“I see and understand “ in support of the use of instructional media in the teaching and learning process . Dahma and Bhatnagar (1992) in their research on the importance of the five senses in learning process found out that ability to learn and recall information is much higher in seeing .Therefore if teaching canbe accompanied with visual objects then much can be remembered. When using instructional media all senses can be involved which would keep the students alert and active.

This study was therefore set to find out:

- i).Which instructional media teachers use when teaching oral literature.
- ii).Students’ response when instructional media is used during lessons.

II. RESEARCH DESIGN AND METHODOLOGY

The study was a survey where information about use of instructional media in teaching oral literature was collected by use of questionnaire, observation and interview schedule. Target population comprised of forty-two (42) secondary schools in Bungoma South Sub-County, Kenya. The study sample comprised of two hundred and forty-two (242) respondents who were selected through purposive, stratified and simple random sampling techniques.The research used self-developed questionnaire with closed questions, classroom observation and interview schedule for teachers with open ended questions. Research instruments covered issues related to availability of instructional media, its use in the classroom and how students

responded when media was used in their lessons. Validity of the instruments was ascertained by specialists from the Department of Curriculum Instruction and Educational Media, Moi University, Kenya and a pilot study which was done in two schools in the neighboring Bumula Sub-County. Data was collected from the sampled schools by the researcher .Several visits were made to the schools for familiarization with the authorities, teachers and students who were selected to take part in the study .Questionnaire was then administered ,lesson observations done and interview held with teachers who had filled the questionnaire. Data collected was then coded and analysed basing on frequency counts then converted to percentages.

III. RESULTS AND DISCUSSION

The main objective of this study was to find out teachers use of instructional media in teaching oral literature. From the study it was evident that there were different types of media in schools examples being writing boards, books, dioramas, models , films , charts , maps , pictures ,television , radio, laptops , computers and newspapers. The teachers admitted that sometimes they invited resource persons or organized field trips to museums and historic sites for purposes of learning.

When asked about instructional media they used when teaching oral literature, teachers gave responses as shown in table 4.1

Table 4.1 Instructional media used to teach oral literature.

Media	YES		NO	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Radio	4	57.1	3	42.9
Television	2	28.6	5	71.4
Pictures	3	42.9	4	57.1
Maps	3	42.9	4	57.1
Charts	2	82.6	5	71.4
Resource people/place	6	85.7	1	14.3
Films/slides	1	14.3	6	85.7
Models	3	42.9	4	57.1
Newspapers	3	42.9	4	57.1
Books	7	100.0	0	0.0
Dioramas	1	14.3	6	85.7
Writing boards	7	100.0	0	0.0
Field trips	7	100.0	0	0.0
Dramatization	3	42.9	4	57.1

From the table it can be concluded that media are available in schools. Most teachers use media to teach oral literature .However from the observation schedule the researcher found out that most teachers did not incooperate media in their lessons as they had indicated in the

questionnaire. All sampled teachers used textbooks and writing board most of the time. A few used drawings, newspapers, field trips and dramatization.

The researcher also used classroom observation to find out students' participation during lessons that incorporated media. The responses are shown in table 4.2

Table 4.2 students' participation during lessons

Students' Participation	Very active (%)	Active (%)	Not active (%)	Total (%)
Asking questions in class	0.0	20	80	100
Answering questions in class	25.5	58.2	16.3	100
Students using relevant media	0.0	14.6	85.4	100

The statistics in table 4.2 reveal that without use of a variety of instructional media in teaching oral literature, 80% of the students were not actively involved in asking questions in class. Only 20% of the students actively asked questions. On answering questions 25.5% were very active to answer questions while 58.2% were active to answer questions during the lesson while 16.3% were not active to answer questions. This meant that without instructional media the students were just passive in class. Commeryas and Inyega (2007) say that the enabling environment to practice lacks in most of oral literature classes.

It was further revealed that a large number of students, 85.4% were unable to make use of relevant media. They did not look at any charts pictures or draw diagrams. Their attention was on their teacher and what he/she wrote on the writing board. It can therefore be concluded that participation of students during lessons that lack instructional media is low. Curren and Rossel (2006) observed rightly that students in classes where participation was encouraged were more likely to prepare for lessons, attend classes and excel in performance. Since this was not the case in lessons that were observed in this study, perhaps this could explain the low participation of students in this case.

On students response when instructional media is used during oral literature lessons the findings show that such lessons were enjoyable. From the students' questionnaire, it was concluded that some teachers used varied instructional media during oral literature lessons while others only used text books and the chalkboard. This left the students passive throughout the lessons. All the sampled students agreed that they enjoyed lessons that incorporated instructional media. They felt motivated, their interest was sustained and they were able to recall the concepts taught. The teachers' questionnaire also revealed that students enjoyed lessons taught using media. They remained alert, and actively participated asking and answering questions during such lessons.

Results from the classroom observation schedule on students' participation during lessons that did not incorporate media showed low participation. They did not ask or answer questions since all their attention was on the teacher who explained facts at length and occasionally wrote on the chalkboard.

IV. SUMMARY

There is a wide variety of instructional media that can be used to teach oral literature in schools. Despite this, only the chalkboard and textbooks were mostly used by the teacher's. In some schools in the rural areas newspapers were not easily available so the

teachers did not use them. In the same vein, some schools did not have electricity so none of the media that required electricity like television, radio, and computer were used to teach.

Most teachers understood and agreed that media was very important during lessons delivery but only used media sometimes. From the observation schedule it was also evident that media was not used in most lessons. This could be as a result of the broad English syllabus in secondary schools, a heavy workload for teachers or unwillingness on the part of the teacher to prepare or use media, a process which perhaps they view as time consuming. Some school administrators only bought textbooks and did not avail other types of media because of scarcity of funds. The exam oriented system of education also made the teachers to concentrate on how to make students pass exams and not refine their methods of teaching which can include use of media to motivate students.

The interview schedule also revealed that training which some teachers received on using instructional media was not adequate. It was more theoretical so they found it hard to practically use media to teach. In fact they mostly used lecture method, books and chalkboard which were the norm during their training days. On the part of students lessons that incorporated media were very enjoyable memorable and made the facts real. They mostly looked forward to such lessons.

V. CONCLUSION

Instructional media should be used as an integral part of teaching and learning in order to achieve the highest level of understanding within the context of subject matter and relationships. According to Patel and Mukwa (1993) integrating media in teaching and learning motivates learners and facilitates their understanding of various disciplines and topics. Since there are varied types of media in schools, teachers should be encouraged to use them during instruction. This will help break monotony of teacher explanations and involve the student actively

Since students enjoy and actively participate during lessons that incorporate media, teachers should strive to vary media use. Students should be given a chance to see, touch, manipulate and internalize concepts in various subjects by use of media. This will enhance their mastery of content, knowledge and interest in different aspects of learning. For the teachers frequent in-service courses, workshops and seminars should be mounted to encourage them to use different types of media during their lessons.

REFERENCES

- [1] Brown, K. (1986); *Taking advantage of media*. Boston: Ruoteledge and Kogan page PLC
- [2] Christenson, S.L Ysseldyke, J.E and Thurlow, M.L (1989).Critical instructional factors for students with mild handicaps. In: Remedial and special Education Vol.10 (5):21-31
- [3] Commeryas, M. and Inyega, H.N. (2007) *International Reading Association Online. An Integrative Review of Teaching and Reading in Kenya Primary Schools*. As retrieved on 28thOctober, 2008. From : <http://www.reading.org/library/retrieve>
- [4] Curran, M.J and Rosen, D.E. (2006) Students Attitudes towards College Courses. An Examination of Influences and Intentions. Journal of Marketing Education, 28 (2), 135-148.
- [5] [http:// www.honolulu.hawaii.edu/internet/committees/facDevcon/guidebk](http://www.honolulu.hawaii.edu/internet/committees/facDevcon/guidebk)
- [6] Edge, J. (1996).Essentials of English Language Teaching New York: Longman.
- [7] Dahmar , D.P and Bhatnagar , D.(1992). Education communication for Development.2nd Ed. New Delhi; Mohana Primlani Publishers Ltd
- [8] Farrant, J (1992): *Principles and Practices of Education*. Singapore: Longman Publishers PTE Ltd
- [9] Joyce, B. (1992).*Models of Teaching*. 4th edition New Delhi: Private Ltd
- [10] Krashen, S.D. (1985). *The Input Hypothesis issues and implications* New York: Longman Group Limited
- [11] Miruka,O. (2003).*Oral Literature for schools*. Nairobi: East African Educational Publishers.
- [12] Patel, M. and Mukwa, C. (1993). *Design and Use of Media in Education*. Nairobi: Lectern Publishers.
- [13] Romiszowski ,A.J. (1988). *The selection and use of instructional media*.2nd edition. New York: Kogan page publishers
- [14] Tucker, N.R (1986). The integration of media into the curriculum. London : Kogan page Ltd.
- [15] Wasiche, J. (2006). Teaching Techniques that enhance students' performance in Mathematics in selected public schools in Butere-Mumias District .:M.ED Thesis. Nairobi: Kenyatta University (Unpublished)

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Water Pollution: Causes, Consequences, Prevention Method and Role of WBPHEd with Special Reference from Murshidabad District

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Abstract- Water is life for all but this water is polluting day by day in severe condition. So it can be said that our life (water) is not safe now. We are in crisis period. Water pollution is a major serious problem for all over the world. It affects drinking water, rivers, lakes and oceans all over the world. It consequently harms the health and wellbeing of human life and the natural environment. The present study is tried to discuss basically what water pollution is and focused on different causes of water pollution, effects of this pollution on Earth, special reference from Murshidabad district and finding possible solutions and preventive methods of this problem, role of WBPHEd for quality treatment of water and supply. This study is based on secondary sources of data from different government reports, research articles, journals and books, internet sources and from the report of West Bengal state pollution control board (WSPCB). We can see the real picture when we see the map of Murshidabad district showing the Arsenic affected Blocks, location map of water testing laboratories (Arsenic, Fluoride, Iron, phvalue), Map of district central PWS scheme and ongoing PWS scheme. Researches proved that water pollution affects not only morbidity and mortality of human life but also the whole ecosystem. In the study area water pollution is mainly caused due to overpopulation, agricultural practices, soil erosion, industrialization and urbanization.

Index Terms- Wellbeing, Natural environment, WBPHEd, WSPCB, PWS scheme.

I. INTRODUCTION

Water is an important natural resource of all over the world. We live without food for few days but not without water. It is need for the survival of all organisms including human, food production and economic development. Two thirds of the earth surface is covered by water. Approximately 98% of the water is sea water and is unusable for drinking because the high concentration of salt. About 2% of planet water is fresh, but 1.6% is locked up in polar icecaps and glaciers. Another 0.36% is found underground in aquifers and wells. Therefore only about 0.036% of the planets water supply is accessible in lakes and rivers.

The environment, economic growth and development are all highly influenced by water its regional and seasonal availability and the quality of surface and ground water. The quality of water is affected by human activities and is declining

due to rise of population growth, urbanization, agricultural development and other factors.

Polluted water not only affects the life of present generation but it also affect the life of upcoming generations because its effect remains for long. If water is polluted in a area, then the all living creatures and people are faced to drink polluted water because they have no other option. It affects their bodies, skin, lungs, brain, liver and kidneys, caused cancers, birth defects and other diseases.

II. WATER POLLUTION

Water pollution may be defined as alteration in the physical, chemical and biological characteristics of water which may cause harmful effects on human and aquatic life.(Report,1965,restoring the quality of our Environment, president science committee, Washington USA)

Olaniran (1995) defined water pollution to be presence of excessive amounts of a hazard (pollutants) in water in such a way that it is no long suitable for drinking, bathing, cooking and other uses.

Water pollution is now a day's considered not only in terms of public health but also in term of conservation, aesthetics and preservation of natural beauty and resources.

III. HISTORICAL BACKGROUND

We know pollution is a human problem because it is a relatively recent development in the history; before the 19th century industrial revolution people lived in harmony with their immediate environment. As industrialization and population spread around the globe, so the problem of pollution is much smaller, no one believed pollution would ever present a serious problem. Today with around 7 billion people on the planet, it has became apparent that these are limits. Pollution is one of the signs that humans have exceeded those limits.

IV. SIGNIFICANCE OF THE STUDY

Everyone knows that to survive you need water. What everyone does not know is that what is being put into the water that we drink, we used for everyday activities has made it unsafe for everything that needs it to survive ,plants, animals and even human. Some states water is very unsafe to drink and has made a lot of people sick. as a example some district of west Bengal

,water is very unsafe to drink and caused water borne diseases like -----Blackfoot, Flurosis, Cholera, Jaundice, Diarrhea, Tuberculosis etc. Now the big question is Why are we polluted this natural resource which is very important to all living organisms and every section of our life. In this paper I plan to inform that some suggestive solution is help to prevent from this continuing issues and playing role of public health department, Govt of west Bengal for safe drinking water supply and treatment.

V. AIMS AND OBJECTIVES

1. To explain and represent water pollution condition and causes of the study area.
2. To discuss how it effects on human being as well as all the living organisms and natural environment.
3. Point out method and prospects of this major problem applied in the study Area.
4. Draw playing role of agencies like WBPHEd for safe drinking water supply and treatment and secure drinking water for future.

VI. HYPOTHESIS FORMULATION

The work has been done with these hypotheses. These are—

- ❖ What is water pollution and main causes of that kind of pollution
- ❖ Water Pollution related consequences and prevention method
- ❖ Role of WBPHEd as a supplier of safe drinking water in Rural and Urban areas

VII. REVIEW OF LITERATURE

Place and warfare (1993) argued that the most important and immediate consequence of environmental degradation in the developing world take the form of damage to human health.

According to Chapman (1996) pollution of the aquatic environment refers to the introduction by man directly and

indirectly and it effects as harm to living resources, hazards to human health, hindrance to aquatic activities including fishing, impairment of water quality with respect to its use in agricultural, industrial and often economic activities and reduction of amenities.

Haque et al (1998) in the study “surface water pollution concern in public health perspectives of Bangladesh.” Discuss the sources and impact of water pollution in Bangladesh.

According to Wolf (1999), when significant improvements in the quality and quantity of water are made in less developed countries, the world be about 2 million fewer deaths from Diarrhea among children.

Down to Earth magazine reveals that pollution level are rising in the river Lidder ,Pahelgam, the base camp of pilgrims going to Amarnath cave in Jammu and Kashmir .Pilgrims are the major polluters of the river and they were generating tones of waste everyday and also sewage everyday and open drains are responsible for water pollution in Lidder river.

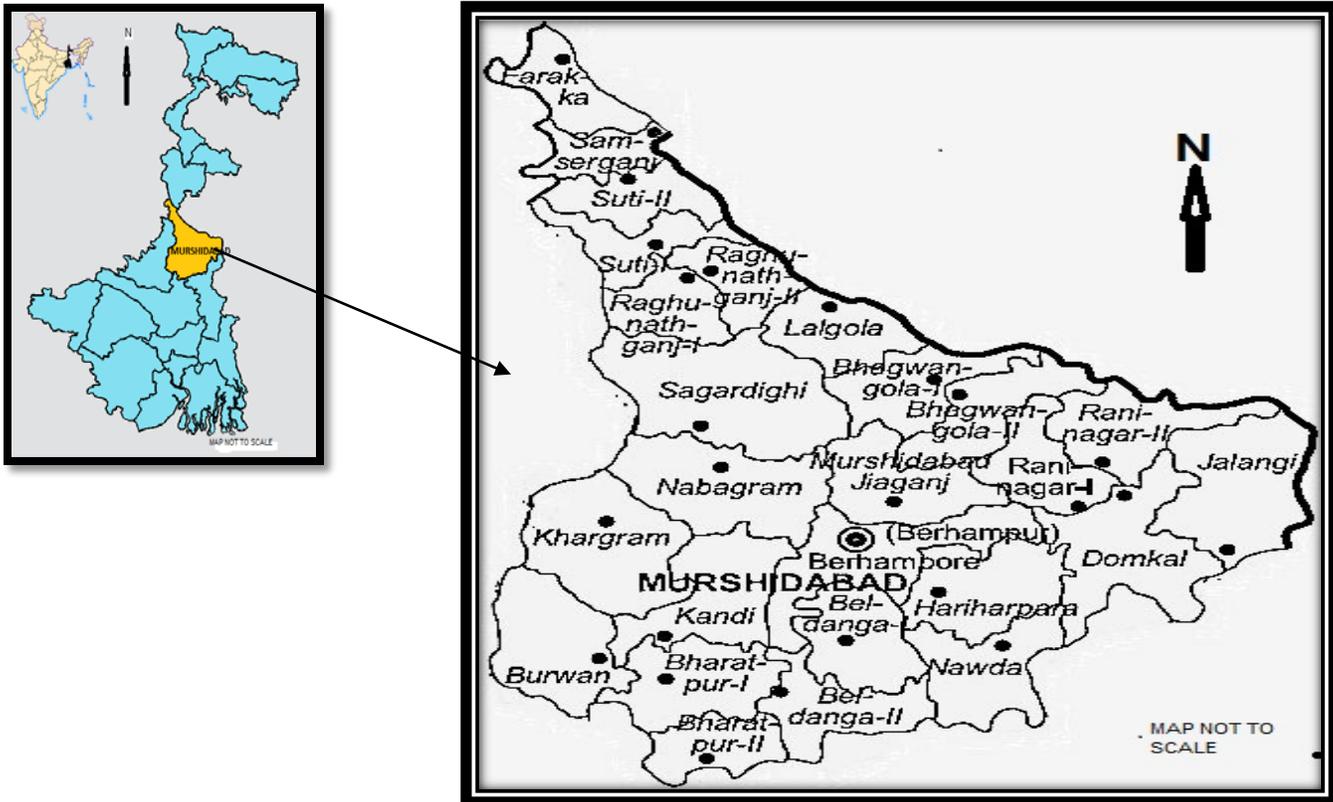
Totalada (2001),in the study “the Chapala lake in Mexico “ reveals the major sources of water pollution in Mexico, major pollutants of the lake are municipal ,industrial and agricultural runoff.

VIII. STUDY AREA

Murshidabad district is northern most district of the presidency division of west Bengal. It lies centrally in the lower Ganga valley.The geographical extension of the district is 24⁰50`20”-23⁰43`30”N and 88⁰46`00”- 87⁰49`17” E. With the area of 5324 sq.km. The district is separated from Malda by the river Ganga on its north. The pear shaped district looked like an triangle with Farakka block in the north west framing apex. On the west by the district of Birbhum, on the south by Burdwan and Nadia and on the East by Bangladesh.

Water pollution is one of the major problems of Murshidabad. Murshidabad district has worst affected by Arsenic. Most of the Block of Murshidabad district had high amount of Arsenic (Suti-1, suti-2, Domkal, Raghunathganj and Harihrpara). Only name of the block Bharatpur- II is safe from Arsenic

LOCATION MAP OF THE STUDY AREA: MURSHIDABAD



IX. DATABASE AND METHODOLOGY

The research work is descriptive and analytical in nature. This study is based on mainly secondary sources of data. Secondary data are collected from different government reports, research articles, journals and books, internet sources and from the report of WSPCB (West Bengal state pollution control board). Using map of Murshidabad districts arsenic affected blocks, showing location map of water testing laboratories and map of central water supply scheme and ongoing PWS scheme in Murshidabad district managed by PHED.

X. CAUSES OF WATER POLLUTION

Pollution of water are the results of various causes. There are three major sources of pollutants of water-Home, Agriculture, Industry. In the study area water pollution caused mainly from home and agriculture rather than industry.

- *high population density (According to 2011 census the district has a population density of 1334 inhabitants per square kilometer)
- *Pollution of ground water through drilling activities
- *Industrial waste dumped into water (industrial waste is extremely harmful to both people and environment)
- *Sewage leakages
- *Flooding during rainy season which carries waste deposits into water (It happen mainly river Ganga in the study area)
- *Heavy metal
- *Toxic waste disposal at river

- *Soil digging inside river area (that is the major point of the study area for water pollution)
- *Eroded sediments
- *Deforestation
- *Littering
- *Pesticides
- *Herbicides and fertilizer
- *Using HYV seed
- *Eutrophication (Eutrophication is an increased level of nutrients in water bodies. This results in bloom of Algae in Water. It also depletes the oxygen in water, which negatively affects fish and other aquatic animal population)
- *Failing septic system
- *Household chemicals (Dishwashing waste, laundry waste)
- *Animal waste
- *Heat(Industrial areas hot water mixed into cold water and polluted...example, saw it at Farakka thermal power project areas hot water mixed into Fider canal water)

XI. EFFECTS OF WATER POLLUTION

Water pollution adversely affects the health and life of man, animals and plants. Polluted water is also harmful for agriculture as it adversely affects the crops and the soil fertility

- ** Health aspects of water quality (Spread of disease: Cholera, Typhoid, Diarrhea, Jaundice and Tuberculosis)
- **Affect body organs: injury to the heart and kidneys

** Effects of nutrients on water quality (Harms the food chain: polluted water can harm aquatic organisms thus breaking a link of food chain)

** Effect of organic pollution on water quality-(Causes Algae in water: algae grow according to how much waste in a water source .Bacteria feed off the algae, decreasing the amount of oxygen in water and this incident harm organisms)

**Flooding

**Harms animal

**Harms all leaving organisms

**Effect of High Dissolved Solids (TDS) in water quality (hamper aquatic ecosystem)

** Thermal discharges on water quality (physiologically stress for organisms)

XII. STEPS TO PREVENT WATER POLLUTION

Water pollution has a huge impact in our lives. With knowledge consideration and preparation, water pollution can be decreased. It does not take much effort-just a little thought.

- Use fewer chemicals to clean your home(EPA-provides a list of cleaning products)
- Dispose of waste properly
- Don't flush medication
- Don't flush trash
- Conserve as much water as possible
- Avoid using plastic
- Recycling and Reuse of water
- Don't use pesticides and herbicides
- Removed concrete surfaces and replace them with ground cover
- Prevent soil erosion from occurring
- Clean up waterways
- Inspects your septic system every 3-5 years
- Don't wash paint brushes in the sink
- Get involved at school and work
- Help clean up litter in water filled areas
- Speak up about water issues that affect your community
- Making **Swachh Bharat Abhiyan** a success
- Finally **Enforcing Laws** to prevent water pollution

XIII. THE WATER CONTROL OF POLLUTION ACT

The water (prevention and control of pollution) Act was enacted in 1974 to provide for the prevention and control of

Water pollution, and for the maintaining or restoring of Wholesomeness of water in the country. The act was amended in 1988. In India CPCB (central pollution control board) play an important role for prevention of water and control of pollution).

XIV. ROLE OF WBPHEd

Public Health Engineering Department Government of West Bengal, their vision to provide safe, sustainable and adequate water supply to all human and livestock in west Bengal in between 2020.PHEd first established and began their work in 1987.Their objectives are-

- (i) To ensure safe and permanent drinking water security
- (ii) To supply water door to door (rural area also) through PWS-pipeline water supply scheme
- (iii) Also aware people about conjunctive use of ground water, surface water and rain water harvesting
- (iv) Check standarity of water at both the supply and consumption points.

XV. WORKPLAN OF WBPHEd

1. Resource creation: i. using subsurface flow of a river, ii. Using ground water, iii. Flood water diversion and storage, iv. Rejuvenation of ponds and development of watershed, v. Developing cheaper solution for treatment of water, rooftop rain water harvesting.

2. .Action plan to use renewable energy for running water supply scheme

3...Action on management of waste water treatment plant

4. Water quality monitoring and surveillance programme

5...Peoples participation: (work 2 organization, SWSSO-state water and sanitation support organization, SWSM-state water and sanitation mission).

XVI. WBPHEd: WATER TESTING LABRATORY

Water quality is very poor in some blocks of Murshidabad. Most of the water polluted by Arsenic. Some water testing laboratories are situated in Murshidabad district managed by PHED and their treatment parameters are Arsenic, Iron and Fluoride.

WATER TESTING LABRATORIES LOCATION

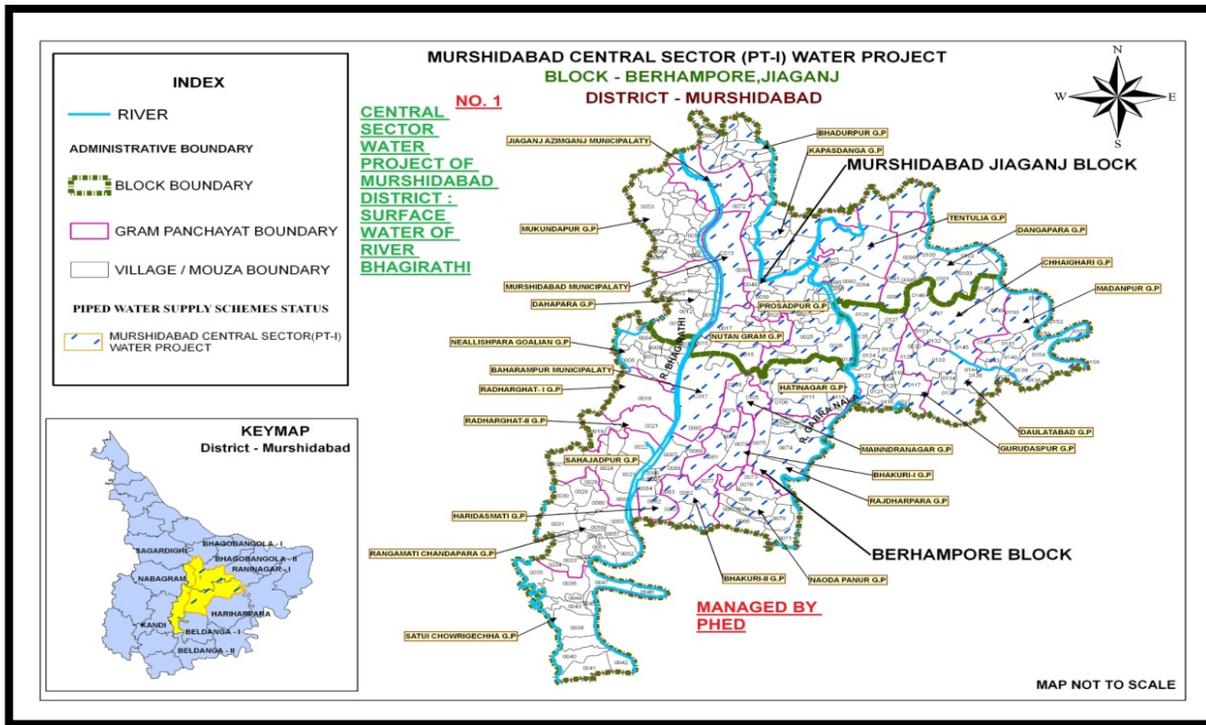


MAP: 1
 SOURCE: WBPHEd

XVII. NAME SOME LABRATORIES

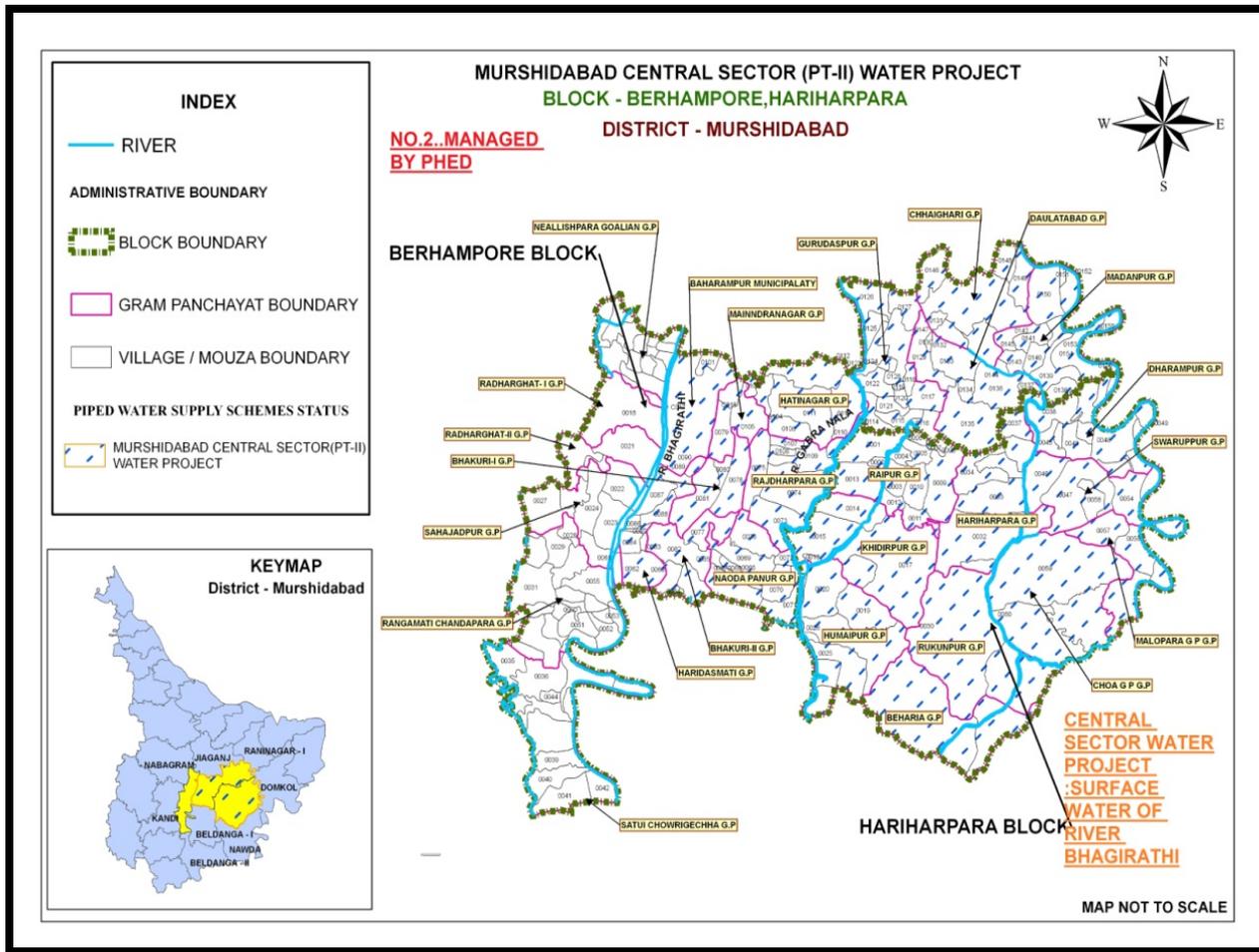
- (1) Baharampur municipal division (2) Jagatai W/S scheme (3) Hariharpara W/S scheme (4) Islampur sub division office (5) Jalangi W/S scheme (6) Jangipur WTP Site (7) Joykrishnapur W/ S scheme (8) Lalbagh sub division office (9) Mahyampur WTP site (10) Murshidabad district lab (11) Rejinagar W/S scheme (12) Sagardighi W/S scheme (13) Salar W/S scheme.

CENTRAL SECTOR WATER PROJECT 1 - MURSHIDABAD



MAP-2
SOURCE: WBPHEd

CENTRAL SECTOR WATER PROJECT 2- MURSHIDABAD



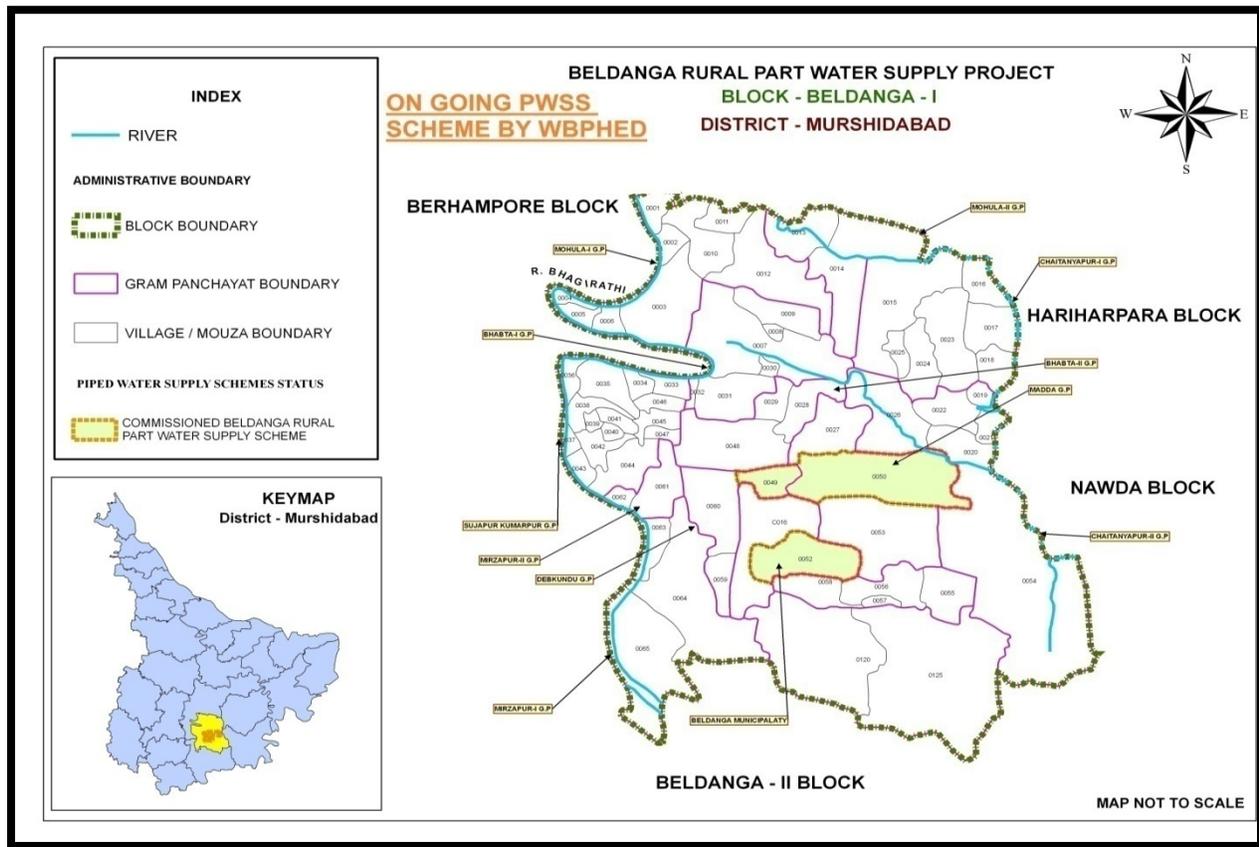
MAP-3
SOURCE: WBPHEd

Murshidabad central sector water project are two numbers, managed by PHED. One is –sector pt 1, developed with Murshidabad, Jiaganj and Berhampur by surface water of river Bhagirathi, covered 135 villages and benefited people 379692. Another one is –sector pt 2, developed with Hariharpara and Berhampore by surface water of river Bhagirathi, covered 105 villages and benefited people 659684.

XVIII. ONGOING PWSS SCHEME BY PHED

Ongoing PWS (pipeline water supply scheme) scheme is developed in Beldanga by surface water of river Bhagirathi, covered 58 villages, and benefited people 754451.

BELDANGA PWS SCHEME



MAP: 4
SOURCE: WBPHEd

XIX. CONCLUSION

From the above discussion we have concluded that due to increase in population and agricultural practice and also industrialization, water quality of drinking water is decrease and there a need to proper treatment of water and some prevention method to reduce water pollution and manage to supply safe drinking water. And there is a big hope in Murshidabad districts to supply safe drinking water, door to door in rural areas by PWS/WS scheme which managed by WBPHEd. At the same time government introduce Environmental Education in school syllabus, which raise awareness and government of west Bengal made the subject compulsory in school and college level. Finally we can say "SAFE WATER, SAVE LIFE."

REFERENCES

[1] OWA, F.D,"Water pollution: sources, effects, control and management" MCSER, volume 4,no 8; Sept-2013 ISSN 2039-2117

[2] Patil,R.B(2009),Environment in Indian society, problems and prospects ,A Mittal publication, New Delhi(India).
 [3] APEC, (2015), the importance of water and your health .Free drinking water.
 [4] Http://project smile india.wordpress.com/2010/07/01/effect of water pollution solutions.
 [5] Dr .Mukesh Garg (2012)"Water pollution in India: causes and remedies", Vol-2, No-6, June, ISSN 2249-5894.
 [6] Ahmed, M and Rahaman, M (2000),"water supply and sanitation".
 [7] Drinking water and sanitation status, Water Air
 [8] Public Health Engineering Department, Government of West Bengal, vision -2020.
 [9] Singh, Savindra (2011),"Environmental Geography", page no.485
 [10] Joshua Nizel Halder and M Nazmul Islam(2015),"Water pollution and its impact on human health" ,Volume -2 ,No-1,ISSN 2373-8324.

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A linear operator of a new class of multivalent harmonic functions

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Abstract- New classes of multivalently functions with a linear operator are introduced . We give sufficient coefficient bounds for $f(z) \in KM_p(K, \beta, q)$ and then we show that these sufficient coefficient conditions are also necessary for $f(z) \in AM_p(K, \beta, q)$. Furthermore, we determine extreme points, convex combination, convolution property and integral operator for these functions. Also we obtain new results in this paper.

Index Terms- Multivalent harmonic functions, Coefficient bounds, Extreme points, Convex combination, Integral operator.

AMS subject classification: 30C45.

I. INTRODUCTION

A continuous function $f = u + iv$ is a complex valued harmonic function in a complex domain \mathbb{C} if both u and v are real harmonic in \mathbb{C} . In any simply connected domain $D \subset \mathbb{C}$, we can write $f = h + \bar{g}$, where h and g are analytic in D . We call h the analytic part and g the co-analytic part of f . A necessary and sufficient condition for f to be locally univalent and sense-preserving in D is that $|h'(z)| > |g'(z)|$ in D , see Clunie and Sheil-Smith [5].

Denote by $M(p)$ the class of functions $f = h + \bar{g}$ that are harmonic multivalent and sense-preserving in the unit disk $U = \{z \in \mathbb{C} : |z| < 1\}$. The class $M(p)$ was studied by Ahuja and Jahangiri [1] and class $M(p)$ for $p = 1$ was defined and studied by Jahangiri et. al. in [6].

For $f = h + \bar{g} \in M(p)$, we may express the analytic functions h and g as:

$$h(z) = z^p + \sum_{n=p+1}^{\infty} a_n z^n, \quad g(z) = \sum_{n=p}^{\infty} b_n z^n, \quad |b_p| < 1. \quad (1)$$

Let W_p denote the subclass of $M(p)$ consisting of functions $f = h + \bar{g}$, where h and g are given by:

$$h(z) = z^p - \sum_{n=p+1}^{\infty} |a_n| z^n, \quad g(z) = - \sum_{n=p}^{\infty} |b_n| z^n, \quad |b_p| < 1. \quad (2)$$

Now, we define anew class $KM_p(K, \beta, q)$ of harmonic functions of the form (1) that satisfy the inequality

$$\operatorname{Re} \left\{ \frac{K \left[\left(D_p(\lambda, \beta, \gamma) f(z) \right)^q + z^2 \left(D_p(\lambda, \beta, \gamma) f(z) \right)^{q+2} \right]}{z \left(D_p(\lambda, \beta, \gamma) f(z) \right)^{q+1}} \right\} > \beta, \quad (3)$$

where $0 \leq \beta < \frac{1}{p}$, $p > q$, $p \in \mathbb{N} = \{1, 2, \dots\}$, $q \in \mathbb{N}_0 = \mathbb{N} \cup \{0\}$, $0 \leq K \leq 1$, $\lambda \geq 0$, $\gamma \geq 0$,

$$f^q(z) = \delta(p, q) z^{p-q} + \sum_{n=1}^{\infty} \delta(n, q) a_n z^{n-q},$$

$$\delta(i, j) = \frac{i!}{(i-j)!} = \begin{cases} 1 & j = 0 \\ i(i-1) \dots (i-j+1) & j \neq 0 \end{cases}$$

and

$$\left(D_p(\lambda, \beta, \gamma) f(z) \right) = \left(D_p(\lambda, \beta, \gamma) h(z) \right) + \overline{\left(D_p(\lambda, \beta, \gamma) g(z) \right)}. \quad (4)$$

The operator $D_p(\lambda, \beta, \gamma)$ denotes the linear operator introduced in [8]. For h and g given by (1), we obtain

$$D_p(\lambda, \beta, \gamma) h(z) = z^p + \sum_{n=p+1}^{\infty} \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta a_n z^n, \quad (5)$$

$$D_p(\lambda, \beta, \gamma) g(z) = \sum_{n=p}^{\infty} \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta b_n z^n, \quad (6)$$

where $p \in \mathbb{N} = \{1, 2, \dots\}, \lambda \geq 0, \gamma \geq 0, \eta \geq 0$.

We further denote by $AM_p(K, \beta, \gamma)$ the subclass of $KM_p(K, \beta, \gamma)$ that satisfies the relation

$$AM_p(K, \beta, \gamma) = AM_p \cap KM_p(K, \beta, \gamma). \tag{7}$$

II. COEFFICIENT INEQUALITY

We need the following lemma in our results:

Lemma 1[2]: $\operatorname{Re}\{w(z)\} > \beta$ if and only if $|w(z) - (1 + \beta)| \leq |w(z) + (1 - \beta)|$.

In the following theorem, we find a coefficient inequality for functions in the class $KM_p(K, \beta, \gamma)$.

Theorem 1: Let $f = h + \bar{g}$ (h and g being given by (1)). If

$$\sum_{n=p+1}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma}\right]^{\eta} |a_n| + \sum_{n=p}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma}\right]^{\eta} |b_n| \leq \delta(p, q), \tag{8}$$

where $0 \leq \beta < \frac{1}{p}, p > q, p \in \mathbb{N} = \{1, 2, \dots\}, q \in \mathbb{N}_0 = \mathbb{N} \cup \{0\}, 0 \leq K \leq 1, \eta \geq 0, \lambda \geq 0, \gamma \geq 0$, then f is harmonic p -valent sense-preserving in U and $f \in KM_p(K, \beta, \gamma)$.

Proof : Let

$$w(z) = \left\{ \frac{K \left[(D_p(\lambda, \beta, \gamma)f(z))^q + z^2 (D_p(\lambda, \beta, \gamma)f(z))^{q+2} \right]}{z (D_p(\lambda, \beta, \gamma)f(z))^{q+1}} \right\}. \tag{9}$$

Using the fact in Lemma $\operatorname{Re}\{w(z)\} > \beta$ if and only if $|w(z) - (1 + \beta)| \leq |w(z) + (1 - \beta)|$.

Substituting for w and resorting to simple calculations, we find that

$$\begin{aligned} |w(z) - (1 + \beta)| &\leq \delta(p, q)[(p - q)((p - q - 1)K - (1 + \beta)) + K]|z|^{p-q} \\ &+ \sum_{n=p+1}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K - (1 + \beta)) + K]|a_n||z|^{n-q} \\ &+ \sum_{n=p}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K - (1 + \beta)) + K]|b_n||z|^{n-q}, \end{aligned} \tag{10}$$

and

$$\begin{aligned} |w(z) + (1 - \beta)| &\geq \delta(p, q)[(p - q)((p - q - 1)K + (1 - \beta)) + K]|z|^{p-q} \\ &- \sum_{n=p+1}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K + (1 - \beta)) + K]|a_n||z|^{n-q} \\ &- \sum_{n=p}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K + (1 - \beta)) + K]|b_n||z|^{n-q}. \end{aligned} \tag{11}$$

Evidently (10) and (11) in conjunction with (8) yields

$$|w(z) - (1 + \beta)| - |w(z) + (1 - \beta)| \leq 0.$$

The harmonic functions

$$f(z) = z^p + \sum_{n=p+1}^{\infty} \frac{x_n}{\delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma}\right]^{\eta}} z^n + \sum_{n=p}^{\infty} \frac{\bar{y}_n}{\delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma}\right]^{\eta}} \bar{z}^n, \tag{12}$$

where

$$\left(\sum_{n=p+1}^{\infty} |x_n| + \sum_{n=p}^{\infty} |y_n| = \delta(p, q) \right),$$

show that the coefficients bounds given by (8) is sharp.

The functions of the form (12) are in $KM_p(K, \beta, \gamma)$ because in view of (12) infer that

$$\begin{aligned} & \sum_{n=p+1}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma} \right]^{\eta} |a_n| \\ & + \sum_{n=p}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma} \right]^{\eta} |b_n| \\ & = \sum_{n=p+1}^{\infty} |x_n| + \sum_{n=p}^{\infty} |y_n| = \delta(p, q). \end{aligned}$$

The restriction placed in Theorem (1) on the moduli of coefficients of $f = h + \bar{g}$ implies for arbitrary rotation of the coefficients of f , the resulting functions would still be harmonic multivalent and $f \in KM_p(K, \beta, \gamma)$.

The following theorem shows that the condition (8) is also necessary for function f to belong to $AM_p(K, \beta, \gamma)$.

Theorem 2: Let $f = h + \bar{g}$ with h and g are given by (2). Then $f \in AM_p(K, \beta, \gamma)$ if and only if

$$\begin{aligned} & \sum_{n=p+1}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma} \right]^{\eta} |a_n| \\ & + \sum_{n=p}^{\infty} \delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma} \right]^{\eta} |b_n| \leq \delta(p, q), \end{aligned} \quad (13)$$

where $0 \leq \beta < \frac{1}{p}, p > q, p \in \mathbb{N} = \{1, 2, \dots\}, q \in \mathbb{N}_0 = \mathbb{N} \cup \{0\}, 0 \leq K \leq 1, \eta \geq 0, \lambda \geq 0, \gamma \geq 0$.

Proof: By noting that $AM_p(K, \beta, \gamma) \subset KM_p(K, \beta, \gamma)$, the sufficiency part of Theorem (2) follows at once from Theorem (1). To prove the necessary part, let us assume that $f \in AM_p(K, \beta, \gamma)$. Using (3), we get

$$\begin{aligned} & \operatorname{Re} \left\{ \frac{K \left[\left(D_p(\lambda, \beta, \gamma)h(z) \right)^q + \left(\overline{D_p(\lambda, \beta, \gamma)g(z)} \right)^q + z^2 \left[\left(D_p(\lambda, \beta, \gamma)h(z) \right)^{q+2} + \left(\overline{D_p(\lambda, \beta, \gamma)g(z)} \right)^{q+2} \right] \right]}{z \left[\left(D_p(\lambda, \beta, \gamma)h(z) \right)^{q+1} + \left(\overline{D_p(\lambda, \beta, \gamma)g(z)} \right)^{q+1} \right]} \right\} \\ & = \operatorname{Re} \left\{ \frac{Kt - \sum_{n=p+1}^{\infty} Kc \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^{\eta} |a_n| z^{n-q} - \sum_{n=p}^{\infty} Kc \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^{\eta} |b_n| \bar{z}^{n-q}}{\delta(p, q + 1) - \sum_{n=p+1}^{\infty} \delta(n, q + 1) \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^{\eta} |a_n| z^{n-q} - \sum_{n=p}^{\infty} \delta(n, q + 1) \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^{\eta} |b_n| \bar{z}^{n-q}} \right\} \\ & > \alpha, \end{aligned}$$

where

$t = \delta(p, q)[1 + (p - q)(p - q - 1)]$ and $c = \delta(n, q)[1 + (n - q)(n - q - 1)]$.

If we choose z to be real and let $z \rightarrow 1^-$, we obtain the condition (13).

III. EXTREME POINTS

Next, we determine the extreme points of the closed convex hull of $AM_p(K, \beta, \gamma)$, denoted by $\overline{AM_p(K, \beta, \gamma)}$.

Theorem 3: $f \in \overline{AM_p(K, \beta, \gamma)}$ if and only if

$$f(z) = \sum_{n=p}^{\infty} (\mu_n h_n + \theta_n g_n), \quad (14)$$

where $z \in U, h_p(z) = z^p$,

$$h_n(z) = z^p - \frac{\delta(p, q)}{\delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma} \right]^{\eta}} z^n, \quad (15)$$

$(n = p + 1, p + 2, \dots)$

$$g_n(z) = z^p - \frac{\delta(p, q)}{\delta(n, q)[(n - q)((n - q - 1)K - \beta) + K] \left[1 + \frac{(n - p)\lambda}{p + \gamma} \right]^{\eta}} \bar{z}^n, \quad (16)$$

$(n = p, p + 1, \dots)$ and

$$\sum_{n=p}^{\infty} (\mu_n + \theta_n) = 1, \quad (\mu_n \geq 0, \theta_n \geq 0).$$

In particular, the extreme points of $AM_p(K, \beta, \gamma)$ are $\{h_n\}$ and $\{g_n\}$.

Proof : Suppose f is of the form (14). Using (15) and (16), we get

$$\begin{aligned}
 f(z) &= \sum_{n=p}^{\infty} (\mu_n h_n + \theta_n g_n) \\
 &= \sum_{n=p}^{\infty} (\mu_n + \theta_n) z^p - \sum_{n=p+1}^{\infty} \frac{\delta(p, q)}{\delta(n, q)[(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^\eta} \mu_n z^n \\
 &\quad - \sum_{n=p}^{\infty} \frac{\delta(p, q)}{\delta(n, q)[(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^\eta} \theta_n (\bar{z})^n \\
 &= z^p - \sum_{n=p+1}^{\infty} \frac{\delta(p, q)}{\delta(n, q)[(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^\eta} \mu_n z^n \\
 &\quad - \sum_{n=p}^{\infty} \frac{\delta(p, q)}{\delta(n, q)[(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^\eta} \theta_n (\bar{z})^n.
 \end{aligned}$$

Then

$$\begin{aligned}
 &\sum_{n=p+1}^{\infty} \frac{\delta(p, q)}{\delta(n, q)[(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^\eta} \mu_n \\
 &\quad + \sum_{n=p}^{\infty} \frac{\delta(p, q)}{\delta(n, q)[(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^\eta} \theta_n \\
 &= \delta(p, q) \left(\sum_{n=p}^{\infty} (\mu_n + \theta_n) - \mu_p \right) = \delta(p, q)(1 - \mu_p) \leq \delta(p, q),
 \end{aligned}$$

which implies that $f \in \overline{AM_p(K, \beta, \gamma)}$. Conversely, assume that $f \in \overline{AM_p(K, \beta, \gamma)}$. Putting

$$\mu_n = \frac{\delta(n, q)[(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^\eta}{\delta(p, q)} |a_n|,$$

($n = p + 1, p + 2, \dots$),

$$\theta_n = \frac{\delta(n, q)[(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^\eta}{\delta(p, q)} |b_n|,$$

($n = p, p + 1, \dots$), we get

$$f(z) = \sum_{n=p}^{\infty} (\mu_n h_n + \theta_n g_n).$$

Theorem 4: The class $AM_p(K, \beta, \gamma)$ is a convex set.

Proof : Let the function $f_{n,j}$ ($j = 1, 2$) defined by

$$f_{n,j}(z) = z^p - \sum_{n=p+1}^{\infty} |a_{n,j}| z^n - \sum_{n=p}^{\infty} |b_{n,j}| \bar{z}^n$$

be in the class $AM_p(K, \beta, \gamma)$.

It is sufficient to prove that the function

$$H(z) = \tau f_{n,1}(z) + (1 - \tau) f_{n,2}(z), \quad (0 \leq \tau < 1),$$

is also in the class $AM_p(K, \beta, \gamma)$. Since for $0 \leq \tau < 1$,

$$H(z) = z^p - \sum_{n=p+1}^{\infty} (\tau |a_{n,1}| + (1 - \tau) |a_{n,2}|) z^n - \sum_{n=p}^{\infty} (\tau |b_{n,1}| + (1 - \tau) |b_{n,2}|) (\bar{z})^n$$

with the aid of Theorem (2), we have

$$\begin{aligned}
 & \sum_{n=p+1}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} (\tau|a_{n,1}| + (1-\tau)|a_{n,2}|) \\
 & + \sum_{n=p}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} (\tau|b_{n,1}| + (1-\tau)|b_{n,2}|) \\
 & = \tau \left[\sum_{n=p+1}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} |a_{n,1}| \right. \\
 & \left. + \sum_{n=p}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} |b_{n,1}| \right] \\
 & + (1-\tau) \left[\sum_{n=p+1}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} |a_{n,2}| \right. \\
 & \left. + \sum_{n=p}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} |b_{n,2}| \right] \\
 & \leq \tau\delta(p, q) + (1-\tau)\delta(p, q) = \delta(p, q).
 \end{aligned}$$

Hence, $H(z) \in AM_p(K, \beta, \gamma)$.

For harmonic functions

$$f(z) = z^p - \sum_{n=p+1}^{\infty} |a_n| z^n - \sum_{n=p}^{\infty} |b_n| (\overline{z})^n \tag{17}$$

and

$$F(z) = z^p - \sum_{n=p+1}^{\infty} |A_n| z^n - \sum_{n=p}^{\infty} |B_n| (\overline{z})^n. \tag{18}$$

We define the convolution of f and F as

$$(f * F)(z) = z^p - \sum_{n=p+1}^{\infty} |a_n A_n| z^n - \sum_{n=p}^{\infty} |b_n B_n| (\overline{z})^n. \tag{19}$$

IV. CONVOLUTION PROPERTY

In the following theorem we examine the convolution property of the class $AM_p(K, \beta, \gamma)$.

Theorem 5: If f and F are in the class $AM_p(K, \beta, \gamma)$, then $(f * F)$ also in the class $AM_p(K, \beta, \gamma)$.

Proof : Let f and F of the from (17) and (18) belong to $AM_p(K, \beta, \gamma)$. Then the convolution of f and F is given by (19). Note that $|A_n| \leq 1$ and $|B_n| \leq 1$, since $F \in AM_p(K, \beta, \gamma)$. Then we can write

$$\begin{aligned}
 & \sum_{n=p+1}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} |a_n| |A_n| \\
 & + \sum_{n=p}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} |b_n| |B_n| \\
 & \leq \sum_{n=p+1}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} |a_n| \\
 & + \sum_{n=p}^{\infty} \delta(n, q)[(n-q)((n-q-1)K-\beta)+K] \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} |b_n|.
 \end{aligned}$$

The right hand side of the above inequality is bounded by $\delta(p, q)$ because $f \in AM_p(K, \beta, \gamma)$. Therefore $(f * F) \in AM_p(K, \beta, \gamma)$.

5- Integral Operator:

Definition 1[7]: The June-Kim-Srivastava integral operator is defined by

$$J^{\sigma} h(z) = \frac{(p+1)^{\sigma}}{z\Gamma(\sigma)} \int_0^z \left(\log \frac{z}{t}\right)^{\sigma} K(t) dt, \quad \sigma > 0. \tag{20}$$

If

$$h(z) = z^p - \sum_{n=p+1}^{\infty} a_n z^n,$$

then

$$J^\sigma h(z) = z^p - \sum_{n=p+1}^{\infty} \left(\frac{p+1}{n+1}\right)^\sigma a_n z^n, \tag{21}$$

also J^σ is a linear operator.

Remark 1: If $f(z) = h(z) + \overline{g(z)}$, where

$$h(z) = z^p - \sum_{n=p+1}^{\infty} |a_n| z^n, \quad g(z) = - \sum_{n=p}^{\infty} |b_n| z^n, |b_p| < 1,$$

then

$$J^\sigma f(z) = J^\sigma h(z) + \overline{J^\sigma g(z)}. \tag{22}$$

Theorem 6: If $f \in AM_p(K, \beta, \gamma)$, then $J^\sigma f$ is also in $AM_p(K, \beta, \gamma)$.

Proof : By (21) and (22), we obtain

$$J^\sigma f(z) = J^\sigma \left(z^p - \sum_{n=p+1}^{\infty} |a_n| z^n - \sum_{n=p}^{\infty} |b_n| \overline{(z)^n} \right) = z^p - \sum_{n=p+1}^{\infty} \left(\frac{p+1}{n+1}\right)^\sigma |a_n| z^n - \sum_{n=p}^{\infty} \left(\frac{p+1}{n+1}\right)^\sigma \sum_{n=p}^{\infty} |b_n| \overline{(z)^n},$$

since $f \in AM_p(K, \beta, \gamma)$, then by Theorem (2), we have

$$\begin{aligned} & \sum_{n=p+1}^{\infty} \delta(n, q) [(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta |a_n| \\ & + \sum_{n=p}^{\infty} \delta(n, q) [(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta |b_n| \leq \delta(p, q). \end{aligned} \tag{23}$$

We must show

$$\begin{aligned} & \sum_{n=p+1}^{\infty} \delta(n, q) [(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta \left(\frac{p+1}{n+1}\right)^\sigma |a_n| \\ & + \sum_{n=p}^{\infty} \delta(n, q) [(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta \left(\frac{p+1}{n+1}\right)^\sigma |b_n| \\ & \leq \delta(p, q). \end{aligned} \tag{24}$$

But in view of (23) the inequality in (24) holds true if $\left(\frac{p+1}{n+1}\right)^\sigma \leq 1$, since $\sigma > 0$ and $p \leq n$, therefore (24) holds true and this gives the result.

Theorem 7: Let $f \in AM_p(K, \beta, \gamma)$. Then

$$|D_p(\lambda, \beta, \gamma)f(z)| \leq (1 + |b_p|)z^p + \frac{\delta(p, q) - |b_p|}{\delta(p+1, q)[(p-q+1)((p-q)K - \beta) + K]} |z|^{p+1}$$

and

$$|D_p(\lambda, \beta, \gamma)f(z)| \geq (1 - |b_p|)z^p - \frac{\delta(p, q) - |b_p|}{\delta(p+1, q)[(p-q+1)((p-q)K - \beta) + K]} |z|^{p+1}.$$

Proof : Let $f \in AM_p(K, \beta, \gamma)$, then we have

$$\begin{aligned} & \delta(p+1, q)[(p-q+1)((p-q)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta (|a_n| + |b_n|) \\ & \leq \sum_{n=p+1}^{\infty} \delta(n, q) [(n-q)((n-q-1)K - \beta) + K] \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta (|a_n| + |b_n|) \leq \delta(p, q) - |b_p| \end{aligned}$$

Which implies that

$$\sum_{n=p+1}^{\infty} \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta (|a_n| + |b_n|) \leq \frac{\delta(p, q) - |b_p|}{\delta(p+1, q)[(p-q+1)((p-q)K - \beta) + K]}.$$

Applying this inequality in the following assertion, we obtain

$$|D_p(\lambda, \beta, \gamma)f(z)| = \left| z^p - \sum_{n=p+1}^{\infty} \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta |a_n| z^n - \sum_{n=p}^{\infty} \left[1 + \frac{(n-p)\lambda}{p+\gamma} \right]^\eta |b_n| \overline{(z)^n} \right|$$

$$\begin{aligned} &\leq (1 + |b_p|)z^p + \sum_{n=p+1}^{\infty} \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} (|a_n| + |b_n|)|z|^n \\ &\leq (1 + |b_p|)z^p + \sum_{n=p+1}^{\infty} \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} (|a_n| + |b_n|)|z|^{p+1} \\ &\leq (1 + |b_p|)z^p + \frac{\delta(p, q) - |b_p|}{\delta(p+1, q)[(p-q+1)((p-q)K - \beta) + K]} |z|^{p+1}. \end{aligned}$$

Also, on the other hand we obtain

$$\begin{aligned} |D_p(\lambda, \beta, \gamma)f(z)| &\geq (1 - |b_p|)z^p - \sum_{n=p+1}^{\infty} \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} (|a_n| + |b_n|)|z|^n \\ &\geq (1 - |b_p|)z^p - \sum_{n=p+1}^{\infty} \left[1 + \frac{(n-p)\lambda}{p+\gamma}\right]^{\eta} (|a_n| + |b_n|)|z|^{p+1} \\ &\geq (1 - |b_p|)z^p - \frac{\delta(p, q) - |b_p|}{\delta(p+1, q)[(p-q+1)((p-q)K - \beta) + K]} |z|^{p+1}. \end{aligned}$$

REFERENCES

- [1] O. P. Ahuja and J. M. Jahangiri, Multivalent harmonic starlike functions, *Ann. Univ. Marie-Curie Skłodowska sect. A*, 55(1)(2001).
- [2] E. S. Aqlan, Some problems connected with geometric function theory, Ph. D. Thesis(2004), Pune University, Pune.
- [3] W. G. Atshan, On a certain class of multivalent functions defined by Hadama product, *Journal of Asian Scientific Research*, 3(9)(2013), 891-902.
- [4] W. G. Atshan and S. R. Kulkarni, New classes of multivalentlyharmonic functions, *Int. J. of Math. Analysis*, Vol. 2, 2008, no. 3, 111-121.
- [5] J. G. Clunie and T. Shell-Small, Harmonic univalent functions, *Aun. Acad. Aci. Fenn. Ser. A. I. Math*, 9(1984), 3-25.
- [6] J. M. Jahangiri, G. Murugusundaramoorthy, K. Vijaya, Sălăgean-typeharmonic univalent functions, *South. J. Pure Appl. Math.*, 2(2002), 77-82.
- [7] I. B. Jung, Y. C. Kimand and H. M. Srivastava, The Hardy space of analytic functions associated with one-parameter families of integral operators, *J. Math. Appl.* 176(1993), 138-197.
- [8] H. Mahzoon and S. Latha, Neighborhoods of multivalent functions, *Int. J. Math. Anal.*, 3(30)(2009), 1501-1507.

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Obstacles and Motivations of Post Graduate Students to Go for Entrepreneurship Activities: A Study on Selected Ethiopian Public Universities

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Abstract: Entrepreneurship has been discovered to be indispensable part of economy and it is prevailing driver of economy in the entire planet. To this end; the study had the objective to assess the obstacles and motivators for post graduate students for entering into entrepreneurship activities. Research design for the study was descriptive research design. Data were collected from 146 Business and Economics college postgraduate students in three purposely selected Ethiopian universities. After the data has been collected, it was analyzed by using Descriptive Statistics (frequency, mean and standard deviation), and the result was presented using tables. The results of the study indicate that fear risk of running in to debt, lack of experience and fear of securing constant income are the main obstacles. The motivating factors are interest to be boss for their own, assertive and have strong personality that is necessary for business ownership, to best use of their personal skills and competencies. The possible suggestions for the problems are the students are better if they focus on the advantages of entrepreneurship activate and sharing experience from actual entrepreneurs through informal way than fearing risks associated to entrepreneurship. Further the universities are better to transform themselves to entrepreneurial University and prepare internship attachment for their students.

Index Term:Entrepreneurship, Motivations, Obstacles, Students, Universities

I. INTRODUCTION

Now days in Ethiopian universities different departments are begun to include Entrepreneurship course in their curriculum for instance under Business and Economics College (Management, Accounting and Finance, Economics, Hospitality and Tourism Management) and under Computing College (Information Technology and computer science) to mention some. According to Bae, *et al.* (2014) entrepreneurship education has helped the university students to develop positive attitude toward entrepreneurship and increased business opportunity analysis.

Interest of Entrepreneurship education is growing from time to time since Entrepreneurship development has direct relationship with economic growth of counties through establishing business organization which has a potential to be successful (Kiukumar and Somayeh, 2011). This strong drive is that entrepreneurship is recognized as a significant source of

minimizing unemployment problem and help to enhance the economic development of a country (Rasli, *et al.*, 2013).

In most parts the world many young and educated people are taking entrepreneurship (starting their own business) as a good opportunity because different countries are facing double digit unemployment in most parts in and a lots support is provided in order to create supportive and encouraging environment (Asif Tanveer, *et al.*, Nd).

Even though importance of entrepreneurship undeniable in many perspective different studies shows that there is an obstacle graduate student for going in to entrepreneurship actives. Fatoki and Olufunso (2010) lack of savings and difficulties in obtaining bank finance biggest obstacles. In addition to finance problem the other factors are lack of skills, lack of assistance, lack of awareness, and fear of future other hindering factor (Asif Tanveer, *et al.*, Nd).

Not only dark sides research done Ooi and Ahmad (2012) shows that the students are motivated to go into entrepreneurship due to extrinsic and intrinsic rewards, and independence/autonomy of being entrepreneurs. Taking this all above mentioned factors in to considerations this study determines the obstacles and motivators for post Graduate students in Ethiopia for going in Entrepreneurship Activities.

1.1. STATEMENT OF THE PROBLEM

Ignoring the youth unemployment problem bring remarkable challenge or cost on economic growth as well as on social development of the country (ILO, 2006). Though the crucial role, played by entrepreneurship in driving economic development and job creation, is increasingly understood, there has been little effort to look at it from a student's perspective. Autio *et al.*, (1997) fund that even if much attention is given on delivering the course, the students are facing the obstacle to go practically for an entrepreneurship.

Ferreira *et al.*, (2017,) conducted a research to compare motivations for entrepreneurship, business planning, and risk management between two groups of university students: those who already had a business and those intending to start one on undergraduate and graduate students. To determine the undergraduate student's entrepreneurial intention Rasli *et al.*'s, (2013) tested work experience, vicarious experience, general attitude, image of entrepreneurship and other demographic

variables. The study of Ooi and Ahmad (2012) and Fatoki, and Olufunso (2010) identify the perception of students on entrepreneurship; motivators as well as obstacles faced by them to start up their own business. Even though different studies are done on Obstacles and Motivations for going into entrepreneurship their findings were not uniform. In addition post graduate students are less involved in business endeavor comparing to undergraduate students after graduation and further the obstacle and motivation facing the students in Ethiopia take different form. In light of this, the study was attempted to answer the following basic questions:

1. What are the obstacles for post graduate students for going into entrepreneurship activities?
2. What are the motivators for post graduate students for going into entrepreneurship activities?

II. LITERATURE REVIEW

1.3. DEFINITION OF ENTREPRENEURSHIP

There is no single definition for Entrepreneurship different scholars define Entrepreneurship in different ways. According to ILO, (2003) Entrepreneurship is a process of bringing land, labor and capital together to make a significant contribution to economic development. Entrepreneurship is the abilities and skills of operating a business organization including skill of planning, organizing, analyzing, and communicating beyond a narrow perspective (Shapiro & Sokol, 1982).

It is fact that the role of university graduates is high in enhancing the innovative business (Robinson and Sexton, 1998). Even if, the role of the graduate students are high there are an obstacle as well as motivation for them to go for Entrepreneurship.

1.4. MOTIVATIONAL FACTORS

According to Ryan and Deci (2000) motivated mean that to be moved to do something or further explained as a person having high desire to do something at the same time as a person that has no desire or inspiration to act is called unmotivated. The study of Benzing, Chu and Kara (2009) shows that the main reasons for starting own business rather than being employed are to increase income, for job security and seeking financial independence.

In addition, driving factors towards entrepreneurial intension for Business students are to realize their dream, to maintain their family and to use opportunities available in the market (Yusof, *et al.*, 2014). Kautonen and Palmroos (2010) specified that the main motivation factor is dissatisfaction with job opportunities available, desire to practice their personal skills. Furthermore capabilities to run their own business Ferreira *et al.* (2017), the positive attitude toward learning new things, fear of unemployment and financial independence are also another motivating factors (Barba-Sánchez and Atienza-Sahuquillo, 2012).

1.5. CHALLENGES OR OBSTACLES

Entrepreneurship activities contributes into countries development in increasing country's revenue, reduce

unemployment problem and upgrade the living standard of the citizen, looking to this all facts it is very important to support the young adults to be an entrepreneur (Moi, *et al.* 2011). Even though importance of the Entrepreneurship very significant for the countries development different research's finding shows that there is an obstacle for the students to go for Entrepreneurship activities. The finding of Sandhu *et al.* (2011) shows that the obstacles for postgraduate students to go for Entrepreneurship activities are; lack of startup finance, fear of not being successful and lack of social networking. Further, lack of saving, lack of practical business experience and exposure, fear of uncertainty in future career of the business and fear of trust among partners are factor that hinder the students from going into entrepreneurship (Yusof, *et al.*, 2014).

Fatoki, and Olufunso, (2010) confirm that the main obstacle for graduate students in south Africa are listed accordingly; lack of access to funds, lack of personal competency, lack support from the government, and problem of macro macro-economy of the country.

As proved by many of the research findings shows the main obstacle for the students to go for entrepreneurship is finance. Unfortunately both governmental and nongovernmental financial institution working in Ethiopia asks for collateral as mandatory requirement to provide fund. According to World Bank report this stand of those financial institutions discriminates against the entrepreneurs who have promising business idea but lack adequate collateral.

III. RESEARCH METHODOLOGY

1.6. RESEARCH DESIGN

To meet the objective of the research descriptive research approach with cross sectional time horizon was employed.

1.7. SAMPLING METHOD AND SAMPLING SIZE

The target population of the study was students of three Ethiopian public Universities (Jimma University, Addis Ababa University and Ambo University). According to the data from each Universities in 2014/2015 academic year number of post graduate second year students in Business and Economic College were 48, 73 and 28 from Jimma, Addis Ababa and Ambo University respectively. The data were collected from the different department's student under Business and Economics College (Masters of Business Administration, Master of public Administration, MSc in Accounting and Finance, and MSc. in Economics)

The research only covered three universities Business and Economics College second year students with the rationale that these three Universities are more close to the researchers and they have post graduate programs in Business and Economics. Considering Business and Economics College as target group was very important since the curriculum of the programs has entrepreneurship and entrepreneurship supporting courses, this implies that students have more concepts of entrepreneurship in theory. In addition the final year post graduates students were

chosen because they are at a period in their career development where they are considering different career routes and are therefore, there are potential source of current and future entrepreneurs.

As the numbers of post graduate students are less in number census of the population were taken from each university. Accordingly, the questionnaires were distributed to selected respondents.

Respondents were disproportional taken from each University since the size of students found in these Universities is not proportional.

1.8. METHOD DATA COLLECTION

Primary data were collected from the students using self-administered questionnaire. Self-administered mainly helps to gather the up to date information from the students themselves and it is easy for analysis and interpretation.

The researcher developed a questionnaire that comprises three parts. The first part was regarding the demographic aspect of the respondents, asking their age, sex, marital status and family background. This part of the questions helps the study to know more respondent's demographic profile and it was close ended questions.

The second part of the questionnaire was regarding the obstacle to enter in to entrepreneurship and third part was to know factor that motivates the students to enter in to entrepreneurship activities. Both the second and the third part of the questionnaire was a Likert scale of 5 levels (1=strongly disagree, 2= disagree 3=neutral, 4=agree and 5=strongly agree) to elicit information from respondents.

1.9. METHOD OF DATA ANALYSIS AND PRESENTATION

For data analysis purpose descriptive analysis such as frequencies, mean and standard deviation were used and summarized and presented using tables.

IV. CONCLUSION

Based on the objective of the study the general picture reflects that there are obstacles for post graduate students to go in to Entrepreneurship activities. From the analysis the factors are

VI. LIMITATIONS AND FURTHER RESEARCH

Studying about Barriers for a post graduate student for going into entrepreneurship is broad concept. The study is one time survey since the time is changing it is hard to generalize the result of the study for a long time.

For the study purpose the three Ethiopian public Universities Business and Economics college post graduate second year

identified and ranked accordingly; (1) fear risk of running in to debt, (2) lack of experience, (3) fear of securing constant income, (4) doubt about the success of the business and (5) difficulty to obtain the finance necessary to start the business are the significant limiting factor for the students.

The factors that motivates the postgraduate students are also identified and ranked accordingly; (1) interest to be boss for their own, (2) assertive and have strong personality that is necessary for business ownership, (3) to best use of their personal skills and competencies, (4) to have their own working time, (5) to get better work/life balance, (6) to use their own business ideas and to use their education to the best advantage and (7) it would give them the privilege to choose the work area/place respectively are significant motivating factors. From this it is possible to infer motivating factors for post graduate students are more of personal attributes.

V. RECOMMENDATIONS

On the basis of the findings and conclusions reached, the following recommendations are forwarded in order to minimize the limiting factors and enhance the motivating factors that are encountered by post graduate students..

Even though entrepreneurship is not free of risks, its better if they think the advantage of going into entrepreneurship activities because starting own business creates sense of independence, flexibility and freedom; give opportunity for family employment, help to be own boss, give time and financial freedoms. In addition now a days it better to be job creator than job seeker because of the serious competition throughout the world to get the dream work. So that it is advisable to take calculate risk by think the advantageous going in to entrepreneurship activities.

In addition, it's better if the students develop habit of sharing experience from the entrepreneurs through informal friendship so that they can learn a lot from best practices of those entrepreneurs.

To address the limiting factors that the students encountered, it is better if the Universities are transformed to the entrepreneurial University. Because this help the students to capture the practical part of the business world in addition to the theory.

Further, it is better if the university prepare the internship attachment on business companies for the students so that they can get the experience on real world.

students were included so that, it is not possible to generalize the result for under graduate and others university students who were not included in the research.

Furthermore other than variables considered in the study there are number of barriers for post graduate students for going into entrepreneurship. For further study it is possible to study the other variables and correlation of different variables.

References

1. Autio, E., Keeley, R. H., Klofsten, M. and Ulfdtedt, T. (1997). Entrepreneurial intent among students: Testing an intent model in Asia, Scandinavia, and USA. *Frontier of Entrepreneurship Research*, 133-147.
2. Bae, T. J., Qian, S., Miao, C., and Fiet, J. O., (2014), The relationship between entrepreneurship education and entrepreneurial intentions: A meta-analytic review. *Entrepreneurship Theory and Practice*, 38(2), 217–254.
3. Barba-Sánchez, V., and Atienza-Sahuquillo, C. (2012). Entrepreneurial behavior: impact of motivation factors on decision to create a new venture. *Investigaciones Europeas de Dirección y Economía de la Empresa*, 18(2), 132-138.
4. Benzing, C., H.M., Chu, O. and Kara, (2009), Entrepreneurs in Turkey: A Factor Analysis of Motivations, Success Factors, and Problems. *Journal of Small Business Management*, 47(1): 58-91.
5. Fatoki, and Olufunso, O., (2010), Graduate Entrepreneurial Intention in South Africa: Motivations and Obstacles, *International Journal of Business and Management*, *International Journal of Business and Management Vol. 5, No. 9*
6. Ferreira, S A., Loiola, E. and Gondim, S. M, (2017), Motivations, business planning, and risk management: entrepreneurship among university students Aleciane: innovation and Management review pp 140–150
7. ILO, (2006), Stimulating Youth Entrepreneurship: Barriers and incentives to enterprise start-ups by young people Small Enterprise Development Programme Job Creation and Enterprise Development Department, SEED Working Paper No. 76 Geneva
8. Kautonen, T., and Palmroos, J., (2010), The impact of a necessity-based start-up on subsequent entrepreneurial satisfaction. *International Entrepreneur Management*, 6, 285–300.
9. Kiumars Z. and Somayeh R., (2011), Effects of Personality Traits on Entrepreneurial Intentions: An Empirical Study in Iran. *International Journal of Management Vol. 28 No. 3*
10. Magsino R. A. and Oplencia K. Y., (2015) Entrepreneurial Intentions Among Entrepreneurial Management Students Class 2014: A Qualitative Longitudinal Study, *Journal of Arts, Science & Commerce Vol.– VI, Issue – 1*
11. Moi, T., Y.L. Adeline, M. L. and Dyana, (2011), Young adult responses to entrepreneurial intent. *Journal of Arts, Science & Commerce*, 2(3): 37-52.
12. Ooi, K. Y., and Ahmad, S., (2012), Study Among University Students In Business Start-Ups In Malaysia: Motivations And Obstacles To Become Entrepreneurs, *International Journal of Business and Social Science Vol. 3 No. 19;*
13. Rasli, M. A., Khan, R. U. S., Malekifar, S. and Jabeen .S., (2013) Factors Affecting Entrepreneurial Intention Among Graduate Students of Universiti Teknologi Malaysia, *International Journal of Business and Social Science*, *International Journal of Business and Social Science Vol. 4 No. 2;*
14. Robinson and Sexton, (1998) : Introduction To The Special Issue On Corporate Entrepreneurship, *Special Management Journal*, 11, pp 1-13
15. Ryan, R. M., and Deci, E.L. (2000), Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25, 54-
16. Sandhu, M.S., S.F. Sidique and S. Riaz, (2011), Entrepreneurship barriers and entrepreneurial inclination among Malaysian postgraduates' students. *International Journal of Entrepreneurial Behaviour & Research*, 17(4): 428-449.
17. Shapero, A. & L. Sokol (1982), *The Social Dimension of Entrepreneurship*, The Encyclopedia of Entrepreneurship, Prentice Hall
18. Tanveer, M.A., Gillani, U.A., Rizvi, S., Latif, M. Maqbool, H. and Rizwan M., (2011). Barriers for Business Students in Becoming an Entrepreneur in Pakistan. *IOSR Journal of Business and Management*. ISSN:2319-7668, 74-82.
19. Yusof, k. C. N. K, Harun, J. R., Abu Bakar, J. M and Tahir, M . I., (2014) ,Motivational Factors and Obstacles to Entrepreneurial Intention Among Business Students, *Australian Journal of Basic and Applied Sciences*, 8(5) Special 2014, Pages: 41-50

Distribution of localize algorithm for linear wireless sensor network

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Abstract- A distributed localization algorithm for determining the position of nodes in a structured wireless sensor network is proposed. Details regarding the implementation of such algorithm are also discussed. Experiments were performed in a testbed area containing anchor and blind nodes deployed in it to characterize the path loss exponent and to determine the localization error of the algorithm. The algorithm is shown to have localization error of 0.74m which is better than 4.73m shown by centroid algorithm for three anchor nodes.

Index Terms- Wireless, sensor, Node, Localization Network, and algorithm

I. INTRODUCTION

Oil, gas, and water pipelines are considered as the most important infrastructures in many countries and protecting the pipeline infrastructure is one of the important priorities of these countries, it has been required either by government regulations or internal policies to ensure the safety of these assets, as well as the population and environment where these pipelines run. In addition, the vandalization of oil pipelines in Nigeria by some restive youths appears to be threatening the long term development prospects of the country. This calls for a drastic control measure in terms of technology that can be used to checkmate these occurrences. These technologies include; from physically walking the lines to satellite surveillance designed to provide a remote facility to monitor and to report needed pipeline system status.

In recent years, wireless sensor networks (WSNs) are emerging as a suitable new tool for a spectrum of new applications. These tiny sensor nodes are low cost, low power, easily deployable, and self-organizing. These are usually capable of local processing. Each sensor node is capable of only a limited amount of processing, but when coordinated with the information from a large number of other nodes, these have the ability to measure a given physical environment in great detail. This paper work proposes a simple distributed localization algorithm for wireless sensor networks used for long distance infrastructure monitoring. This algorithm will utilize received signal strength (RSS) range based method to locate the position of nodes.

II. PROBLEM STATEMENT

Research in the field of WSNs is relatively active and involves issues such as efficient routing algorithms, energy conservation technique, and localization algorithm and security mechanisms. However, these algorithms cannot be effectively

applied to the class of linear wireless sensor Network needed for linear long distance infrastructure monitoring. Fortunately, the WSN needed for monitoring linear infrastructure such as oil pipeline is a structured network in which the nodes will be deployed along the pipeline and not in an adhoc manner. This work aims at developing algorithm for structured WSNs.

III. MATERIALS

Wireless Sensor Network (WSNs) has been widely considered as one of the most important technologies for the twenty – first century (Business week, 1999). Enabled by recent advances in micro electromechanical system (MEMS) and wireless communication technologies, tiny, cheap, and smart sensors deployed in a physical area and networked through wireless links and the internet provide unprecedented opportunities for a variety of civilian and military applications; for examples, environmental monitoring, pipeline monitoring, battle field surveillance, and industry process control (Chony, C.Y. and Kumar, S.P, 2003). Distinguished from traditional wireless communication network, for example, cellular system and mobile adhoc networks (MANET), WSNs have unique characteristics for example denser level of node deployment, higher unreliability of sensor nodes, and severe energy, computing and storage constraints (Akyildiz, et al 2002)., which presents many new challenges in the development and application of WSNs.

A WSN typically consists of a large number of low-cost, low-power, and multifunctional sensor nodes that are deployed in a region of interest (Jun zheng et al, 2009). These sensor nodes are small in size but are equipped with sensors, embedded microprocessors, and radio transceivers, and therefore have not only sensory capability, but also data processing and communicating capabilities. These communicate over a short distance via a wireless medium and collaborate to accomplish a common task.

Sensors can be used to detect or monitor a variety of physical parameters or conditions (Akyildiz, et al 2002)., for example: Illuminosity (light), Sound, Humidity, pressure, temperature, soil composition, air or water quality and attributes of an object such as size, weight, position, speed and direction. Wireless sensors have significant advantages over conventional wired sensors (Zhao, F. and Guibas, L, 2004). These cannot only reduce the cost and delay in deployment, but also be applied to any environment, especially those in which conventional wired sensor networks are impossible to be deployed, for example, inhospitable terrains, battlefields, outer space or deep oceans. WSNs were originally motivated by

military applications, which range from large scale acoustic surveillance system for ocean surveillance to small networks of unattended ground sensors for ground target detection(Business week, 1999). The characteristics of sensor networks and requirement of different applications have a decisive impact on the network design objectives in terms of network capabilities and network performance. The core function of WSN is to detect and report events which can be meaningfully assimilated and responded to only if the accurate location of the event is known. Also, in any WSN, the location information of nodes plays a vital role in understanding the application context. Automatic localization of the sensor nodes in this wireless network is a key enabling technology. The overwhelming reason is that a sensor's location must be known for its data to be meaningful. Localization is the process by which an object determines its spatial co-ordinates in a given field or it can be defined as the mechanism for discovering spatial relationship between objects.

Existing Localization Algorithm

This paper work surveyed different techniques available for localization and proposes a better algorithm for localization of sensor nodes. Chris Savarese and Rabacy, Jan.(2002) used a minimum of four anchor nodes in trying to get a robust positioning algorithm for wireless sensor networks; in their assumptions, it was considered that all nodes are equal in terms of their processing ability with the exceptions of few ; the use of centralized algorithms were also criticized which is okay. Distributed algorithms were preferred to centralized algorithms because all computations were done on the sensor nodes

themselves and communicate with each other to get their positions in a network.

IV. METHODOLOGY

WSN System Model for localization Algorithm

This section presents localization system model that was used to establish the 2D Cartesian coordinates of the blind nodes. Real time experiments were also carried out on an experimental TinyOS-based WSN test bed environment to measure Received Signal Strength Indicator (RSSI) at the receiving nodes in other to estimate distance between communicating nodes. In this research work, the focus is on a pipeline segment which runs on a few kilometres (1-2 km); the sensor nodes on a pipeline segment are assumed to transmit their sensed data (temperature, light and humidity) to one base station (sink) located in a distance far away from the remote site; and the sensed data is collected through a multihop forwarding scheme. Consider a case where sensor nodes are deployed along a pipeline consisting of sensor nodes {N1, -----, Nn}. This is used to monitor an oil pipeline segment of length (L= 1km). Here, the pipeline segment is assumed to be a straight line. The closest to the sink is Nn and node

N1 is the farthest one as shown in Fig1. It was further assumed that sensor nodes transmit the sensed data in a multihop fashion towards the base station. Let S1x and S1y refer to the X and Y coordinates of the location of sensor N1 in 2-dimensional (2D) plane.



Figure 1: A pipeline segment with nodes

To determine location of sensor nodes along the pipeline constitutes the localization problem. However, some sensor nodes are aware of their own positioning through manual configuration or by placing it in an already known position; these nodes are known as anchor or beacon nodes. All other nodes that are not aware of their position are called blind nodes; these nodes localize themselves with the help of location references received from the anchors. It was assumed that there are a set of B beacon nodes among the Sensors, and there positions (xb, yb) for all b ∈

B. The positions (xn,yn) for all blind nodes n ∈ N would be found.

The localization system model is comprised of both the signal propagation model and the trilateration model. Trilateration is a localization technique used when there is an accurate estimate of distance between a node and at least three anchor nodes in a 2D plane. This method finds the intersection of three circles centred at anchor as the position of the node. The scenario is shown in Figure 2

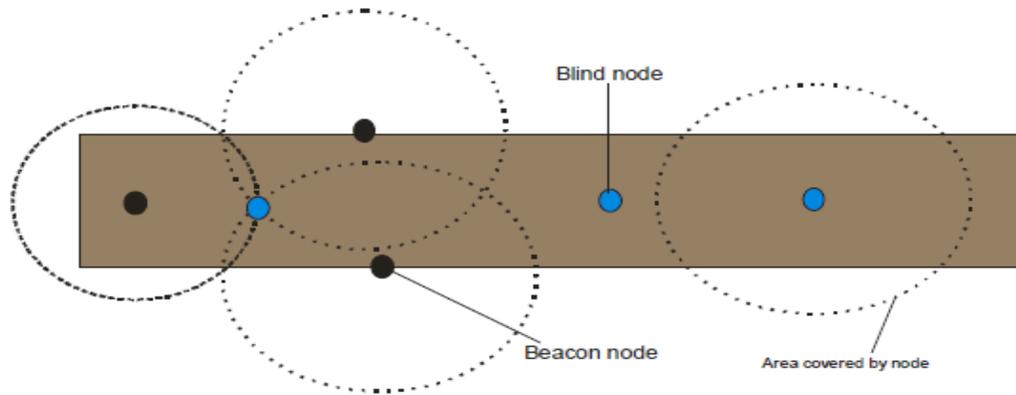


Figure 2: Trilateration of nodes

Deployment Strategy

The problem of how to manually deploy the blind nodes along the pipeline to ensure connectivity gave rise to this section. Topology control for a sensor network is how to set the radio range for each node so as to minimize energy usage, while still ensuring that the communication graph of the nodes remains connected and satisfies other desirable communication properties. The critical transmitting range (CTR) is a term used in describing the minimum common transmitting range, r , such that the network is connected. The solution to the CTR problem depends on information about the physical placement of the nodes. If the node positions are not known then the problem now becomes to estimate the range r that guarantees network connectivity among the nodes after placement. For example, Panchapakesan P. and manjunath, D. (2001) show that if n nodes are uniformly distributed in a unit square, then the critical transmission range is, with high probability:

Received Signal Strength Indicator (RSSI) Measurement



Figure 3: Experimental test bed Environment

The test bed environment is depicted in figure 3. The Environment consists of the outdoor environment of the faculty of Engineering wing B, NnamdiAzikiwe University Awka, AnambraState. The Area covers (100 X 50) m² around the packing site for staff. The test bed has four (4) telosbmotes (TPR 2420CA) equipped with a chipcon CC2420 radio chip operating in the 2.4 GHz frequency band and running on tiny operating system (tiny OS). The nodes both anchor and blind are deployed within this test bed environment. The sink node is located at the

department of Electronic and Computer Engineering which is situated at the First floor of the faculty of engineering building. The sink node is usually attached to an Hp personal computer where the monitoring is carried out.

Measurement Environment

The measurement environment is located at Awka, AnambraState of south-east of Nigeria. Most of the measurements were carried out during the later end of the rainy season (August) and early October. The area is not a level ground but somewhat sloppy, and the temperature ranges between 28-33 degree centigrade. The area also has high rise buildings scattered around.

RSSI/Distance Measurement

To determine the path loss exponent n of the test bed area, RSSI measurements with respective distances were carried out. In this case four telosb nodes were used for the measurement. The nodes were programmed to have different identification numbers (ID'S). The nodes ID's is what identify each node when transmitting to the sink. Hence, for this paper work the following node ID's were adopted; 100, 200, 300 and 700. The node ID 700 is solely reserved for the sink node. Since the path loss exponent n is to be determined every direction as considered by placing node 100 at 180° of the sink node, node 200 at 90° of the sink node and node 300 at 270° of the sink. The respective nodes senses environmental parameters such as temperature, humidity and light intensity and send to the sink node. The hp laptop housing the sink has a program in it that can be called up by double clicking the *run sensor app* at the desktop to produce an interface where various measurement such as RSSI [dBm], Link Quality Indicator (LQI) etc. carried out can be seen. Through the above interface the various nodes and what they sensed can be monitored, by seeing how their respective values vary. It also has the option of saving the data collected and also clearing the data not saved. The RSSI values within 10 meters of the sink from the respective nodes were measured with a step size of 1 meter and collected for two months. The collected data are presented below

Result and Discussion

Some of the data will be used to determine the path loss exponent n of the test bed area while others will be used

to find the RSSI and the estimated distance between a blind node and an anchor node based on the known path loss exponent n without assuming it to be 2 as in free space. All these will assist in achieving the proposed localization algorithm.

Table 2 shows the RSSI values in dBm for the three nodes at 5seconds interval. The measurements represent the average measurements carried out during the months of August -

September (first month), some were done in the morning hours, others in the afternoon hours while others in the evening hours. The result shows that the further the distance of the nodes from the sink node, the lower the received signal strength indicator values.

Table 1: Total Average Receive signal Strength measurement for First and Second Month

Distance (m)	RSSI[dBm] for Nodes100,200,300
1	-44.8
2	-47.7
3	-48.7
4	-53.1
5	-55.6
6	-61.8
7	-67.2
8	-66.5
9	-69.0
10	-67.3

Table 1 the data collected was used to develop a matlab script for computing the path loss exponent n of the test bed area. From the computation, n was computed to be 2.2. Hence, $n = 2.2$ will be used as the path loss exponent in this paper work.

The results of the measurements for first and second months are depicted. Figure 4 shows the total average of the RSSI values for all the nodes with respect to distance for the first and second month

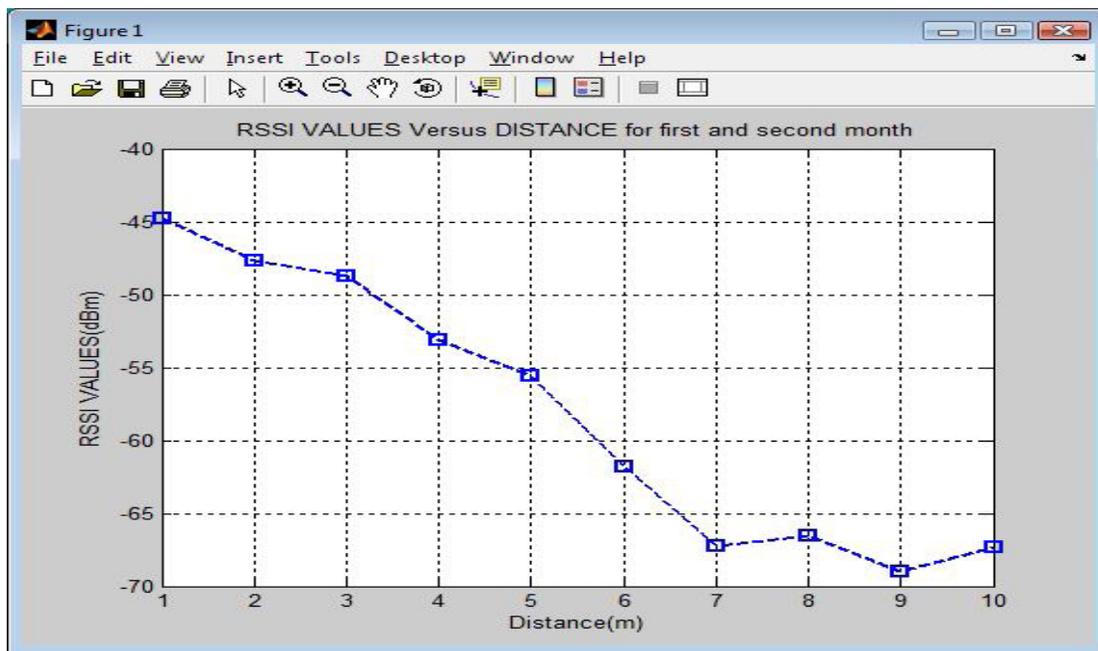


Figure 4: Total Average Values of RSSI versus Distance

Figures 4 shows that as distance increases, the values for the RSSI decreases. Based on the result obtained, one can express distance as x (m) and the measured RSSI as y (dBm) for the test bed area. One can now model the relationship between distance and Received signal strength

Proposed Algorithm

The goal of this algorithm is to determine specific blind node’s location within the distributed nodes along a long distant infrastructure. If the positions of the blind nodes are not known in a network, the event these monitor and report cannot be located if need be. The primary obstacles to localization in wireless sensor network is the sparse anchor node problem, hence, this algorithm is structured to solve the problem. The proposed algorithm is made up of two phases: initialization phase and the final phase.

Initialization Phase

Prior to the implementation of the positioning algorithm, most of the nodes in a network have no positioning data, with the exception of the anchors but all the nodes have identification number (IDs). The network being considered for this algorithm will be scalable to very large number of nodes, which will be spread over a linear structure such as pipeline, relative to short radio ranges that each of the nodes is expected to possess. Furthermore, it is expected that the percentage of nodes that are anchor nodes will be small. This results in a situation in which only a very small percentage of nodes in the network are able to establish direct contact with any of the anchor nodes. In order to overcome this initial information deficiency, this initialization

phase is usually initiated at all anchor nodes by making them broadcast their data which includes their location position and other parameters sensed. The blind node within the range of the broadcast should be able to store the anchor locations once for a particular node and estimate the range to anchors based on the Received Signal Strength; after which these also broadcast the anchor locations to other blind nodes. Through this process all blind nodes will know the location of the anchors.

Final Phase

If a blind node is able to estimate its distance to at least three anchor nodes; then the blind node can perform trilateration to get its accurate location in 2D, this blind node becomes a “converted” anchor node, its positioning will now be sent to the sink. This process (initialization and final phases) will continue until all blind nodes become converted.

Algorithm Implementation

To study the robustness of the proposed localization algorithm, a MATLAB program was developed; this program implemented the algorithm using the *input statement* and other matlab statements which is more interactive and better for analysis. This is normally called structured programming.

Input Parameters

The table 2 shows all necessary inputs to the algorithm; some of the values have been described already in this work.

Table 2: Input Parameters for Algorithm

Name	Value	Description
A	-44.8	The RSSI value in dBm one meter apart from a transmitter
n	2.2	The value represent the path loss exponent
RSSI	-40 to -100	Received Signal Strength Values, measured in dBm
X, Y	(0,0) to (100,100)	X and Y coordinate relative to a fixed point for anchor node

Table 2 shows the parameters needed as input to the algorithm in order for it to produce the required output. Path loss exponent $n = 2.2$ was experimentally determined, $A = -44.8$ was also experimentally determined (see table 1). The RSSI values will not be static but varies, and will be dependent on real time values. (x ,y)values are fixed positions for anchor nodes.

Experiment 1

In order to evaluate the algorithm, it was assumed that one has a few nodes been deployed along a pipeline segment of width 36inchs(approximately 100cm) and length of 100m and are within the communication range of one another. The nodes consist of anchor nodes (nodes that are aware of their positions)

and blind nodes(nodes that are not aware of their positions).The question becomes; given some blind nodes located somewhere along the pipeline and at least 3 anchor nodes, find the position of a particular blind node and report to sink?

Assumptions

If

1. $X_a = 35, Y_a = 10$ are the 2D coordinate for anchor node A.
2. $X_b = 50, Y_b = 5$ are the 2D coordinate for anchor node B.
3. $X_c = 60, Y_c = 15$ are the 2D coordinate for anchor node C.

The proposed algorithm can locate the positions of the blind node if the blind node in question can receive packets (positioning and sensed parameter) from the three anchor nodes.

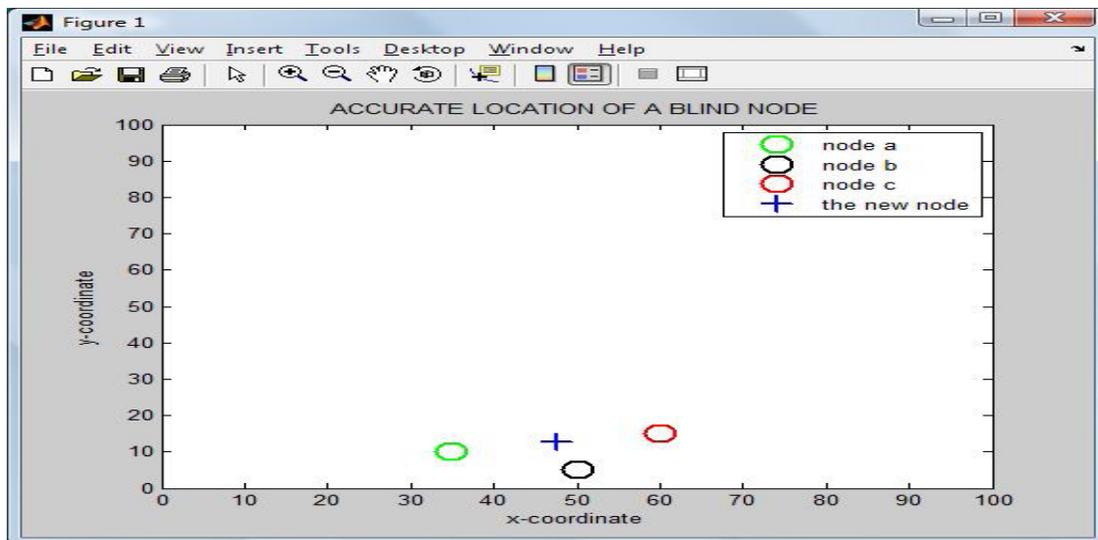


Figure 5: Accurate locationing of a blind node

Figure 5 shows a representation of the assumed pipeline segment with width 100cm and length 100m. Node a, Node b and node care all anchor nodes while the new node is the blind node; the points where these appear in the pipeline segment represent their locations. The position of the blind node was found to be $X = 47.5\text{cm}$ and $Y = 12.6\text{m}$ after the algorithm was implemented for this case.

Hence the 2Dcoordinates of the blind node represent the point of intersection of the three anchor nodes. If there is

locationing error so that the blind nodes true position is different from the localized position then it means that the position of the blind node does not represent the point of intersection of the three anchor nodes.

Metric for Evaluating Algorithm

- Localization Error
- Distance Error
- Anchor node density

Localization Error

Localization Error is defined as the difference between the estimated and the actual distances between the coordinates of the node

Distance Error

Distance Error is defined as the difference between the estimated distance and the actual distance.

Anchor Density

Anchor density is the number of anchor nodes in a network with respect to other blind nodes. Theoretically more anchors bring higher location accuracy. However, too many anchors cause high-energy consumption and calculation complexity.

Performance Evaluation

In other to evaluate the performance of the proposed algorithm based on the above stated metrics, let's consider a case

where 3 anchor nodes are deployed together with blind nodes; the goal is to determine how accurate this localization algorithm is. Experiments were carried out in the test bed area. The dimension of the testbed area is taken to be (36inch) approximately 100cm width and 100m length, (assumed pipeline dimension). The actual distance between the blind nodes and the anchors are measured and recorded, the estimated distances between the blind nodes and anchor nodes were also calculated through the algorithm and recorded. The table 3 shows the summary of data collected while figure 6 shows the accurate position of the blind node at (32.27, 43.87), and figure 7 shows the estimated position (inaccurate) at (31.79, 44.43). The localization error of this algorithm for this case is 0.74m.

The error is not that much, and is usually caused by distance error which normally depends on the RSSI values between the communicating nodes.

Table 3: Node Distance Measurement

Anchor nodes	Actual distance	Estimated distant	Actual position
A	13.8	14	(20,40)
B	19.4	20	(50,50)
C	15	16	(35,30)

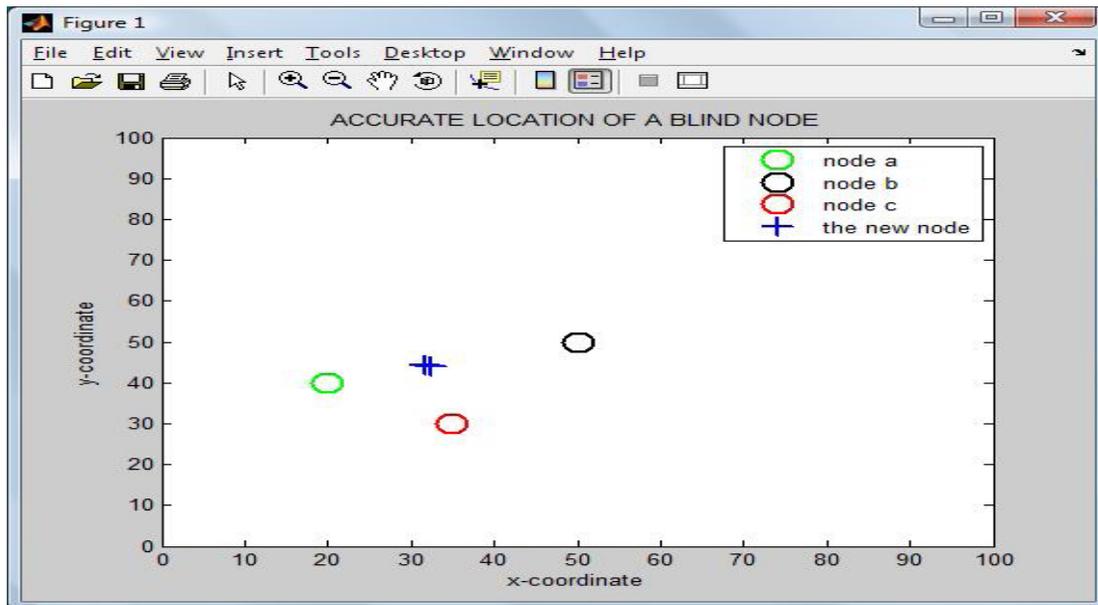


Figure 6: Actual position of blind node (new node)

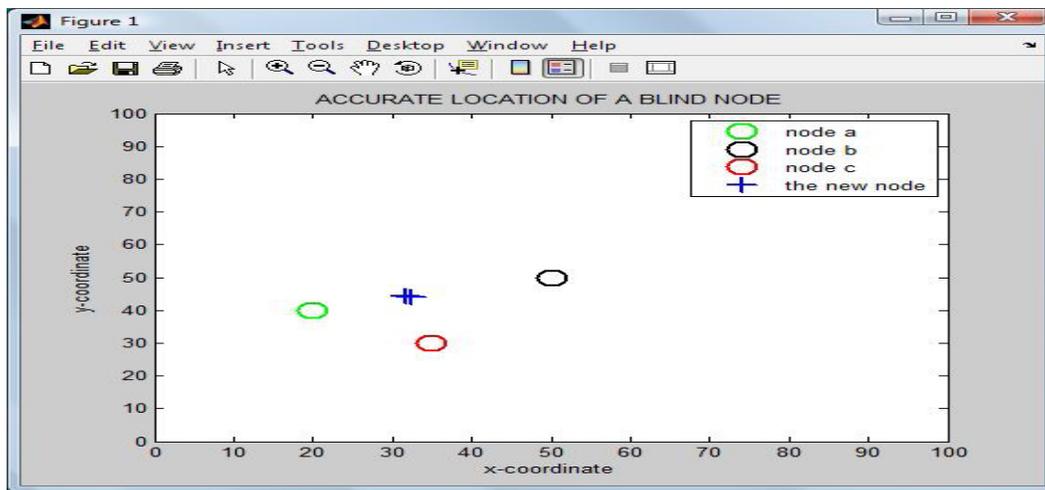


Figure 7: Estimated position of blind node

The distance error between the blind node and anchor node A, anchor Node B and anchor node C are computed to be 0.2m, 0.6m and 1m respectively (14 -13.8, 20 -19.4 and 16 -15). Due to the limited number of nodes available for experiments; assumptions were made to see how anchor density affects the localization error. In the experiment carried out, the Localization errors for three and four anchor nodes for this algorithm

were 0.74m and 0.56m respectively. Hence, it means that with the addition of one anchor node to the three anchor nodes present in the network, the localization error reduces by 0.18. Based on this fact, one assumes to have anchors (N_a= 3, 4, 5, 6, 7) and the localization errors will now be (L_e= 0.74, 0.56, 0.38, 0.20, 0.02). The position errors are shown in figure 8.

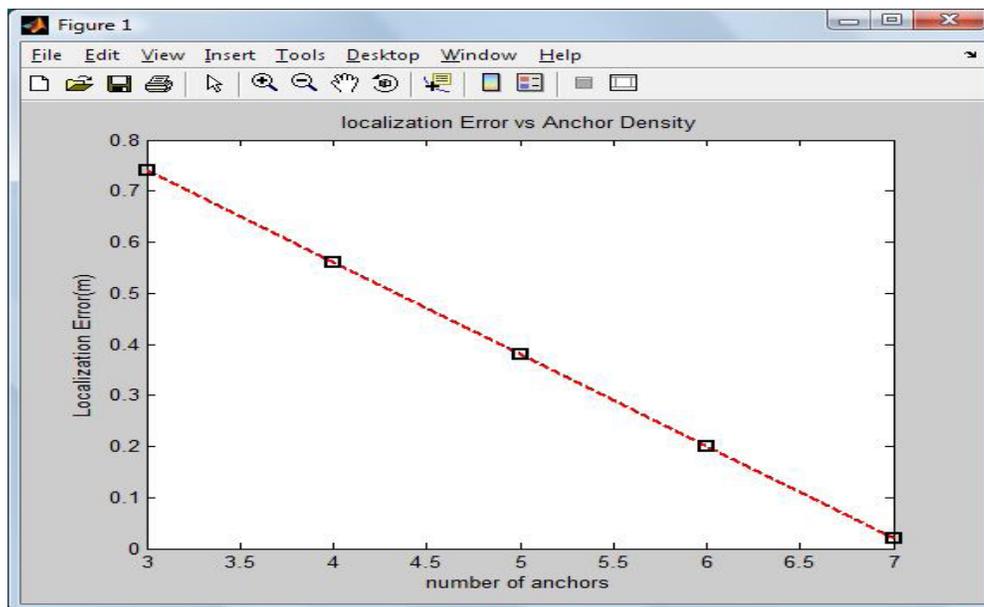


Figure 8: localization Errors vs. Anchor density

From the figure.8 one will notice that as the number of anchor nodes increases the localization error decreases.

Comparative Evaluation

For the proposed algorithm to be evaluated and score high, it has to be compared with an existing algorithm. The proposed algorithm will be compared with the centroid localization algorithm, which is one of the best existing algorithms. Some of the data needed for comparison will be collected experimentally.

Centroid Localization Algorithm

Bulusu, N.Heidemain, J. And Estrin, D. (2000).proposed a range proximity-based,coarse grained localization information that uses anchor beacons, containing location information (x₁,y₁), to execute blind node deposition; where i = 1 ...N. After receiving these beacons, a blind node estimates its location using the following centroid formula.

$$(x_{est}, y_{est}) = \left(\frac{x_1 + \dots + x_N}{N}, \frac{y_1 + \dots + y_N}{N} \right) \tag{1}$$

Some of the reasons of comparing the proposed algorithm with the centroid algorithm are because it is easy to implement and has low computation cost.

Let's still use the experimental data recorded in table 3 as one of the basis for comparison.

In table.3, there are three anchor nodes (anchor A, Anchor B and

Anchor C) with their positions (20, 40), (50, 50) and (35, 30).

To find the position of the blind node, centroid algorithm proposes

That

$$(x_{est}, y_{est}) = \left(\frac{X_1 + \dots + X_N}{N}, \frac{Y_1 + \dots + Y_N}{N} \right) = \left(\frac{20+50+35}{3}, \frac{40+50+30}{3} \right) = (35, 40)$$

But the accurate position of the blind node in the experiment is (32.27, 43.87), the proposed algorithm estimated the blind nodes position to be (31.79, 44.43). Finding the localization error (LE) for the centroid algorithm. It was computed to be 4.73m. While the localization error for the proposed algorithm is 0.74m. This means that the proposed algorithm is quite better than the centroid algorithm when using 3 anchors. Theoretically, the more the anchor nodes in a network the lesser the distant and localization errors accumulated but the trade-off is that it affects the life span of the nodes and is costly.

V. CONCLUSION

A simple localization algorithm for a special class of wireless sensor networks (WSNs) used for long distance infrastructure monitoring was developed. This was achieved through experiment and by characterizing the test bed environment where these sensor nodes will be deployed. A path loss exponent=2.2 was obtained for the test bed environment, this path loss exponent is used as an input parameter to the proposed algorithm which helps in reducing the localization error exhibited by it. The proposed algorithm is shown to have a localization error of 0.74m which is better than 4.73m shown by centroid algorithm for three anchor nodes. From the experiments carried out it was concluded that whenever anchor nodes broadcast packets containing their locations and other sensed parameters, the blind node within the broadcast

range can always estimate its distance to the anchor nodes, and if peradventure the blind nodes receive packets from at least three anchors, the blind node can localize its position and send to sink. Future works should be done in a real pipeline facility. Quite a few numbers of nodes were used during the real time experiment; for future works more nodes should be used for the experiments.

REFERENCES

- [1] Akyildiz, I.F., Su, W., Sankarasubramanian, Y and Cayirci, E (2002). A survey on sensor network, IEEE communication magazine, vol 40, no. 8, Aug. 2002, pp. 102 -114.
- [2] Akyildiz, I.F., Su, W., Sankarasubramanian, Y and Cayirci, E. (2002). Wireless sensor network: A survey, computer networks, vol. 38, no.4, pp 393 – 422.
- [3] Bulusu, N., Heidemann, J. and Estrin, D. (2000). GPS-less low cost outdoor localization for very small devices, IEEE Personal communications magazine, 7(5):28-34
- [4] Business week (1999). 21 ideas for the 21st century, Aug. 30 1999, pp. 78-167.
- [5] Chong, C.Y. and Kumar, S.P (2003). Sensor networks. Evolution opportunities, and challenges, proceedings of the IEEE, Vol. 91. No 8, pp. 1247- 1256
- [6] Chris Savarese and Rabinovich, Jan. (2002). Robots positioning algorithm for distributed ad hoc wireless sensor networks Berkeley wireless research centre.
- [7] Jun zheng and Jamalipour, Abbas (2009). Wireless sensor networks: A networking perspective, IEEE communication magazine.
- [8] Panchapakesan P. and Manjath, D. (2001). On the transmission range in dense ad hoc radio networks. In proc. IEEE signal processing and communication conference.
- [9] Zhao, F. and Guibas, L. (2004). Wireless sensor networks: An information processing approach Morgan Kaufmann publishers, San Francisco

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Particle Size Distribution, Reactivity, Organic Matter and Exchange Properties of Soils from Different Parent Materials in Abia State, Southeastern Nigeria.

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Abstract- Soils derived from different parent materials (PM) exhibit variations in their properties. In AbiaState, soils formed from four contrasting PM were studied to provide information on the variations in their physico-chemical properties. The parent materials were shale (SH), alluvium (AL), coastal plain sands (CPS) and sandstone (SS). From each PM location, eight soil auger samples were randomly collected at 0-20 and 20-40 cm depths totaling 32 soil auger samples from all four PM. Standard procedure was used in the laboratory analysis. SPSS version 20 package was used for statistical analysis. Analysis of variance (ANOVA) for a randomized complete block design was performed to evaluate the influence of PM on soil properties. Correlation analysis was used to determine relationship among soil properties. Soils derived from SH and AL contained more clay (520.00 and 386.00 g/kg, respectively) and less sand (277.00 and 449.50 g/kg, respectively) than the CPS- and SS- derived soils (82.50 and 235.00, respectively for clay and, 644.50 and 887.00 g/kg, respectively for sand). The SH and AL soils were strongly to moderately acidic (pH: 5.40-5.85) while CPS- and SS- derived soils were very strongly to strongly acidic (pH: 4.50-5.13). The acidity of these soils increased with depth. The organic matter (OM) contents of the soils ranged from the lowest of 12.40g/kg in the SS-derived soil at 20-40 cm depth to the highest of 37.70g/kg in the SH-derived soil at 0-20 cm depth. However, soil derived from AL contained the overall highest of OM (35.40g/kg at topsoil +24.30 at subsoil). The exchange properties were higher in soils derived from SH and AL compared to CPS- and SS- derived soils although, the exchange acidity (EA) was higher in the latter soils. Apart from EA which increased with soil depth, all the other exchange properties reduced. For the SH- and AL- derived soils, the sand fraction, more than silt and clay, correlated with pH, OM and the exchange properties whereas for the CPS- derived soil, clay correlated with these soil parameters. For the soil formed from SS, the sand and clay fractions correlated with the parameters better than the silt fraction. It is therefore recommended that practices which will maintain the OM status of the soils as well as reduce acidity of CPS- and SS- derived soils should be adopted. These practices may include mulching, cover cropping, minimum tillage, liming, etc.

Index Terms- Exchange properties, organic matter, parent material, pH, soil depth

I. INTRODUCTION

Soils generally contain the same components (mineral, organic, water and air) (Anon, 2001) but vary in their properties such as texture, organic matter content, pH, etc. (Effiong and Ibia, 2009; Randy and Thompson, 2006; Obasi, 2004). These variations are attributed to changes in soil forming factors and processes occurring in different parent materials under different climatic, topographic and biological conditions over time (Soil Survey Staff 1999; Jaiyeoba, 1996). The cultural and land use practices such as tillage systems, soil amendments, cropping sequences and systems, animal dungs and manures, as well as compaction from grazers or machinery could also be the causes of variations (Oguike and Mbagwu 2009, Hartemink 2003). The variability of soil chemical properties such as organic matter (OM), pH, base saturation, etc. are key factors that affect the health status of soils, thereby determining crop performance.

The type of parent material (PM) in an area determines the predominant mineral and particle sizes of the soil (Ahukaemere *et al.*, 2016; Irmak *et al.*, 2007) and thus confers certain characteristics on the soil which influence its general behavior and use. Typically, soils of Abia State fall within the broad ferrallitic soils of the coastal plain sands (CPS) and escarpment (Abia State Government, 2012). Other soil types within the State include alluvial soils, soils from shale, coastal plain sands, sandstone and soils formed over basement complex (FPDD, 1990). Their physico-chemical characteristics are therefore a reflection of the varied nature of the underlying parent materials which determine the fertility status as well as the agronomic potentials of these soils.

The proper knowledge of the distribution of particle sizes, chemical properties and their variations according to parent materials in a zone is imperative in the determination of the use to which soils of the area may be put (Amusan *et al.*, 2006) as well as the management strategies to be adopted. Therefore the objective of this study was to provide some basic information on the variation and distribution of some physico-chemical properties of soils formed from four parent materials in Abia State, Southeastern Nigeria.

II. MATERIALS AND METHODS

The physical environment and land use

The soils used for this study were collected from locations typical of four parent materials (PM) in Abia State. The parent materials were identified and mapped by the Federal Department

of Agriculture and Land Resources (FDALR, 2005) through a reconnaissance soil survey. The locations were at Ibere (shale - SH), Owerinta (alluvium - AL), Umudike (coastal plain sands - CPS) and Ohafia (sandstone - SS). The distances between locations ranged from 10km to 70km.

Abia State lies within latitudes 5° 25' to 5° 43' N and longitudes 7° 31' to 7° 52' E in Southeastern Nigeria. The climate is tropical with wet and dry seasons. Mean annual rainfall is 2250mm. The rainy season starts in early March and ends in late October while the dry season starts in November and ends in February. A short break in rainfall known as 'August break' is usually experienced in August and may last for about 14 days. Maximum and minimum temperatures are 31°C and 21°C, respectively (NRCRI, 2007). Throughout the year, insolation is high in the area. The area is geomorphologically low-lying, tropical rainforest with moderately high plains and wooded savanna in some places. It has an average elevation ranging from 120 to 180 m above sea level (Abia State Government, 2012).

Farming is done at subsistence level with traditional tools like hoes and machetes. Food crop cultivation dominates the agricultural landscape. The conservation practices include shifting cultivation that involves a one-season cropping followed by a two to four years bush fallow period, multiple cropping, covercropping, mulching and organic manure application. Due to financial constraints of the resource-poor farmers, inorganic fertilizer application is rarely practiced.

Soil sampling

A total of 32 auger soil samples were collected at two depths (0-20 and 20-40cm) from the four PM locations. At Ibere, the sampling location was under a cocoa plantation where plant litter was continually returned to the soil. The sampling location at Owerinta was a vegetable farm by the bank of Imo River interspersed with oil palm trees. The Umudike sampling location was a cassava plot intercropped with cocoa yam while the Ohafia location was a two-year grass fallow land. In each location, soil samples were randomly collected at four different spots. At each spot, six auger samples were randomly taken and bulked to form one composite sample.

Laboratory analysis

The composite soil samples were air dried, and sieved with a 2mm sieve and used for the determination of particle size distribution, soil pH, organic matter, exchangeable bases, and exchangeable acidity. Effective cation exchange capacity was calculated as the sum of the exchangeable bases and exchangeable acidity.

Particle size distribution was by Bouyoucos hydrometer method as outlined by Gee and Or (2002). Soil organic matter was by the method outlined by Nelson and Sommers (1996). Soil pH was determined using a pH meter in a 1:1 soil - water ratio (Hendershot *et al.*, 1993). Exchangeable bases were determined by leaching the soil with neutral ammonium acetate (NH₄OAc). From the leachate, Ca and Mg were determined using the EDTA titration method (Lanyon and Heald, 1984) while K and Na were by flame photometry (Kundsen *et al.*, 1982). Exchangeable acidity (EA) was determined by 1N KCl extraction procedure as described by Thomas (1996).

Statistical analysis

Statistical package used for the analysis was SPSS version 20. Data generated were subjected to analysis of variance (ANOVA) for randomized complete block design (RCBD). Differences between means were detected by least significant difference at 5% probability level (LSD_{0.05}). Correlation was used to determine the relationship among soil properties under the four different parent materials.

III. RESULTS AND DISCUSSION

Particle size distribution

The physico-chemical properties across the parent materials (PM) are shown in Table 1. The values of the particle size distribution indicated that the textural classes were clay at the two depths for shell-derived soil (SH), clay loam (0-20cm) and clay (20-40cm) for alluvium soil (AL) and sandy loam (0-20) and sandy clay loam (20-40cm) for coastal plain sand-derived soil (CPS). For the soil formed over sandstone (SS), the texture was sand (0-20cm) and loamy sand (20-40cm). These variations suggested direct relationship of texture with parent materials (Igwe, 1999).

Soil derived from SS contained more sand than the other soils with values of 887.00g/kg at 0-20cm and 852.00g/kg at 20-40cm depths while the soil formed over SH contained the least (277.00g/kg at 0-20cm and 337.00g/kg at 20-40cm depths). At 0-20cm depth, the sand fraction was significantly ($P \leq 0.05$) different across the PM while at 20-40cm it was statistically different only in CPS- and SS- derived soils but similar in soils of SH and AL origins. For the silt fraction, soil formed from SH had the highest at both depths (203.00g/kg at 0-20cm and 337.00g/kg at 20-40cm). The decreasing order according to PM was SH > AL > CPS > SS. However silt contents were statistically similar in soils derived from SH, AL and CPS at both depths. With regard to clay fraction, significant ($P \leq 0.05$) variation was observed. Soil derived from SH had the highest values of 520.00 and 480.00g/kg at 0-20cm and 20-40cm depths, respectively. The clay fraction of the SH-derived soil was significantly ($P \leq 0.05$) higher than those of AL, CPS and SS soils at both depths whereas soil derived from SS had the lowest. Apart from the SH-derived soil where reduction in clay content with depth was observed, the other soils derived from AL, CPS and SS increased in clay content with depth. These results were in consonance with the observations of other researchers. Obasi (2004) reported similar results where sand contents of soils derived from SS and CPS were higher than those formed from SH. In the present study, observation of high clay and silt contents in the SH-derived soil corroborated the reports of Chikezie *et al.* (2009) and Oguike and Henshaw (2013) that the clay and silt fractions of soils from SH were above 30 and 15%, respectively. The increase in finer particles with depth as observed in the AL, CPS and SS may be as a result of very high leaching and illuviation processes common in humid tropics (Mbagwu, 2003) due to high rainfall. Leaching was unlikely with respect to soil derived from SH due to their dense and poor subsurface drainage nature (Soil Survey Report, 2009) reflected in high clay content.

Table 1: Physico-chemical properties of soils formed from diverse parent materials in Abia State

Properties	Values					Values				
	SH	AL	CPS	SS	LSD _{0.05}	SH	AL	CPS	SS	LSD _{0.05}
	0 – 20 cm					20 – 40cm				
Sand g/kg	277.00	449.50	704.50	887.00	127.20	337.00	384.50	644.50	852.00	61.00
Silt ::	203.00	164.50	143.00	30.50	75.90	188.00	172.00	120.50	43.00	75.30
Clay ::	520.00	386.00	152.50	82.50	39.60	480.00	433.50	235.00	105.00	52.20
pH (H ₂ O)	5.85	5.68	5.13	4.78	0.27	5.50	5.40	4.73	4.50	0.20
OM (g/kg)	37.70	35.40	31.50	23.70	11.70	19.80	24.30	20.90	12.40	4.50
Ca (Cmol/kg)	13.10	10.55	3.98	2.90	1.57	8.80	6.20	2.85	2.05	0.52
Mg ::	6.38	5.05	2.45	1.60	2.15	4.95	3.55	1.55	1.00	0.44
K ::	0.23	0.22	0.15	0.09	0.02	0.20	0.20	0.12	0.08	0.59
Na ::	0.18	0.16	0.11	0.07	0.03	0.14	0.14	0.09	0.05	0.59
EA ::	0.32	0.41	1.19	1.70	0.13	0.50	0.57	1.78	2.09	0.29
ECEC	20.20	16.39	7.86	6.36	2.08	14.95	10.65	6.65	5.27	0.75

SH=shale, AL=alluvium, CPS=coastal plain sands, SS=sandstone, LSD_(0.05)= least significant difference at 0.05 level of confidence, OM=organic matter, Ca=calcium, Mg=magnesium, K=potassium, Na=sodium, EA=exchangeable acidity, ECEC=effective cation exchange capacity.

pH and organic matter

The result presented in Table 1 showed that pH and OM varied with the parent materials. Soils derived from SH and AL were lower in acidity and higher in OM than those formed from CPS and SS probably due to the higher contents of finer particles such as clay and silt in the former than the latter. The high clay and OM contents buffer the soil against changes in pH. The soil formed from SS was the most acidic while SH- derived soil was the least acidic. At 0-20cm and 20-40cm depths, pH values ranged from 4.78 to 5.85 and 4.50 to 5.50, respectively. These values were considered very strongly acidic to moderately acidic in reaction (Enwezoret *al.*, 1989). Some researchers had previously reported higher values of pH and OM in fine textured soils than in coarse ones (FAO, 2015; Adeleye *et al.*, 2010). The pH of the soils from the various PM decreased with depth. Similar results where pH values of soils derived from SH, AL, CPS and SS decreased with depth had been reported (Obasi, 2004). The pH of soils derived from SH and AL were statistically similar at both depths but significantly ($P \leq 0.05$) different from those of CPS- and SS- derived soils which were also significantly ($P \leq 0.05$) different from each other. The higher pH observed in the soils derived from SH and AL compared to the CPS- and SS-derived soils was possibly due to reduced leaching intensity and mineral weathering occasioned by higher colloidal presence in the former soils. The higher contents of OM in the finer textured soils may have resulted to higher concentrations of exchangeable cations, reflected in the higher contents of Ca, Mg, K, capable of reducing acidity in these soils. The increase in exchangeable cations was probably a result of microbial decarboxylation of OM in these soils (Natsher and Schwetnmann, 1991) which may have resulted to an increase in ion exchange reaction (Dikinya and Mufwanzala, 2010) leading to the higher pH values in the soils formed from SH and AL. This observation affirmed the earlier findings of Onwuet *al.* (2014) that soils with high OM contents were less acidic than those with low OM. However, this observation disagreed with Obasi (2004) who reported that soils with higher OM contents had lower pH compared to soils with lower OM contents.

The organic matter (OM) contents of these soils varied, ranging from 12.4g/Kg in the soil formed from sand stone (20-40cm) to 37.7g/Kg in the SH-derived soil (0-20cm) (Table 1). The values were considered high with soil derived from AL containing the overall highest (35.40g/kg at topsoil +24.30 at subsoil). Across parent materials, OM decreased with depth. At both depths, the OM contents of the soils derived from SH, AL and CPS were statistically similar. However, the OM content of soil derived from SH was significantly ($P \leq 0.05$) higher than that of soil derived from SS. In this study, the higher OM contents of soils derived from SH, AL and CPS compared to SS-derived soil corroborated (Obasi, 2004) who made similar observation. With regard to the SH- and AL-derived soils, the higher OM contents observed could be attributed to their fine textures and probably poor aeration status (FAO, 2005). The fine clay-sized particles protected the associated OM against microbial decomposition (Yuan and Theng, 2012). Also, litter fall (Hirabuki, 1991) common in the SH environment and prolonged saturation and anaerobic conditions (Randy and Thompson, 2006) in the AL environment may have contributed to the high OM

contents. Contrarily, in the coarse textured soils, the rapid decomposition of OM (FAO, 2005), annual burning of vegetation (Debano, 1990) by farmers in the area and high leaching potentials of sandy soils could also be responsible for the lower OM content in the SS- derived soil. The influence of PM on OM is derivable from their control of texture. This can be explained by the characteristics of the different sized particles. Sandy soils are well aerated, tending towards low moisture content which favours low OM contents. On the other hand, clayey soils are less aerated, higher in micro pores with tendency towards higher moisture retention and therefore, higher OM content. Some researchers had earlier reported coarse textured soils to be characteristically low in OM content (Oguike and Ndifreke, 2016, Myravarapuet. *al.*, 2014; Onunkwoet *al.*, 2013; Kauret *al.*, 2002).

Exchange properties

The variations in the exchange properties were controlled by the parent materials of the soils studied (Table 1). Soils derived from SH and AL contained higher concentrations of exchangeable bases and ECEC with a lower concentration of EA than soils derived from CPS and SS. Some researchers had previously shown that fine-textured soils contained higher concentrations of exchangeable bases and ECEC compared to soils with coarse textures (Soil Quality, 2016; Onunkwoet *al.*, 2013; Filipek, 2011; Van Erpet *al.*, 2001). A general decline of exchangeable bases with depth was observed. At the two depths, the exchangeable bases in the soils followed the descending order of $SS < CPS < AL < SH$. The exchangeable Ca in the soils were significantly ($P \leq 0.05$) different from each other at 20-40cm depth whereas at 0-20cm depth, it was statistically the same in soils derived from CPS and SS. Soil derived from SH had the highest concentration of exchangeable Mg while SS- derived soil had the lowest. The exchangeable Mg concentration at 0-20cm depth in SH- and AL- derived soils were statistically the same but significantly ($P \leq 0.05$) higher than those formed from CPS and SS which were as well statistically similar. At 20-40cm depth, Mg in the soils significantly ($P \leq 0.05$) differed from one another. Exchangeable K varied across the parent materials. The highest and the lowest values were observed in soils derived from SH and SS, respectively. However, at 0-20cm depth, K concentration in soils formed from SH and AL were statistically similar but differed significantly ($P \leq 0.05$) from CPS and SS soils which were also statistically different from each other. At 20-40cm depth, K concentrations in the soils were statistically similar. With regard to Na, the concentration at 0-20cm depth in soil derived from SH and AL were statistically the same but significantly ($P \leq 0.05$) higher than those of CPS and SS soils which were also significantly ($P \leq 0.05$) different. At 20-40cm depth, Na concentration in the soils was statistically the same. Soils derived from CPS and SS were considered to be of low base status (Enwezoret *al.*, 1989) while soils derived from SH and AL were of high base status. The high concentration of exchangeable bases in soils of SH and AL origins may be due to the high contents of colloidal materials such as clay and OM in these soils (Table 1) (Filipek, 2011). Across the depths, exchangeable acidity (EA) in soil derived from SH and AL were statistically the same but significantly ($P \leq 0.05$) lower than those

of CPS and SS soils which were significantly ($P \leq 0.05$) different (Table 1). The EA was observed to increase with depths. This observation was inconsistent with the report of Obasi (2004) who stated that the EA of soils derived from diverse PM reduced with depths. At both depths of 0-20 and 20-40cm, respectively, soils derived from SH held the highest amount of cations (20.20 and 14.95Cmolkg^{-1}) at the exchange complex while the SS soil held the lowest (6.36 and 5.27Cmolkg^{-1}). However, at 0-20cm depth, ECEC of soils derived from CPS and SS were statistically similar but significantly ($P \leq 0.05$) lower than those of SH and AL soils which were significantly ($P \leq 0.05$) different from each other. At 20-40cm depth, ECEC of the soils were significantly ($P \leq 0.05$) different from one another. The lower values of ECEC observed in soils derived from CPS and SS compared to SH and AL soils were expected because sandy soils are known to have lower ECEC compared to clayey soils (Soil Quality, 2016). This may be as a result of the low aggregation due to the low concentration of basic cations (Mbagwuet *al*, 2004) common to sandy soils.

The results of this study, where values of ECEC were observed to be higher in the SH and AL soils than those of CPS and SS origins, confirmed that soils with high sand contents are usually low in ECEC (Mbagwuet *al*, 2004). However, this observation disagreed with Obasi (2004) who reported ECEC values in soils derived from SS to be higher than soils of SH and AL origins.

Correlation of soil physico-chemical properties

The correlations of the soil properties studied are shown in Tables 2 – 5. In the SH-derived soil (Table 2), sand fraction negatively correlated with the clay fraction, pH, OM and the exchange properties, and positively with EA. Therefore, the sand fraction reduced with increase in these soil properties but only increased with increase in EA. Silt fraction only correlated positively with OM and showed no significant correlation with the other soil properties. The clay fraction positively correlated only with Mg, and negatively with EA.

Table 2: Correlation matrix of soil physicochemical properties derived from Shale

	Sand	Silt	Clay	pH	OM	Ca	Mg	K	Na	EA	ECEC
	← g/kg →			(H ₂ O)	(g/kg)	← (Cmol/kg) →			→		
Sand (g/kg)	1										
Silt ..	-.341	1									
Clay ..	-.914**	-.069	1								
pH (H ₂ O)	-.846**	.460	.699	1							
OM ..	-.821*	.709*	.565	.921**	1						
Ca (Cmol/kg)	-.802*	.549	.615	.876**	.933**	1					
Ng ..	-.818*	.340	.722*	.851**	.867**	.954**	1				
K ..	-.714*	.699	.457	.925**	.935**	.869**	.772*	1			
Na ..	-.843**	.634	.621	.943**	.976**	.923**	.867**	.954**	1		
EA ..	.924**	-.548	-.744*	-.915**	-.946**	-.937**	-.913**	-.897**	-.966**	1	
ECEC ..	-.809*	.500	.643	.876**	.923**	.997**	.974**	.851**	.915**	-.937**	1

** Correlation is significant at 0.01 level (2-tailed).
* Correlation is significant at 0.05 level (2-tailed).

As shown in Table 2, sand fraction influenced pH, OM and the exchange properties more than they were influenced by clay and silt fractions. The soil pH was observed to correlate positively with these properties but was negatively correlated with EA. Generally, there was observable positive correlation among the soil properties but with EA always negatively correlating with the others.

For the AL-derived soil (Table 3), sand fraction negatively correlated with pH, OM and the exchange properties but positively correlated with EA. This indicated that EA increased with increase in sand fraction. This may be as a result of low basic cations attached to sand fractions. The silt fraction did not

show correlation with the soil properties studied and so did not influence them. Soil pH correlated with all the properties but not with Na and silt fraction. The OM correlated with the soil properties other than silt and clay fractions. The exchange properties were correlated, though they revealed negative correlation with EA. The clay fraction of the CPS-derived soil (Table 4) positively correlated with the soil properties but negatively with EA. Except for the sand fraction which correlated positively with Na, together with clay, they showed no correlation with the other properties. There was a general correlation of pH, OM and the exchange properties.

Table 3: Correlation matrix of soil physicochemical properties derived from Alluvium

	Sand	Silt	Clay	pH	OM	Ca	Mg	K	Na	EA	ECEC
	← g/kg →			(H ₂ O)	(g/kg)	← Cmol/kg →			→		
Sand (g/kg)	1										
Silt ..	-.450	1									
Clay ..	-.768*	-.226	1								
pH (H ₂ O)	.862**	-.176	.814*	1							
OM ..	.765*	-.330	.598	.779*	1						
Ca (Cmol/kg)	.816*	-.114	.808*	.863**	.938**	1					
Ng ..	.817*	-.095	.823*	.920**	.913**	.984**	1				
K ..	.722*	-.044	.756*	.776*	.884**	.967**	.953**	1			
Na ..	.429	.000	.467	.588	.749*	.803*	.801*	.904**	1		
EA ..	-.893**	.268	-.782*	-.965**	-.891**	-.923**	-.941**	-.820*	-.610	1	
ECEC ..	.813*	-.104	.812*	.876**	.933**	.999**	.991**	.969**	.811*	-.926**	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 4: Correlation matrix of soil physicochemical properties derived from CPS

	Sand	Silt	Clay	pH	OM	Ca	Mg	K	Na	EA	ECEC
	← g/kg →			(H ₂ O)	(g/kg)	← Cmol/kg →			→		
Sand (g/kg)	1										
Silt ..	-.577	1									
Clay ..	-.687	-.198	1								
pH (H ₂ O)	.331	.429	.779*	1							
OM ..	.702	-.019	.826*	.472	1						
Ca (Cmol/kg)	.527	.346	.940**	.918**	.769*	1					
Ng ..	.353	.414	.792*	.739*	.698	.872**	1				
K ..	.430	.401	.872**	.846**	.773*	.956**	.915**	1			
Na ..	.818*	-.080	.910**	.776*	.674	.855**	.676	.754*	1		
EA ..	-.573	-.290	-.946**	-.838**	-.808*	-.966**	-.834*	-.905**	-.820*	1	
ECEC ..	.412	.412	-.861**	.859**	.717*	.950**	.970**	.965**	.776*	-.882**	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Table 5 revealed correlation among the properties of the soil derived from SS. The EA exhibited negative relationship with all the properties except in its relationship with silt which was positive. The sand fraction and Ca mostly correlated with all the other soil properties. The sand fraction decreased as the clay and silt fractions increased. The sand fraction also increased with increase in pH, OM and the exchange properties but decreased with increase in EA.

These correlations indicated that increasing OM content of soil will reflect in an increase in its base status. The results of the correlation analyses corroborated the observations of Adeleye *et al.*

(2010) and Grichs (1990) who reported that enhanced OM contents in soils increased their exchangeable bases. Reports had shown that the exchangeable bases of soils varied with the OM fractions (Oortset *et al.*, 2003), soil texture (Van Erpet *et al.*, 2001) and soil pH (Katou, 2002). Perhaps, certain pedogenic and anthropogenic conditions (not investigated in this study) such as illuviation and soil erosion, respectively (Filipek, 2011, Favre *et al.*, 2002), may also be sources of variation.

Table 5: Correlation matrix of soil physicochemical properties derived from Sandstones

	Sand	Silt	Clay	pH	OM	Ca	Mg	K	Na	EA	ECEC
	← g/kg →			(H ₂ O)	(g/kg)	← (Cmol/kg) →					
Sand (g/kg)	1										
Silt	-.830*	1									
Clay	-.934**	.575	1								
pH (H ₂ O)	.788*	-.673	.724*	1							
P(Mg/kg)	.898**	-.674	.883**	.765*							
OM	.743*	-.782*	.589	.718*	1						
Ca (Cmol/kg)	.989**	-.856**	.902**	.797*	.738*	1					
Ng	.805*	-.520	.846**	.456	.375	.819*	1				
K	.808*	-.647	.770*	.870**	.662	.829*	.505	1			
Na	.867**	-.845**	.730*	.891**	.768*	.909**	.574	.927**	1		
Ea	-.979**	.773*	-.939**	-.810*	-.799*	-.963**	-.797*	-.781*	-.846**	1	
ECEC	.910**	-.698	.886**	.611	.514	.932**	.965**	.675	.753*	-.879**	1

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Tables 2, 4 and 5 showed significant ($P \leq 0.01$; 0.05) negative relationship of EA with exchangeable bases in soils derived from SH, CPS and SS, while in soils derived from AL (Table 3), EA correlated negatively and significantly ($P \leq 0.01$) with Ca, Mg and K only. However, it showed no significant relationship with Na in soil derived from AL. These results indicated that increase in the basic cations reduced EA of these soils. The availability of Ca and Mg in soils had been reported to reduce EA by neutralizing Al in the soils (Mbagwuet *al.*, 2004). Tables 2 to 5 showed a positive correlation between ECEC and OM as well as ECEC and exchangeable bases in the soils studied. In SH derived soil (Table 2) ECEC positively correlated significantly ($P \leq 0.01$) with OM as well as with exchangeable bases. Similar positive significant ($P \leq 0.01$) correlation in AL-derived soil was observed (Table 3). In soil derived from CPS, ECEC also positively correlated significantly ($P \leq 0.01$) with OM and exchangeable bases (Table 4) whereas Table 5 showed positive significant ($P \leq 0.01$, 0.05) correlation of ECEC only with Ca, Mg and Na for SS- derived soil. There was no significant correlation of ECEC with K though the relationship was positive. These results implied that the ECEC of the soils studied varied according to the OM content (Oortset *al.*, 2003), the concentration of exchangeable bases and soil texture (Van Erp *et al.*, 2001).

IV. CONCLUSION

The results from this study indicated that soils derived from SH and AL were less acidic with higher contents of OM, higher concentrations of basic cations, and ECEC compared to the soils of CPS and SS origins. These were attributed to the former's higher clay contents compared to the latter. The condition of lower clay and silt contents as well as higher sand content in soils of CPS and SS made them very prone to the leaching of basic cations, and thus more acidic. However, it is recommended that practices such as mulching, cover cropping, minimum tillage, etc. that will enhance OM contents of these soils should be adopted. These will stabilize soil aggregates and

thus reduce leaching in CPS- and SS-derived soils while enhancing the properties of SH and AL soils for sustainable agriculture. Liming will be useful in checking the acidity problems of CPS and SS soils.

REFERENCES

- [1] Abia State Government (2012): About Abia State. Federal Republic of Nigeria. Retrieved from <https://www.abiastate.gov.ng/state>. On 15th 2015.
- [2] Adeleye, E.O., Ayeni, L.S. and Ojeniyi, S.O. (2010). Effect of poultry manure on soil physico-chemical properties, leaf nutrient contents and yield of yam (*Dioscorea rotundata*) on Alfisol in Southwestern Nigeria. *J. Am. Sci.* 6(10): 871-878.
- [3] Anon, (2001). Components and properties of soils. Instructional Materials Service. College station. A and M University, Texas. 8382: 1-12. Retrieved from www-ims.tamu.edu.
- [4] Ahukaemere, C.M, Onweremadu, E.U, Ndukwu, B.N and Nkwopara U.N. (2016). Properties of soils of contrasting lithosequences in Southeastern Nigeria. *FUTO. J. Series. Vol. 2(1)*. 48-56.
- [5] Amusan, A.A., Shitu, A.K., Makinde, W.O. and Orewole, O. (2006). Assessment of changes in selected soil properties under different land use in Obafemi Awolowo University Community, Ile Ife. *Electron J. of Environ. And Agric Food Chain*. 5(1): 1178-1184.
- [6] Chikezie, I. A., Eswaran, H., Asawalam, D. O. and Ano, A. O. (2009). Characterization of two benchmark soils of contrasting parent materials in Abia State, southeastern Nigeria. *Global Journal of Pure and Applied Sciences*. 16(1): 163-175.
- [7] Debano, L.F. (1990). The effect of fire on soil properties. A paper presented at the symposium on management and productivity of western-montane forest soils. Retrieved from www.forest.moscowsl.wsu.edu/smp. On 5th Feb. 2015.
- [8] Dikinya, O. and Mufwanzala, N. (2010). Chicken manure-enhanced soil fertility and productivity: Effects of application rates. *Journal of Soil Science and Environmental Management*, 1 (3): 46-54.
- [9] Effiong, S.G and Ibia, O.T. (2009). Characteristics of some river flood plain soils for crop production in south-eastern Nigeria. *Agric. J.* 4(2): 103-108
- [10] Enwezor, W.O., Ohiri, A.C., Opuwaribo, E.E and Udo, E.J. (1989). A review of fertilizer use on crops in southeastern zone of Nigeria. Fertilizer Procurement, Federal Min. of Agric. Water Res. and Rural Development, Lagos, Nigeria. 1: 53-100
- [11] FAO. (2005). Importance of soil organic matter: key to drought resistant soils and sustainable food production, Soil Bulletin, Issue 80. FAO
- [12] FAO. (2015). Soil properties. FAO soil portal. Available at www.fao.org/soil-portal Retrieved on 3rd Feb. 2016.

- [13] Favre F., Tessier, D., Abdelmoula M., Genin, J. M. Gates, W. P. and Boivin, P. (2002). Iron reduction and changes in cation exchange capacity in intermittently waterlogged soil. *European Journal of Soil Science*. 53(2): 175 – 183.
- [14] FDALR (2005). Federal Dept. of Agriculture and Land Resources. Soil Map of South Eastern Nigeria. FDALR, Owerri.
- [15] FPDD, (1990): Fertilizer procurement and distribution: a literature review on soil and fertilizer use research. In: literature review on soil fertilizer investigation in Nigeria. Produced by the fertilizer procurement and distribution division. Fed. Min. of Agric & Rural Development, Lagos Nig. P 460.
- [16] Filipek, T. (2011). Liming effects on soil properties. *Encyclopedia of Agrophysics*. 490-500.
- [17] Gee, G.W. and Or, D. (2002). Particle size analysis. In: Methods of soil analysis, part 4, physical methods, Dane, J.H. and G.C. Topp (eds.). ASA and SSSA, Madison, WI, pp 255-293.
- [18] Grichs, D.I. (1990). Biological and organic aspects of plant nutrition in relation to needed research on tropical soils. Seminar on tropical soils. IITA, Ibadan, Nigeria.
- [19] Hartemink, A. E. (2003). Soil fertility decline in the tropics – with case studies on plantations. CAB International. Wallingford, U.K.
- [20] Hendershot, W.H., Lalonde, H and Duquette, M. (1993). Soil reaction and exchangeable acidity. In: soil sampling method of analysis, Carter, M.R. (Ed) Lewis publishers, Boca Raton, Fl., pp: 141-145.
- [21] Hirabuki, Y. (1991). Heterogeneous disposal of tree litter fall corresponding with patchy canopy structure in a temperate mixed forest. *Vegetatio*. 94: 69-79
- [22] Igwe, C. A. (1999). Land use and soil conservation strategies for potentially highly erodible soils of central- eastern Nigeria. *Land Degradation Development* (10): 425-434.
- [23] Irmak, S. Surueu, A.K and Aydogdu, L.H. (2007). Effect of different parent materials on mineral characteristics of soils in the Arid Region of Turkey. *Pakistan J. of Bio.Sciences*. 10(4): 528-536.
- [24] Jaiyeoba, I.A. (1996). Variation of soil chemical properties over Nigerian savanna. *Singapore Journal of Tropical Geography*. 16 (2): 141-157.
- [25] Katou H. (2002). A pH-dependence implicit formulation of cation- and anion-exchange capacities of variable-charge soils. *Soil Science Society of America Journal*, 66(4): 1218–1224.
- [26] Kaur, R., Sandar, S. and Gurung, H.P. (2002). Evaluation of pedotransfer functions for predicting field capacity and wilting point soil moisture contents from routinely surveyed soil texture and organic carbon data. *J. of Indian Society of Soil Sc.* 5: 205-208.
- [27] Kundsén, D., Peterson, G. A. and Pratt, P. F. (1982). Lithium, Sodium and Potassium. In: Page, A. L. (ed) Methods of Soil Analysis part 2. Monograph No. 9. Am. Soc. Agron. Madison, WI. 241-262.
- [28] Lanyon, L. E. and Heald, W. R. (1984). Magnesium, Calcium, Strontium and Barium. In: Page, A. L. (ed) Methods of Soil Analysis part 2. Monograph No. 9. Am. Soc. Agron. Madison, WI. 247-262.
- [29] Mbagwu, J. S. C. (2003). Aggregate stability and soil degradation in the tropics. Public lecture. Dept. of Soil Science, University of Nigeria, Nsukka. Pp 247-252.
- [30] Mbagwu J. S. C., W. I. E. Chukwu and Bazzofi, P. (2004): Intrinsic soil component influencing the water stability of aggregates: a principal component analysis. *J. Sustainable Agric. Environ.* 6(1) 63-76.
- [31] Myravarapu, R., Mitchel, C.C. and Savoy, H.J. (2014). Soils of the southeastern US. In: soil test methods from the southeastern United States. Southern Cooperative Series Bulletin. No. 419.
- [32] Nelson, D. W. and Sommers L. E. (1996). Total Carbon, Organic Carbon and Organic Matter. In: Methods of Soil Analysis Part 3-Chemical Methods. Sparks, L.D. (Eds). SSSA Book Series 5, Madison, Wisconsin, USA. Pp. 961-1010.
- [33] NRCRI. (2007). National Root Crops Research Institute, Umudike. Meteorological Station.
- [34] Natsher, M. and Schwetnmann, N. (1991). Proton buffering in organic horizons of acid forest soils, *Geoderma*, 48: 93-106.
- [35] Obasi, M.N (2004): Spatial variability of soil chemical properties in selected soils of diverse parent materials of south eastern Nigeria. *Proceedings of the 37th Annual Conf. of Agric. Soc. Of Nig.* 340-344.
- [36] Oguike, P. C. and Henshaw, I. E. (2013) Evaluation of water retaining and conducting characteristics, aggregate stability and bulk density of cocoa growing soils in Ikwuano, Abia State, Nigeria. *International Journal of Agriculture and Rural Development*. 16(1): 1342-1347.
- [37] Oguike, P. C. and Mbagwu, J. S. C. (2009). Variations in some physical properties and organic matter content of soils of coastal plain sand under different land use types. *World Journal of Agricultural Sciences*. 5(1): 63-69.
- [38] Oguike, P.C. and Ndifreke, N. S. (2016). Variations in soil aggregate stability and organic matter contents in soils derived from diverse parent material in Abia State, Nigeria. *Nigerian Journal of Soil and Environmental Research* (14): 12-20.
- [39] Onunkwo, A. A., Obioha, Y.E. and Oha, I.A. (2013). Structural and land cover mapping of Ohafia area, south eastern Nigeria. Using remote sensing technique. *Intl. J of Engineering Trends and Development*. 3 (6): Pp8.
- [40] Onwu, A.C., Abubakar, J.R. and Unah, P.O. (2014). Effect of poultry manure on growth, yield of Okra and soil properties in Makurdi, North Central Nigeria. *Intl. J. of Agric. and Food Sc.* 4(1): 9-12.
- [41] Oorts K, Vanlauwe B, and Merckx R. (2003). Cation exchange capacities of soil organic matter fractions in a Ferric Lixisol with different organic matter inputs. *Agriculture, Ecosystems & Environment*, 100(2-3): 161–171.
- [42] Randy, K.K. and Thompson, J.A. (2006). Wetland geomorphology, soils and formation processes. In: Ecology of freshwater and Estuarine wetlands. University of California Press. Pp 7-20.
- [43] Soil Quality (2016). Soil quality for environmental health. Available at www.soilquality.org/indicators. Retrieved on 25th May 2015.
- [44] Soil Survey Report (2009). Soils and their interpretations. USDA. Soil Conservation Service (Digitized). 28-30.
- [45] Soil Survey Staff. (1999). Soil Survey Manual. USDA handbook, No. 18.
- [46] Thomas, G.W. (1996). Soil pH and soil acidity. In: Method of soil analysis, Part 3- Chemical method. Sparks, L.D. (Ed). SSSA Book Series 5, Madison, Wisconsin, USA. Pp. 475-490.
- [47] Van Erp P. J., Houba, V. J. G. and van Beusichem, M. L. (2001). Actual cation exchange capacity of agricultural soils and its relationship with pH and content of organic carbon and clay. *Communications in Soil Science and Plant Analysis*, 32(1-2): 19–31.
- [48] Yuan, G. and Theng, B.K.G. (2012). Clay-organic interactions in soil environments. In: Huang, P.M., Li, Y., and Sumner, M. E. (2012). Handbook of soil science, resource management and environmental impacts. 2nd edn.

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Model Development of Evaporative Water Cooling (EWC) grinding system for improving grinding quality of spices

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Abstract- Study on the Evaporative Water Cooling (EWC) grinding was performed by the use of a new model development as the novelty of spice grinding industry in order to control the temperature increase during grinding due to size reduction inside the grinder. The developed Evaporative Water Cooling grinding process consisted of three main units, namely water atomizing unit, dehumidified air supplying unit and grinding unit with vibratory hopper. The water atomizing unit is a cooling device designed of other sub parts, namely water pressure pump and knapsack nozzle, produced atomized water vapor in to the grinding system. The function of the water atomizing unit of Evaporative Water Cooling grinding system is to absorb the heat, which is generated due to the size reduction process during grinding. In this experiment, comparative study in between the conventional grinding and Evaporative Water Cooling grinding with different water rates was done for obtaining analytical results in terms of retention capsaicin content, final moisture content, temperature increase/decrease during grinding, water activity of final product, final product color and specific energy consumption. The tests based on the MI-2 chili variety revealed that it could be successfully ground at a feed rate of 30 kg/hr, reducing the temperature by 12 ± 1.53 degrees under the water spray rate of 2.1kg/hr. The maximum Capsaicin recovery was yield by 15% higher than the conventional grinding. The water activity in all the Evaporative Water Cooling grinding samples are within the allowable range and specific energy consumption is non-significant among both trials; the Evaporative Water Cooling grinding and the conventional grinding. The study indicated that the Evaporative Water Cooling Grinding is considerably influenced by the grinding properties among the parameters studied.

Index Terms- Spice grinding, Evaporative water cooling, Quality of spices

I. INTRODUCTION

Use of spices has a valuable greater history compared to any other matters used by the human. Viuda-Martos et al, 2011 reveal that the history, the date back to 5000 BC documentarily evidence has been found on the use of thyme which is one of spices by the Sumerians. In 2000 BC a precursor of curry was used in India, while Egyptian papyrus from 1555 BC mention the use of coriander, funnel, juniper, cumin, garlic and thyme and dried mint dating from 1000 BC has been found in pyramids from the same country (Block, 1986).

Spices are very important part of preparation of meals among all over the culture of the world. Spices and aromatic herbs have been used since antiquity as preservatives, colorants, and flavor enhancers. Spices have long have been the basis of traditional medicine in many countries, have also been the subject of study, particularly by the chemical, pharmaceutical, and food industries, because of their potential use for improving health. Both in vitro and in vivo studies have demonstrated how these substances act as antioxidants, and hypolipidemics and show antibacterial, anti-inflammatory, antiviral, and anticancerigenic activities. These beneficial physiological effects may also have possible preventative applications in a variety of pathologies. The aim of this review is to present an overview of the potential of spices and aromatic herbs as functional foods (Viuda-Martos et al, 2011).

Spice milling is an ancient industry, akin to the cereal milling industry, with the difference that in spice grinding there are additional problems of the volatility of essential oils naturally present therein (Pruthi, 1980). As a result in 1998, a cryogenic grinding system has been designed and developed to cool the spices before feeding to the grinder and also maintain the cryogenic temperature in the grinding zone by Singh and Goswami. Study on ambient and cryogenic grinding was performed to test the novelty of cryogenic grinding and pin point the drawbacks of ambient grinding. Comparative study had shown that ambient grinding need more power (8.92%) and specific energy (14.5%) than cryogenic grinding. Particle size analysis had shown that cryogenic grinding produced coarser particles. Comparative study of energy law constant shows that ambient is more power consumptive. The higher amount of volatile oil (2.15 ml/100 g) content was found in cryogenic grinding and also powder of freshness and lower whiteness (40%) and higher yellowness (14%) indices found for cryogenic grinding (Meghwal and Goswami, 2010).

In this design study, the alleviation of heat stress in grinding chamber have been tried of lowering by the latent heat of vaporization of water whereas dehumidified air was being a facilitator to drag out of moist air from the system. Evaporative cooling is based on a physical phenomenon in which evaporation of a liquid usually water into surrounding air cools an object or a liquid in contact with it. As the liquid turns to a gas, the phase change absorbs heat. Technically, this is called the "latent heat of evaporation". Water is an excellent coolant because it is plentiful, non toxic and evaporates easily in most climates.

Besides, chilli (*Capsicum Annum L.*) was used to test the system because it is an important spice providing pungent, color and appetizing effect to the cousins and various factors affect the stability of capsaicin which is identified as the primary pungent principle in Capsicum fruits with $C_{18}H_{27}NO_3$ molecular formulae. And less research carried out on it is also the basis for selecting chilli as the raw material in this study. It was important to find out the chemical characteristic of Capsaicin selecting for chemical analysis procedure. According to the PubChem data base of U.S National Library of Medicine, United states, it is stated that the color of Capsaicin is pure dark red and solid base. It is highly volatile and the melting and the boiling points are 210-220°C and 65°C respectively. Moreover Capsaicin is insoluble in water by 28.93 mg/L around 25°C (Lewis, 2012 and O'Neil, 2013).

II. DESIGN AND DEVELOPMENT

The evaporative water cooling unit consisted of three main units, namely water atomizing unit, dehumidifier air supplying unit and grinding unit with vibratory hopper. The schematic diagram is shown in figure 1.

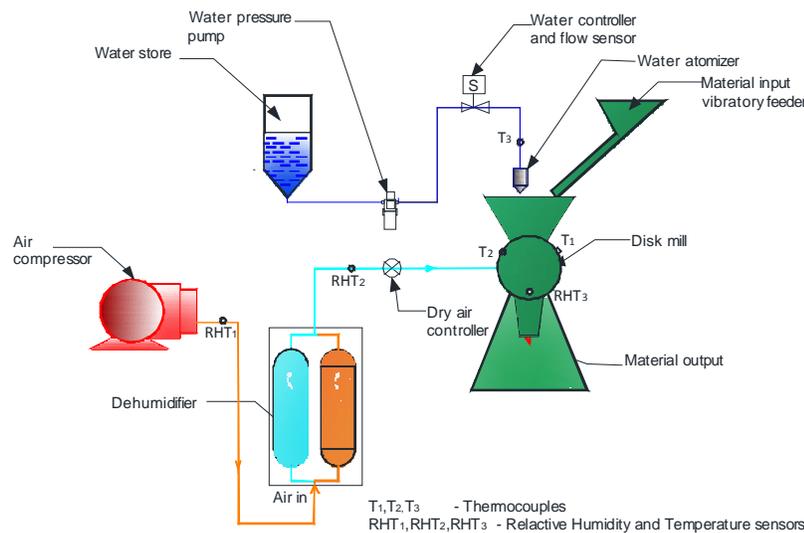


Figure 1. Schematic diagram of evaporative water cooling (EWC) spice grinding system

Water atomizing unit

The water atomizing unit is a cooling device designed of two other sub parts, namely water pressure pump (model:CH-1260) and knapsack nozzle (model:SIBAOLU-001), capable of producing atomized water spray in to the grinding system as shown in Figure 1. The function of the water atomizing unit of EWC grinding system is to absorb the heat, which is generated due to the size reduction process during grinding and giving barrier to absorb heat to the grinding product. Here atomized water vapor absorbs the heat generated during grinding as the latent heat more and less amount of sensible heat. But the evaporated water vapor must be facilitated to be blown out from the system before depositing on the ground product. This function is able to get fulfilled by a dehumidified air flow. The water consumption is calculated according to the energy balance laws of heat transfer and manipulated using electronic and mechanical controllers such as flow sensors, solenoid valves and non-return valve.

Dehumidifying air supplying unit

The purpose of having this type of apparatus to this EWC system as stated above is to remove the moist generated in the grinding chamber due to artificial humidification. For this, a Dehumidifier known as refrigerating air dryer (Model: ELRD20) was used. Air supply to the air dryer is obtained from the air compressor (Model: V-O-25 CU). Air flow from the dehumidifier is connected through a high pressure flexible fluid duct to the center of grinding chamber and it is manipulated by flow sensors and air pressure control valves.

Grinding unit with vibratory feeder

There are three types of chili grinding machinery commonly available in the Sri Lankan market. Small and medium scale spice processors are widely using plate mill and pin mill which are the most popular and simple grinding mills in Sri Lankan spice processing industry. Hence, of these two types disk mill was selected for testing EWC grinding evaluation of performance. There are four types of pin mills according to the capacity. In this study, the machine UD 23 which consists of rotating disk having diameter of 0.23 m and 4 kW motor was selected for the experiment. Throughout the experiment the internal screen attached to the grinding chamber was maintained with 500 micron perforation. This machinery is fabricated by Udaya Industries, Weligalle and

installed at Institute of Post-Harvest Technology, Anuradhapura, Sri Lanka. Component drawing of the disk mill used by the research study is shown in figure 2.

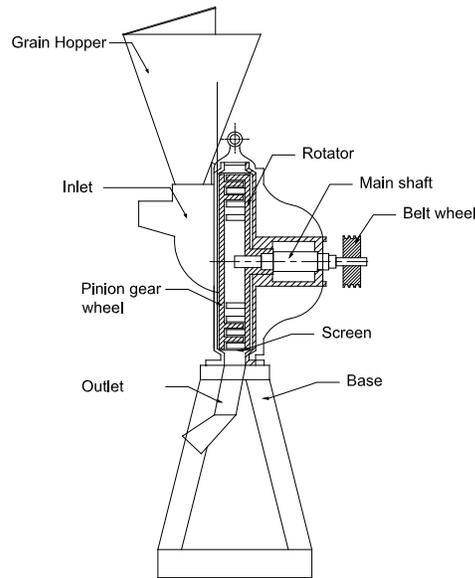


Figure 2. Component drawing of the disk mill UD 23

To feed the materials with different feed rates throughout the experiment, a vibratory feeder is developed for attaching a variable frequency drive (VFD). The frequency is calibrated according to the rated capacity of the grinder.

Calculation of water consumption and dry air flow

The heat to be discharged at EWC grinding is composed of heat which is generated at the size reduction of feed material and the heat introduced by the drive capacity of the mill provided that the cooling effect required for the operation of the grinding chamber is met by spraying atomized water vapor into the system that must be blown out of the system by the use of dehumidified air. When consider the grinding system there are different kinds of energy in put to the system as follows.

- Size reduction of the chili
- Heat absorbed by the chili powder
- Heat absorbed by the dry air
- Evaporation of the water (latent heat)
- Heat absorbed by the water (sensible heat)

Motor power for grinding action

$$\text{Power in} = \sqrt{3}VI_L \text{csc } \theta$$

V =Voltage of the motor

I_L =current in load condition

$\text{csc } \theta$ =power factor

Measuring the current of the motor without loading the motor (without input chili, water, dry air) is no load current. Similarly measure the current when the material and air input allowed for the loaded condition current is load current.

Assume that the current do not vary for different water flow rates and the fixed chili and dry air flow.

For single phase motor: power = $VI_L \cos \theta$

For three phase motor: power = $\sqrt{3}VI_L \cos \theta$

Energy for size reduction

Crushers and grinders are the equipment mostly used for size reduction of the agricultural products. An ideal reducer should fulfill the following conditions, namely (1) large capacity (2) should yield per desired sized product or range of size, (3) small power input requirement per unit mass handled and (4) easy and trouble free operation. Size reduction result in the production of small particales which may be required either for larger surface area or because of their definite shape, size and number. Amount of power required to create smaller particles is one of the parameters of the efficiency of operation. Second parameter is the desired uniformity of size. (K.M Sahay and K.K Singh,2004)

The exact power required for a specific job is difficult to determine. The type of material, moisture content of the material and rate of feed affect the power required in grinding. There are three well known postulate predicting energy requirements for particle size reduction.

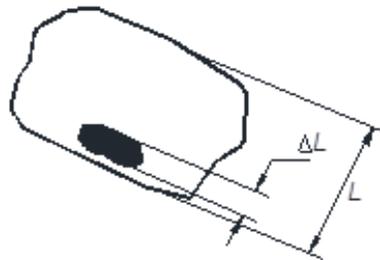


Figure 3. Reduction of feed to symmetrical smaller particle

An idealized particle which is to be reduced to geometrically similar particles.

The required energy must relate to some function of the size of the initial and reduced particle, and ,since the particles are assumed symmetrical, common dimension would probably be used so that:

$$\begin{aligned} \Delta E &\propto \Delta L L^1 / L^m \\ \Delta E &= G \Delta L / L^n \end{aligned} \tag{1}$$

This generalization implies that the energy required to reduce a unit is proportional to a dimation of the required particles relative a similar dimation of the original particle raised to some power n.(Henderson and Perry,1976)

kick's Law

Kick assumed that the energy required to reduce a material in size was directly proportional to the size reductione ratio d/l.

$$E = K_R f_c \log \left(\frac{L_1}{L_2} \right) \tag{2}$$

Where K_R IS called kick's constant and f_c is called the crushing constant of the material; L_1 is initial dimension of the feed and L_2 is final dimension of the product.

Rittinger's Law

Rittinger on the other hand assumed that the energy required for size reduction is directly proportional not to the change of length but to the change in surface ariea.

$$E = K_R f_c \left(\frac{1}{L_2} - \frac{1}{L_1} \right) \tag{3}$$

Bond's Law

Bond has suggested and intermediate course,in which he postulates that n is - 3/2 and leads to:

$$E = E_i \left(\frac{100}{L_2} \right)^{1/2} \left[1 - \frac{1}{q^{1/2}} \right] \tag{4}$$

Bond defines the quantity E_i by this equation : l is measured in microns and so E_i is the amount of energy required to reduce unit mass of the material from an infinitely large particle size down to a particle size of 100 mm.it is expressed in term of q, the reduction ratio where $q=L_1/L_2$.(R.L.Earle,1992)

Assuming bond's equation for our practical situation

Power required to size reduction of chili

$$E_{c,red} = \dot{m}_{c,in} E_i \left(\frac{100}{L_2} \right)^{1/2} \left[1 - \frac{1}{q^{1/2}} \right] \tag{5}$$

Where $\dot{m}_{c,in}$ is input chili mass frlow rate

Energy transferred for heating up the ground chili

$$E_{c,heat} = \dot{m}_{c,in} \cdot C_{chili} \cdot \Delta T_c \tag{6}$$

Where $E_{c,heat}$ is chili mass flow rate input, c_{chili} is specific heat capacity of dry chili and ΔT_c is temperature change of chili

Energy transferred for heating the air inside the system

$$E_a = \dot{m}_{a,in} \cdot C_{air} \cdot \Delta T_{air} \tag{7}$$

Where $\dot{m}_{a,in}$ is input air mass flow rate, C_{air} is specific heat capacity of air and ΔT_{air} temperature change of air inbetween the out let of the dehumidifier and air outlet of the mill.

Assuming specific heat capacity of air does not change of its moisture content. Also assume that the input air mass of the grinder, without considering the added moisture.

Latent heat for evaporating the system

a) Consider the water introduced to the system externally

$$E_{w1} = \dot{m}_{w,in} \cdot L_w \tag{8}$$

Where $\dot{m}_{w,in}$ is water input rate by the nozzle and L_w is latent heat of evaporation of water

b) consider the internal water content (moisture) of chili. If the moisture content of the chili is defined

$$\text{Where, } \dot{m}_{w,c} = M_c \times a\% \tag{9}$$

$$E_{w2} = \dot{m}_{w,c} \cdot L_w$$

M_c is a input total chili mass flow rate and $a\%$ is moisture content of chili

It is assumed that total water content is evaporated.

Considering the equations,

$$E_{in} = E_{out} \tag{10}$$

$$\sqrt{3}V I_L \cos \phi = \dot{m}_{c,in} \cdot C_{chili} \cdot \Delta T_c + \dot{m}_{a,in} \cdot C_{air} \cdot \Delta T_{air} + \dot{m}_{w,in} \cdot L_w + \dot{m}_{w,c} \cdot L_w \tag{11}$$

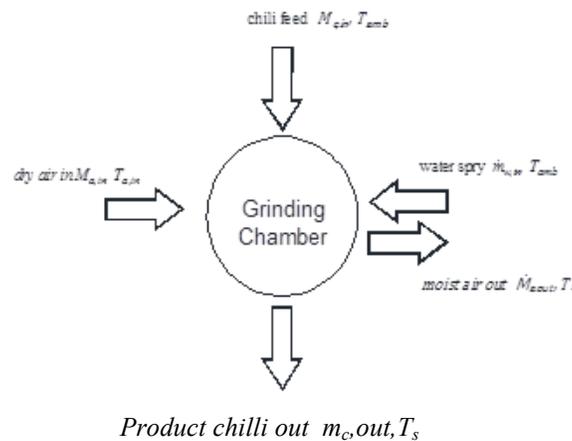


Figure 4. Material in and out through out the EWC grinding inside the grinding chamber

$$\sqrt{3}V(I_L - I_0)\mu \csc \phi = k_2 \text{ constant through out the process} \tag{12}$$

$$\dot{m}_{c,in} = \dot{M}_{c,in} - \dot{M}_{c,in} \times a\%$$

$$\Delta T_c = T_s - T_{amb}$$

$$\Delta T_{air} = T_s - T_{a,in}$$

$$\dot{m}_{w,c} = \dot{M}_{c,in} \times a\%$$

I_0 = no load current

$$\sqrt{3}V(I_L - I_O)\mu \text{ csc } \phi = (\dot{M}_{e.in} - \dot{M}_{e.in} \times a\%) \cdot C_{chilli}(T_s - T_{amb}) + \dot{m}_{a.in} \cdot C_{air}(T_s - T_{a.in}) + \dot{m}_{w.in} \cdot L_W + \dot{M}_{e.in} \times a\% \cdot L_W \quad (13)$$

Relationship between in put water rate and the system temperature: $T_s, \dot{m}_{w.in}$

$$k_2 = k_m C_{chilli} T_s - k_m C_{chilli} T_{amb} + \dot{m}_{a.in} \cdot C_{air} T_s - \dot{m}_{a.in} \cdot C_{air} T_{a.in} + \dot{m}_{w.in} \cdot L_W + \dot{M}_{e.in} \times a\% L_W$$

$$\dot{M}_{e.in} - \dot{M}_{e.in} \times a\% = k_m$$

$$T_s (k_m C_{chilli} + \dot{m}_{a.in} \cdot C_{air}) = (k_2 - k_m k_1 + k_m C_{chilli} T_{amb} - \dot{m}_{a.in} \cdot C_{air} T_{a.in} + \dot{M}_{e.in} \times a\% L_W) + \dot{m}_{w.in} \cdot L_W$$

$$a(\text{constant}) = (k_2 - k_m k_1 + k_m C_{chilli} T_{amb} - \dot{m}_{a.in} \cdot C_{air} T_{a.in} + \dot{M}_{e.in} \times a\% L_W)$$

$$b(\text{constant}) = (k_m C_{chilli} + \dot{m}_{a.in} \cdot C_{air})$$

$$T_s = \frac{\dot{m}_{w.in} \cdot L_W + a}{b}$$

$$T_s = \left(\frac{L_W}{b}\right) \dot{m}_{w.in} + \frac{a}{b} \quad (14)$$

But, externally inserted water must be blown out from the system otherwise water vapor can be deposited in the ground product.

Dehumidified air flow was produced to the system through out the process could be carried away by the dehumidified air flow. The ratio of moisture addition to the air equal to the flow rate of water \dot{m}_w injected is determine by the water vapor mass balance.

$$\dot{m}_w = \dot{m}_a (W_2 - W_1)$$

Where W_1 = Initial humidity ratio of humidified air injected to the system from the dehumidifier at $T_{a.in}$

W_2 = Final humidity ratio of air leaving from the system at T_s

Assuming that heat generated inside the grinder during grinding that is totally converted from mechanical force produced by the the single phase 5 hp motor is used to evaporate water injected and moisture content of feed material.

Current drawn by the motor under the condition of No load and Load condition is tested using clip on ampere meter (DT226 CLAMP METER HOLD and actual mechanical force inserted to the grinder calculated. Rated capacity of UD 23 is taken as 30kg/hr for the testing.

$$I_O = 4.9 A \quad I_L = 11.9 A \quad V_O = 230v \quad \dot{M}_{e.in} = 30kg/hr$$

Therefore, maximum water required for absorbing heat dissipated is calculated.

$$(230v \times 11.9 A \times \cos \phi \times 3600s)/1000 = \dot{m}_{w.in} \times \frac{2256kJ}{kg} + 30 \times 7.95\% \times \frac{2256kJ}{kg}$$

$$\dot{m}_{w.in} = 1.98kg/hr$$

At the maximum water sprayed to the system, the dry air needed for carrying evaporated water is calculated as below. The maintaining set temperature (T_s) inside the system is assumed as 35°C and dry air inserted to the system from the Dehumidifier (ELRD-020) is maintained at 20°C and 20% humidity. From Psychometric chart, W_2 and W_1 were taken.

$$\dot{m}_w = 0.021 \dot{m}_a$$

$$\dot{m}_a = 94.40kg/hr$$

III. MATERIALS AND METHOD

Materials

For the study, dry chilli pods were obtained from Rajangana area, Sri Lanka during December- January, 2016. The variety was identified as MI- 2 and moisture content was found to be 13.9% d.b. at the time of purchasing. The moisture content was measured using Dean and Stark method. Selected homogenous chili pods are cut into one centimeter length pieces using a sharp scissor and made 500 g samples. Before testing, sample materials were undergone on two hours sun drying and moisture content was reached to $7.95 \pm 0.26\%$ d.b.



Figure 5. (a) Chili pod and (b) Chilli Pieces

Data Acquisition procedure

To get the experimental parameter such as temperature, relative humidity, water flow rates, dry air flow rate, the different transducers at the relevant places were used as shown in figure 1. Both side of inside the grinding chamber, two thermocouples (Model: MAX6675) were placed and another transducer for sensing relative humidity and temperature two in one (model:AM2305) was attached to the bottom of the chamber closer to the outlet. In order to measure the dehumidified air flow rate, air temperature and relative humidity entered to the grinding chamber, air flow hole transducer (model:YF-S201) and temperature, relative humidity sensor (Model:DHT22) was attached to the air out let of the dehumidifier. Same flow transducer used to measure air flow rate was lined up to water flow directed into the grinding chamber. All the transducers were programmed with Arduino using two Atm ega 328 Micro controller and a network card. The Printed Circuit Board (PCB) drawing of these sensors which was designed for this machinery set up is shown in figure 6.

For experimentation, switch mode power supply, power distribution PCB (Printed Circuit Board), Arduino uno platforms, were fixed in to a plastic enclosure and mounted on a lesser vibrating part of the mill.

For data acquisition at the PC side, a monitoring application which was developed using Java programming language is capable of monitoring realtime sensor data, record sensor data and retrieve previously stored sensor data. For recording sensor data, the MySQL (Standard Query Language) database management system was used.

Since there were multiple sensors connected to the Arduino uno platform, more than one interrupt could fire while running the main programme. So if it is also used for handling communication, the data rate could fluctuate or there could be delays in communication. There fore a second Arduino was used to handle the communication between the sensor setup and the PC side data acquisition program. Ethernet interface was selected for communication between the PC and the sensor setup because of the higher reliability.

The first Arduino was programmed to acquire all the sensor data one by one and when finished update the corresponding sensor values in the communication handling second Arduino. It follows this procedure in a cycle.

Second Arduino was programmed to handle PC side requests and give appropriate responses. When the PC programme request for sensor data, the second arduino creates a response packet with the updated sensor data and send to the PC desktop application. It is also capable of processing other command requests such as opening and closing water flow valves.

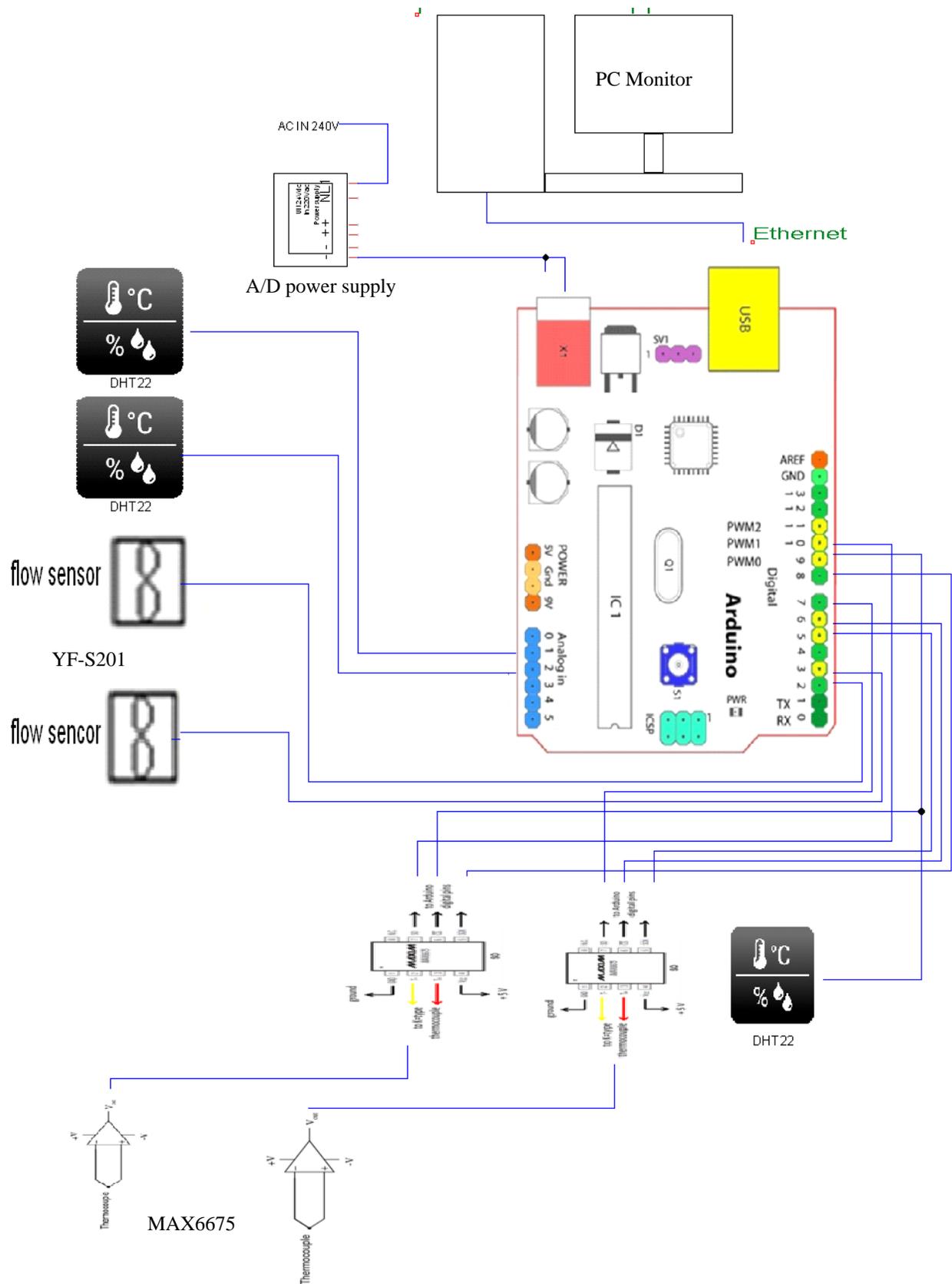


Figure 6. PCB drawing of sensor set up

Experimental procedure

For experimentation, PCB (Printed Circuit Board) was turned on such a way that it could give each and every reading of temperature and relative humidity while adjusting flow rates of dehumidified air and water flow.

De-humidifier with compressor was run before starting the experiment in order to get the desired relative humidity value and temperature of air. It was adjusted and kept constant at the level of the maximum water flow rate to be absorbed. The experiment were carried out with four different water flow rates, 25 cm³/sec, 35 cm³/sec, 45 cm³/sec and 55 cm³/sec whereas the dry air flow rate at 20⁰C and 20% RH was maintained at 36 cm³/sec. Trial was conducted at the ambient condition of 25⁰C and 58% RH. The grinding temperature was elevated up to the 40⁰C before experiment starts. The first samples were undergone conventional grinding and other three samples were undergone EWC samples with three different atomized water spraying as stated above. After grinding samples were allowed to cool down for two hours at room temperature and sealed with 300 micron gauge until HPLC analysis starts.

Laboratory testing procedure for quality analysis

Extracting Capsaicin Oleoresin

The extraction, using the method of Collins *et.al* (1995) and Zeid Abdullah Al Othman *et.al* (2011) with slight modifications was undergone. For capsaicinoid extraction, each powder samples (5g d.b) was placed in ethanol 50 ml in a 120 ml glass bottle equipped with a Teflon lined lid. Bottles were capped and placed in a water bath at 80⁰C for 4hours, then swirled manually every hour. Samples were removed from the water bath and cooled to room temperature. Each supernatant layer of samples (50ml) was filtered through 0.45µm filter paper into a HPLC (model: DIONEX Ultimate3000) sample vial capped and stored at 5⁰C until analyzed.



Figure 7. HPLC analyser

High Liquid Chromatographic Analysis (HPLC)

HPLC operating conditions for short run are ambient temperature, 1ml.min⁻¹ flow rate and 7 min run duration. The mobile phase was isocratic with 70% solvent B(100% methanol) and 30% solvent A (10%methanol) (by volume) in water. HPLS operating condition for individual capsaicin peak detection for long run included ambient temperature, a flow rate of 1 ml.min⁻¹ and a run duration of 20 min. The mobile phase was gradient consisting of 57% solvent B and 43 % solvent A for 10 min followed by 68% solvent B and 32% solvent A for an additional 10 min.

Capsainoid Standards. Standard of 8 methyl-n-vanillyl – nonenamide (capsaicin) was obtained from Sigma-Aldrich INC., USA and was used for retention time verification and instrument calibrations of 300, 250, 200, 150, 100 and 50 ppm were prepared in 100% methanol by delusion of a 1000 ppm stock solution. The standard solutions were run on the HPLC and the obtained standard curve plots of peak area against concentration are shown on Figure 10.



Figure 8. Structure of capsaicin



Figure 9. Capsaicin Standard from Sigma-Aldrich INC., USA

Compounds known as capsaicinoids cause the spicy flavor (pungency) of chili pepper fruit. The two major capsaicinoids, capsaicin and dihydrocapsaicin are responsible for up to approximately 90% of total pungency of chilli fruits (Bernal, M.A, *et.al*, 1993). Therefore, for this study Capsaicinoid was selected for comparing quality attribute in two types of grinding.

Aparatus. Reverse Phase Chromatographic column is C₁₈ (dimension 100x5 mm) from GERMANY. Its absorbent detector and Fluorescent Detector were set at 280nm and 280nm emission at 338.

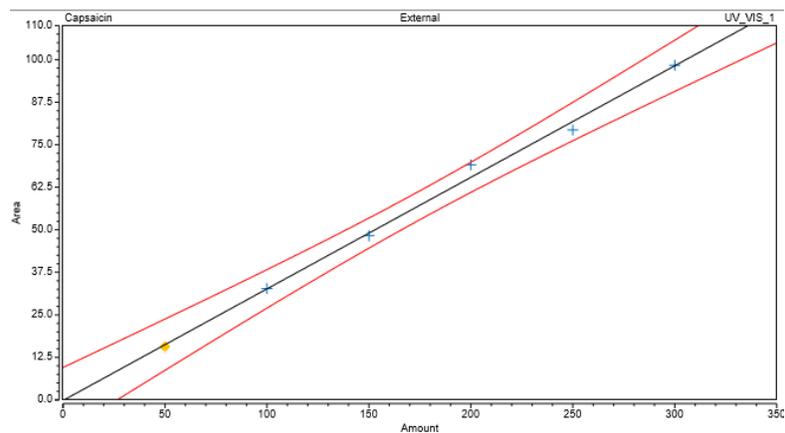


Figure 10. Calibration Curve for Capsaicin taken from HPLC

Analyzing Moisture Content of Final samples

It is unable to use the oven dry method to calculate the moisture content of chili powder, because when chili gets heated more than 120⁰C, volatile compounds will be removed as the capsaicin melting point is 65⁰C. Hence Dean and Stark apparatus was used. In a Dean and Stark method, representative chili sample (50g) was mixed with 100ml of toluene in 500ml glassware. The heating of the mixture was carried out above boiling temperature for six hours. Extracted moisture volume on toluene layer was measured using measuring cylinders. Then moisture content was calculated by using following equation (AOAC, 2000).

$$M_c = \frac{M_v \times D_w}{S_w} \times 100$$

Where,

Mc =Moisture content

W_v =Water volume

D_w =Density of water

S_w =Sample weight

Analyzing water activity

Water activity, not moisture content, predicts safety and stability with respect to microbial growth, chemical and biochemical reaction rates, and physical properties. Water activity (ISO21807) represents the energy status of water in a system. It is equal to the relative humidity of the air in equilibrium with a sample in a sealed chamber. Controlling water activity in spices maintains proper product structure, texture, and stability, density, and rehydration properties. It is defined as the vapor pressure of water in a sample divided by the vapor pressure of pure water at the sample temperature. It is easily measured using highly accurate instrumentation called water activity meter (Model: *Labstart-aw*). The lower limit for all microorganisms is 0.60aw (Beuchat, L. R., 1981; Muggeridge, M. and M. Clay., 2001; Peter, K. V., 2001).

Analysing color value of final products

Surface color was determined using HunterLab (HunterLab – LabScan XE, Hunter Associates Laboratory Inc., Reston, VA, www.hunterlab.com), which includes lightness and chroma saturation. The Hunter L, a, b color space is a 3 dimensional rectangular color space based on the opponent – colors theory. For the L value which is “L” (Lightness) axis, 0 value is black and 100 is regarded as white. Similarly for “a” (red-green) axis, positive values are red, negative values are green and 0 is neutral. And for “b” (blue-yellow) axis, positive values are yellow, negative values are blue and 0 is neutral. After obtaining the sample from the grinder in different treatment the $L^*a^*b^*$ values were tested.

Specific Energy Consumption

The energy consumed in grinding per unit mass is important because too much finer may not be advised as it may not allow easy movement of the intake in the human intestine and too big particle size of the ground seed may not be desirable as it may reduce the bioavailability of the constituents (Meghwal, M. and T.K. Goswami, 2013). The Specific energy is the amount of energy required to grind per unit mass of the ground seed which is represented by kJkg^{-1} . The electric current used by the machine during the grinding operation was measured by clip-on ampere meter (KYORITSU, Model 2608A). It was assumed that line voltage was 230 V and consumed power by the machine was calculated using following equation.

$$P = \frac{VI(W) \times 3.6}{\text{Feed Rate (kg/h)}} \quad (17)$$

Where;

P = Power
 V = Voltage
 I = Ampere

Statistical analysis

The experimental structure of all the experiments was complete randomized design. Data gathered were analyzed using Analysis of Variance (ANOVA) by Statistical Analysis System (Annon, 2000). Percentage data were transformed to arc sin values prior to analysis. Differences between treatment means were obtained by Duncan’s multiple range test at 5% significance level ($p < 0.05$).

IV. RESULTS AND DISCUSSION

The experiments on grinding of chilli were conducted five different conditions while some parameters were tested for whole chilli. One treatment on conventional grinding whereas other four treatments on EWC condition with four different water rates which were selected closer to the calculated water flow rate value. Using data acquisition system, temperature during grinding was monitored. After that collected samples were undergone for measuring temperature variation, moisture content, color observation, water activity and HPLC-Capsaicin analysis. Before carrying out the capsaicin extraction, samples prepared with ethanol are shown in figure 11.

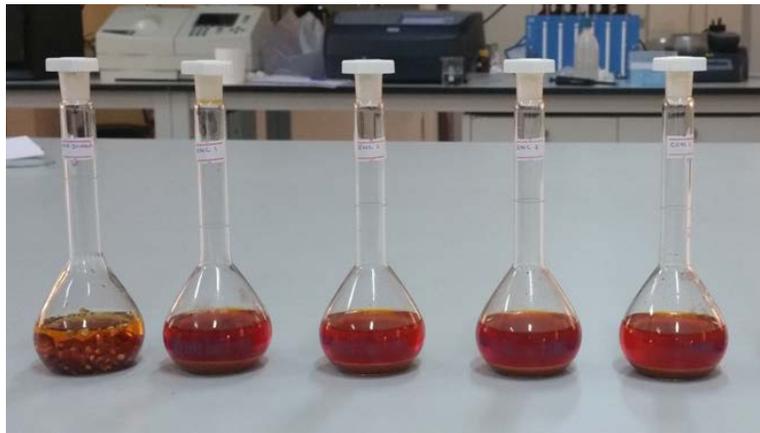


Figure 11. Sample prepared for extraction of Capsaicin

Table1. Effect of spraying water during grinding chilli compared to the conventional grinding.

No.	Treatment	Treated water Quantity/ (cm ³ /sec)	Temperature increase during grinding/ (°C)	Final Moisture content (%)	Capsaicin content/ (Peak area UV_VIS_1 ppm)	Water Activity	Color value (Hue L, a, b)	Energy Consumption /(kJ/kg)
1	CONVEN	non	4.67 ^a ±0.58	5.87 ^d ±0.3	128 ^c ±3.0	0.52 ^a ±.006	53.33±0.6, 16.01±0.9, 28.87±1.6	303.6
2	EWC 1	25	*10 ^b .00±1	7.1 ^d ±0.2	133 ^c ±12.5	0.53 ^b ±0.01	51.62±0.2, 13.99±0.6, 26.01±1.2	303.6
3	EWC 2	35	*12.33 ^c ±1.53	8.53 ^b ±0.2	163 ^b ±14.19	0.53 ^b ±0.06	50.16±0.3, 14.40±0.1, 25.05±0.6	303.6
4	EWC 3	45	*13.33 ^c ±1.53	9.4 ^a ±0.5	136 ^c ±8.02	0.57 ^a ±0.01	50.16±0.3, 14.12±0.2, 25.09±0.1	303.6
6	EWC 4	55	The system stucked due to the excess water					
7	Whole	-	-	7.95±0.26	238 ^a ±2.65	-	43.93± 0.4 16.12±0.210.12±0.3	-

*Temperature decreased during grinding and Any two means in the same column followed by different letters differ significantly according to Duncan's multiple range test (P<0.05).

This grinding trials were performed in a open space and done with chilli 500g lots. Grinding time for each trials took small durations in which all recorded within 60 seconds. Therefore, temperature changes were observed and changes are significant. The correlation between the temperature change respect to the sprayed water amount shown in figure 12 which is given similar linear pattern with R² equal to 0.986 what we obtained in mathematical derivation given in equation 14.

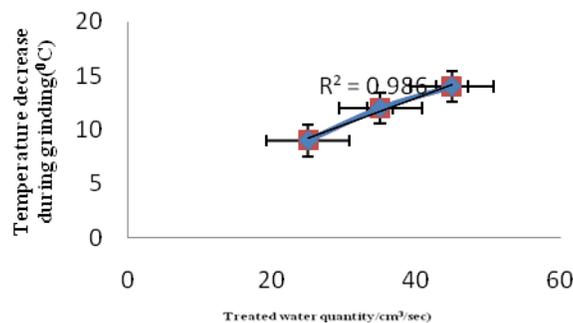


Figure 12. Treated water quantity vs. Temperature increase during grinding

Even though the results shows the decrease in temperature while increase in water amount, Capsaicin amount does not show same correlation. Maximum Capsaicin amount shows the water quantity in $35\text{cm}^3/\text{sec}$ which is closer to the theoretical amount which is $33\text{cm}^3/\text{sec}$. However, the next increased amount $45\text{cm}^3/\text{sec}$ shows the reduction in Capsaicin, maybe it evaporates with water in fact the literature shows Capsaicin is insoluble in water at 25°C . Anyway there is a significant difference for Capsaicin preservation in between conventional grinding and the second EWC grinding which is 15 % success. The comparison of Capsaicin content in between the conventional grinding and the EWC grinding respect to the Chili unground is shown in figure 13 using the HPLC graphs.

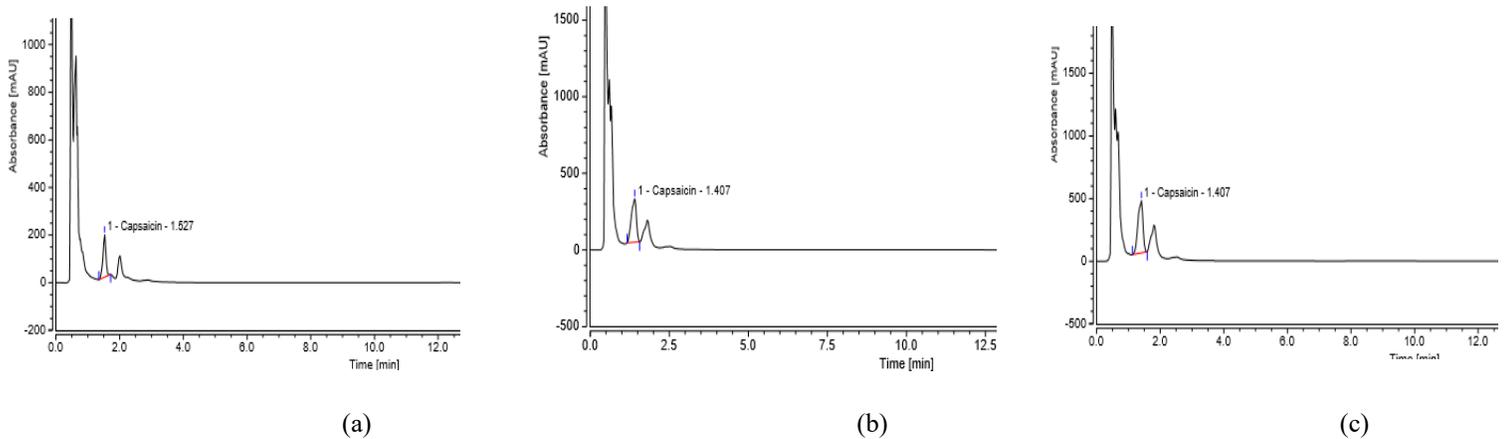


Figure 13. Chromatogram Results of (a) Conventional (b) EWC 2 (c) Chili unground

According to the Hue angle, conventional grinding sample is the most closer to the orange color with the highest lightness value than the others. Second and third EWC samples possess in darker red zone with lower lightness value. It means EWC samples tend to become red color than the conventional grinding sample as the matter of fact that the Capsaicin which is higher in EWC grinding is red in native color.

In the present study, Specific energy consumption results of different conditions of EWC and conventional grinding doesn't show any difference among each other. The power requirement, size of the ground particle and increase in the total surface area are the functions of initial size, material nature, strength of the particle, shape, hardness, smoothness, brittleness, stickiness and moisture content. Therefore, it can be imagined that external addition of water to the chili before grinding couldn't affect the grinding properties which are stated above.

V. CONCLUSION

This study could be concluded that Evaporative Water cooling (EWC) Grinding is a successful new grinding method for controlling temperature during grinding while preserving the aroma quality of spices without retention of excess water in the final product. According to the feeding rate of product fed into the grinder, necessary water flow rate and dry air flow rate must be calculated before introducing this method in spice processing.

REFERENCES

- [1] Annon, (2000). SAS Institute Inc., SAS User's Guide: Statistics. SAS Institute Inc. Cary, NC, 2000
- [2] Bernal, M.A.; Calderon, A.A.; Pedreno, M.A.; Muñoz, R.; Ros Barceló, A.; Merino de Caceres, F. Capsaicin oxidation by peroxidase from *Capsicum annum* (variety Annum) fruits. *J. Agric. Food Chem.* 1993, 41, 1041-1044.
- [3] Beuchat, L. R. "Microbial stability as affected by water activity." *Cereal Foods World* 26.7 (1981): 345-49.
- [4] Crop Protection Handbook Volume 100, Meister Media Worldwide, Willoughby, OH 2014, p. 156
- [5] E. Block, Antithrombotic agent of garlic: A lesson from 5000 years of Folk medicine. In: *Folk medicine, the art and the science*, 1986, pp125 – 137.
- [6] Horwitz, W., Official Method of Analysis of AOAC International, Vol. II, Suite 500 481, Maryland 20877-2417. USA., 2000
- [7] <https://pubchem.ncbi.nlm.nih.gov/compound/Capsaicin#section=Top> National Center for Biotechnology Information, U.S. National Library of Medicine 8600 Rockville Pike, Bethesda MD, 20894 USA.
- [8] J.S Pruthi, Spice and condiments –chemistry, microbiology and technology. Academic press. New York, 1980, pp1-450.
- [9] K.K. Singh, and T.K.Goswami, Design of a Cryogenic grinding system for spices, of food engineering , 1998,39:pp 359 -368.
- [10] K.M Sahay and K.K Singh, Unit Operation in Agricultural processing, Vikas Publishing House Pvt. Ltd, 2004, pp 233-235.
- [11] Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 12th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2012., p p. 849.
- [12] M. Viuda –Martos, Y. Ruiz – Navajas, J. Fernandez – lopez, and P J.A. erez – Alvares, spice as functional foods critical reviews in food science and nutrition, 2011, pp 51:13-28.
- [13] M.Meghwal, T.K Goswami, Cryogenic grinding of spices is a novel approaches whereas ambient grinding needs improvement, journal of food science and technology, 2010, pp 4:24-37.
- [14] Meghwal, M. and T.K. Goswami, Ambient and Cryogenic Grinding of Fenugreek and Flow Characterization of Its Powder. *Journal of Food Process Engineering*, 2013. 36(4): p. 548-557.
- [15] Muggerridge, M. and M. Clay. "Introduction." *Handbook of Herbs and Spices*. Ed. K. V. Peter. 1st ed. Cambridge, England: Woodhead Publishing Limited, 2001. 13-21.
- [16] Peter, K. V. "Introduction." *Handbook of Herbs and Spices*. Ed. K. V. Peter. 1st ed. Cambridge, England: Woodhead Publishing Limited, 2001. 1-12.
- [17] R.L Earle, Unit Operation in Food Processing, Second Edition, Pergamon Press, Oxford. New York, Seoul. Tokyo, 1992, pp159-165
- [18] S.M Henderson and R.L Perry, Agricultural Process Engineering, The AVI Publishing Company, Inc., USA, 1976, pp 130-149
- [19] Singh, S., (2003). Electric Engineering Drawing. part II., S.K., Kataria and sons, p 156

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Study of the impact of natural organic matter on the variation of the overall reaction coefficient in a simulated water distribution network

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Abstract- The main objective of this research was to study the factors that influenced the variation of the overall reaction coefficient (k_{OR}) in a water distribution network. Experiments were carried out in a simulated water distribution network constructed with four sets of independent polyvinyl chloride (PVC), galvanized steel (GS), polypropylene (PP) and high-density polyethylene (HDPE) loop pipes of 50 mm in diameter and 12 m in length each, and located at the Hydraulic Laboratory of the Engineering Institute at the National Autonomous University of Mexico. A sampling campaign was conducted at 2-hour intervals over an 8-hour period. Water samples were taken to the laboratory for analysis of pH, turbidity and COD, while chlorine concentration and temperature were measured during the experiments. Results of this research showed that initial chlorine concentration, the presence of high levels of natural organic matter (NOM) and the characteristic of pipe material should be considered as the main factors which modified the wall decay constant.

Index Terms- wall chlorine decay, natural organic matter, pipe material, initial chlorine concentration, simulated water distribution systems.

I. INTRODUCTION

Water is vital, water is life and water saves. There are many reasons why water is important to our daily life. It is indispensable for normal function of the body. The human anatomy and physiology cannot function without an adequate supply of water per day. It is essential for life, and without it people can survive for only few days. Massive waterborne diseases, however, are associated with the presence of contaminants in water.

Surface and groundwater are susceptible to pollution from both natural and man-made sources. Naturally occurring substances such as iron, manganese, barium, selenium, total nitrogen, urea nitrogen, K_2O water-soluble potassium, total humic carbon, humic acid carbon and fulvic acid carbon hydrogen sulfide, and salt may be present in undesirable levels. Bacteria and nitrate-nitrogen from sewage, septic tanks, animal waste, and fertilizers are a common problem.

Chlorine is a strong oxidant commonly used in water during the oxidation and disinfection process. It is also used to control biological growth and to inhibit microbial activity in the network system (EPA 2014). While flowing through pipes, however, the chlorine concentration decreases.

The simplest model for chlorine decay is the first decay model, and the equation used to describe this phenomenon is as follows:

$$C(t) = C_0 \exp(-kt) \quad [1]$$

where C is the final chlorine concentration [mg/L] at time t , C_0 is the initial chlorine concentration [mg/L], t is the residence time in the pipe (h) and k is the first order decay constant [h^{-1}] (Chambers et al. 1995, Powell et al. 2000).

Therefore, the overall decay constant is often expressed as the sum of the bulk decay (k_b) (Biswas and Clark 1993; Clark et al. 1994, Hua et al. 1999) and the wall decay. For the purpose of this study, the wall decay rate (k_w) is substitute by the overall reaction coefficient (k_{OR}). Eq.1 becomes:

$$C = C_0 \exp(-k_{OR}t) \quad [2]$$

in which C : final chlorine concentration (mg/L); C_0 : initial chlorine concentration (mg/L); k_{OR} : overall reaction coefficient (h^{-1}) and t : time (h)

Bulk chlorine decay depends on the physicochemical characteristic of the source, while wall decay depends on the pipe material and its conditions (Nejjaria et al. 2014). Thus, it is crucial to model them separately to provide a fair approximation.

The determination of this coefficient (k_{OR}) can be obtained by performing either field or laboratory study. Few field studies, however, have been performed because of the complexity of the water distribution systems. Currently, during the expansion of an existing network, water supply authorities are using high-density polyethylene, polypropylene and PVC pipelines because of their flexibility during an earthquake and their low cost compared to metal pipes. Because of the special interest of using large amounts of polyethylene, polypropylene and PVC pipelines by the water utilities, the aim of this work presented in this paper is to estimate the overall reaction coefficient in four different pipe materials mounted in a laboratory-scale distribution system.

II. MATERIALS AND METHODS

II. Experimental setup and preparation

In order to estimate the overall reaction coefficient, a series of experiments were performed using an experimental setup consisting of three parts:

- 1) A water reservoir of 2.12 m³ of capacity,
- 2) A storage tank (450 L of capacity) at elevated position for gravity flow, and
- 3) A simulated water distribution network consisting of four sets of independent polyvinyl chloride (PVC), galvanized steel (GS), polypropylene (PP) and high-density polyethylene loop pipes of 50 mm in diameter and 12 m in length each.

The system also included

- a) nine flow control valves,
- b) an on-line CL763 (B&C Electronics, Italy) chlorine analyzer installed in each loop, which can monitor and control operating continuously and detect chlorine concentration in the range from 0.1 to 20 mg/L,
- c) a data logger (EI-USB-4, Lascar Electronics, USA) (connected in each chlorine analyzer that records data over time for their analysis,
- d) a manual mixer installed at the storage tank to obtain a homogeneous mixture of tap water, natural organic matter and chlorine,
- e) a 4HME200 centrifugal pump,
- f) a 350 mercury thermometer (Lauka, USA), and
- g) a M530P (Pinnacle Series, USA) unit was used for pH measurement.

A schematic diagram of the lab-scale water distribution network (2D, 3D) and a schematic drawing of a manual mixer are shown in Fig. 1 and Figs. 2 and Fig. 3, respectively.

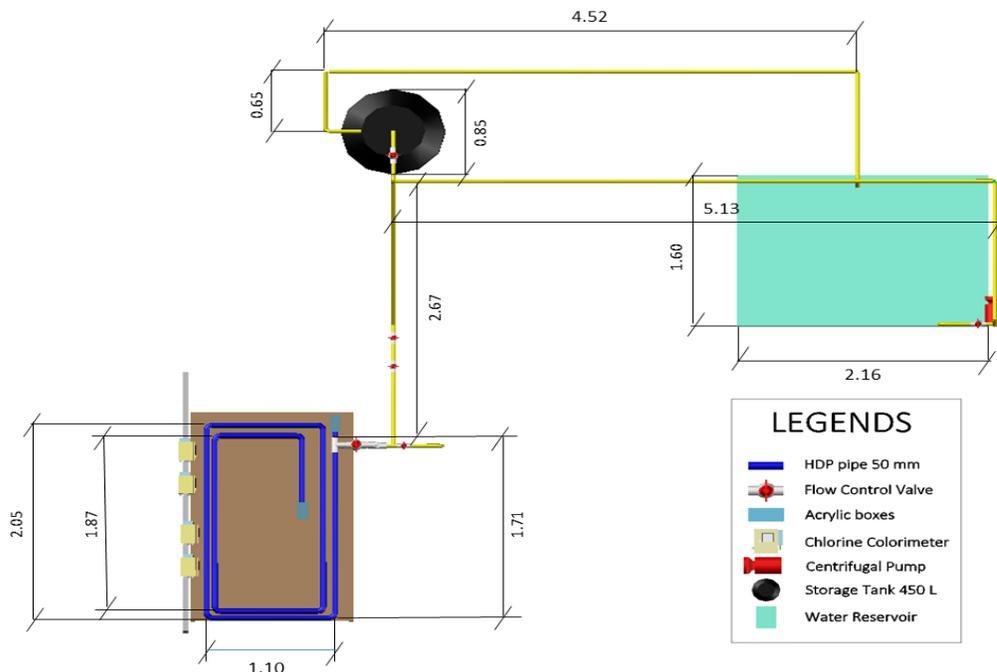


Fig. 1 Schematic diagram of the lab-scale water distribution network.

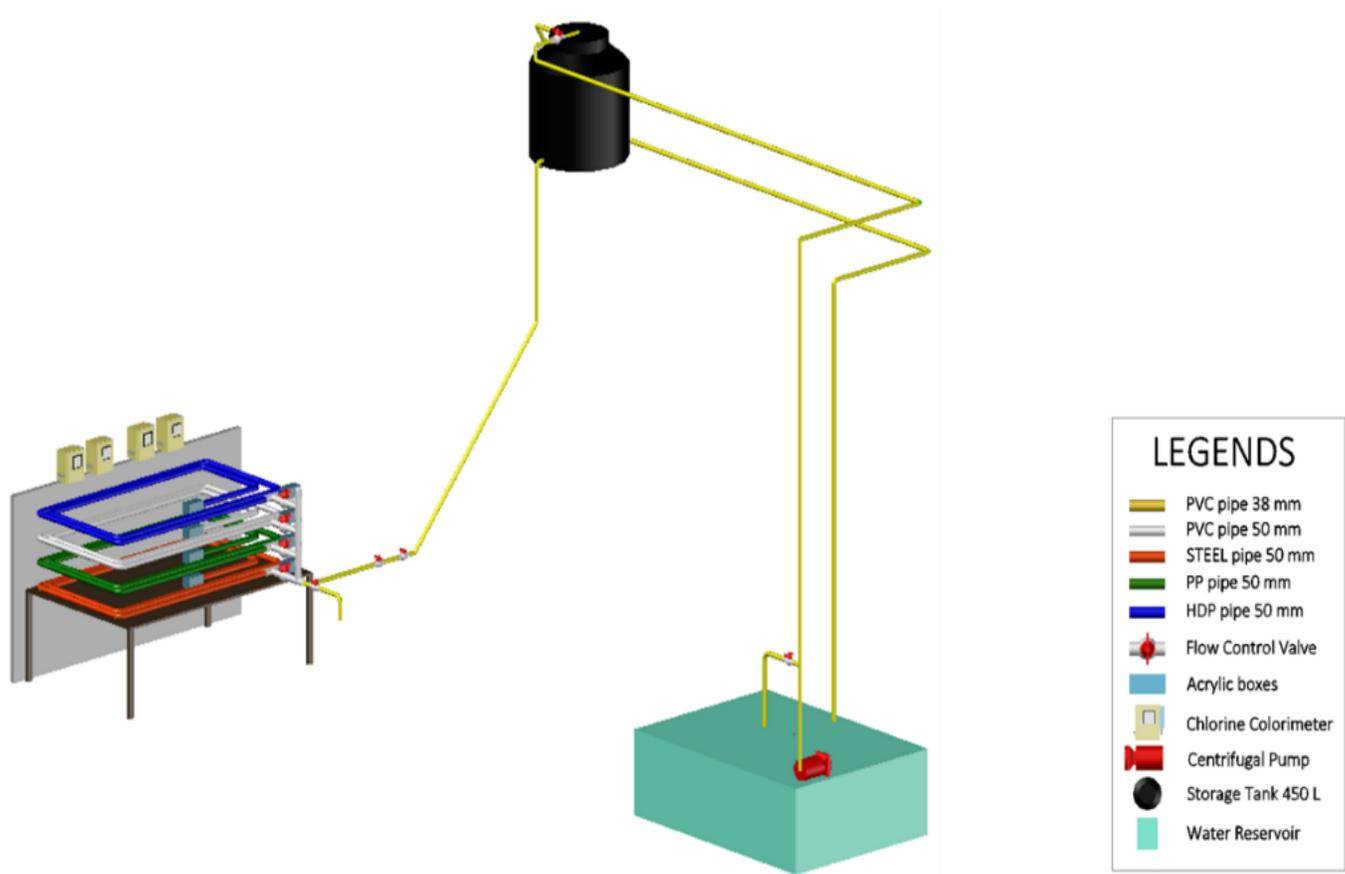


Fig. 2. 3D view of the schematic diagram of the lab-scale water distribution network.

III. EXPERIMENTAL PROCEDURE

Experiments were performed with the final objective of estimating the overall reaction coefficient in four different new pipe materials as a function of initial chlorine concentration and natural organic matter. Before each set of experiments, unchlorinated water from the 2.13 m³ reservoir was pumped to the elevated storage tanks by using the 4HME200 centrifugal pump. In each test, 2.5 mL of K-Tonic solution (1.15 g/mL), which is a mix of six compounds such as total nitrogen, urea nitrogen, K₂O water-soluble potassium, extract of total humic carbon, humic acid carbon and fulvic acid carbon were used (as contaminant agent) to provide 1.50 mg/L of NOM. The chlorination process was conducted for a given chlorine dosage of 1.20 mg/L in scenario 1 and 1.60 mg/L and 0.71 mg/L in scenarios 2 and 3, respectively. In order to get a homogeneous mixture of tap water and chemicals (NOM and chlorine), a manual mixer was installed at the storage tank; see Fig. 3.

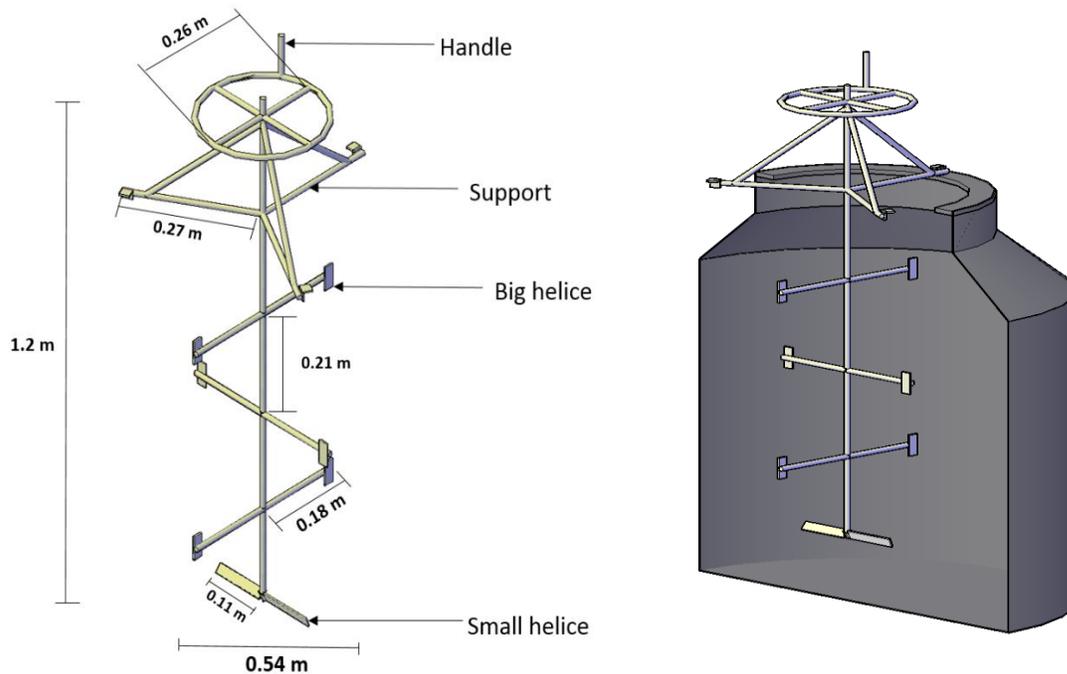


Fig. 3. Schematic drawing of a manual mixer. NOTA: helix

Once completed the initial data measurement in the storage tank was completed, the flow control valves (A-F) were kept open. In addition, each pipe loop was first flushed with clean water (free of chlorine) for approximately 10 minutes to ensure that no chlorine demand was present; it was then filled with the chlorinated water from the storage tank. At the extremity of each loop is located a $0.18 \text{ m} \times 0.09 \text{ m}$ acrylic box. The first box (1) is equipped with a mini (4203, Aquakril) submersible water pump which takes the sample to the chlorine analyzer (overflow cell) through a $1/4''$ connection. The cell's manufacturing characteristics allow the sample to run through the (sensor) potentiostatic electrode site with a constant velocity then exit through a $10 \times 14 \text{ mm}$ tubing to the second acrylic box (located in the other extremity of the loop). Thus, water was continuously recirculated in the simulated distribution system. The experiments were performed at a constant recirculation velocity of 0.0061 m/s . The chlorine decay was determined continuously since the sample was run through the sensor. Upon activation, data loggers were deployed to record chlorine concentration at two-hour intervals for the duration of the monitoring period (8 h). Once the experiments were completed, software was used to download and analyze the collected data. Experiments were performed three times to ensure that the results are reliable and to carry out statistical analysis. A schematic diagram of the experimental procedure is shown in Figure 4.

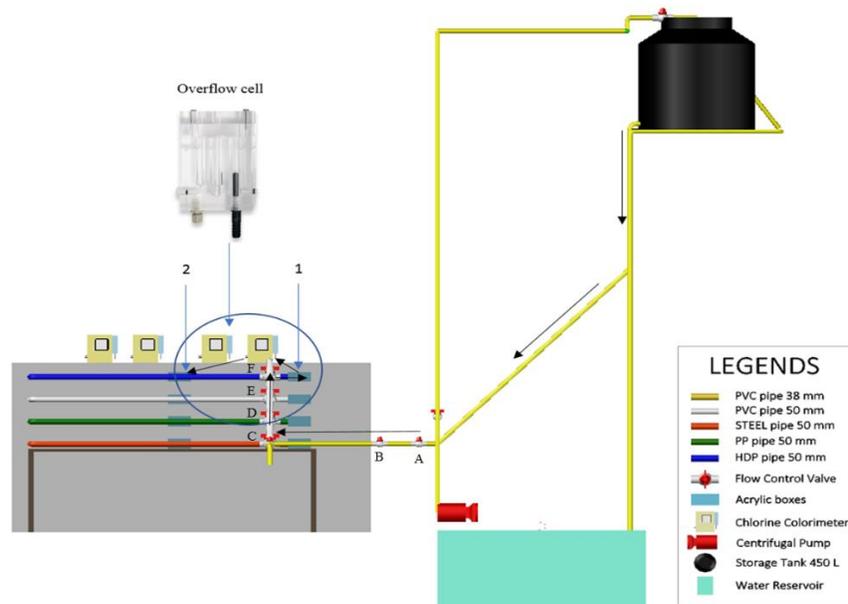


Fig. 4. Schematic diagram of the experimental procedure.

IV. EXPERIMENTAL RESULTS

1. Scenario 1

The experiment's results are summarized from Table 1 to Table 7. Table 1 summarizes chlorine decay observed in samples collected in each pipe loop for the first experimental run. Results showed how chlorine reacted differently with pipe material. The ranking of the chlorine decay rate observed in the pipe loop system after 8 hours was as follows: steel pipe (with the highest percentage of decay, 100%) > high-density polyethylene (88.42%) > PVC (82.62%) > polypropylene (79.33%). The decrease in chlorine concentration with reduced hydraulic residence time (8 h) appears to be associated directly with the effect of NOM.

Table 1. Chlorine decay observed in samples collected in four pipe loops [mg/L]

Time (h)	Cl ₂ [mg/L] Steel Pipe	Cl ₂ [mg/L] Polypropylene pipe	Cl ₂ [mg/L] PVC pipe	Cl ₂ [mg/L] HDPE pipe
0	1.21	1.21	1.21	1.21
2	0.50	0.78	0.74	0.57
4	0.28	0.53	0.46	0.39
6	0.07	0.35	0.32	0.21
8	0.00	0.25	0.21	0.14

In most of the cases, the chlorine decay is represented by the first-order decay equation. In this study, a kinetic model was suggested in which two separated decay formulae can be used: the second-order decay equation (Eq.2) for the first phase and the first-order decay equation for the second phase.

$$C = \frac{C_0}{1 + C_0 k_{OR} t} \quad [3]$$

where C is the final chlorine concentration [mg/L] at time t, C₀ is the initial chlorine concentration [mg/L], t is the residence time in the pipe [hour] and k_{OR} is the overall reaction coefficient [h⁻¹].

In the present study, since the hydraulic residence time was very short (8 hours) determining only a coefficient (k_{OR}) was suggested. Figure 5 shows free chlorine decay profiles of water measured at temperatures ranging from 20-25°C.

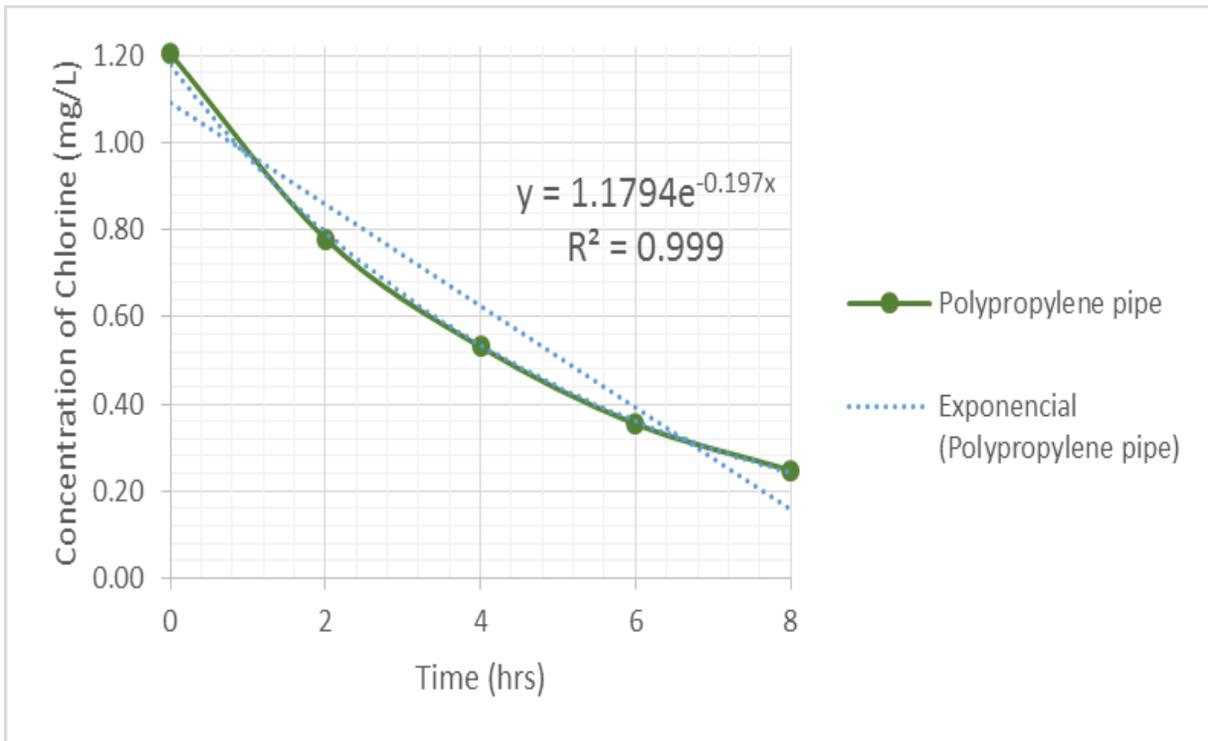


Fig. 5. Chlorine decay observed in simple collected in polypropylene pipe. NOTA: Exponential

Table 2 shows the regression equation for the relationships between initial chlorine concentrations. In most of the cases (except in the steel pipe), the coefficients of determination R^2 were better than 0.91. The overall reaction coefficient (k_{OR}) was found to be greater in the steel pipe (0.807 h^{-1}) followed by high-density polyethylene (0.263 h^{-1}), PVC pipe (0.216 h^{-1}) and polypropylene (0.197 h^{-1}).

Table 2. Regression equation for the relationships between initial chlorine concentration and the overall reaction coefficient for different pipe materials (scenario 1, Cl_2 initial = 1.21 mg/L)

PIPE MATERIAL	REGRESSION EQUATION	R^2
GS pipe	$y = 2.6151e-0.807x$	0.835
PP Pipe	$y = 1.1794e-0.197x$	0.999
PVC Pipe	$y = 1.1602e-0.216x$	0.997
HDPE Pipe	$y = 1.0915e-0.263x$	0.989

Once k_{OR} values for each pipe loop were obtained, the second-order decay equation was used for the first phase (0-2) since the percentage of decay was approximately 53% and the first-order decay equation for the second phase (2-8 hours). Table 3 shows the results for polypropylene pipe.

Table 3. Comparison of measured and estimated chlorine concentration for scenario 1

POLYPROPYLENE PIPE								
Time [hrs]	Cl ₂ [mg/L]	K _{OR} [h ⁻¹]	Cl ₂ measured [mg/L]	Cl ₂ estimated [mg/L]	D = Cl ₂ measured – Cl ₂ estimated [mg/L]	D ² [mg/L]	Absolute error	Relative error
SECOND-ORDER EQUATION								
0	1.21	0.197	1.21	1.21	0.00	0.0000	0.0000	0%
2	1.21	0.197	0.78	0.82	0.04	0.0016	0.0506	5%
FIRST-ORDER EQUATION								
4	1.21	0.197	0.53	0.55	0.02	0.0003	0.0348	3%
6	1.21	0.197	0.35	0.37	0.02	0.0003	0.0467	5%
8	1.21	0.197	0.25	0.25	0.00	0.0000	0.0084	0%

Clearly the combined second- and first-order model provides good results. The predicted concentrations fit well together the measured concentrations. A relative error- ranging from 3-5% was observed. From the present study, using sample water containing NOM, it was found that the highest value of k_{OR} was obtained in GS pipes followed by HDPE, PVC and PP pipes, respectively.

2. Scenarios 2 and 3

Water quality analysis was performed in scenarios 2 and 3. Free chlorine concentration was measured at approximately 2-hour intervals over an 8-hour period. Results are summed up in Tables 4 to 7, respectively.

Table 4. Regression equation for the relationships between initial chlorine concentration and the overall reaction coefficient for different pipe materials (scenario 2, Cl₂ initial = 1.60 mg/L]

PIPE MATERIAL	REGRESSION EQUATION	R ²
GS pipe	y = 1.5823e-0.366x	0.978
PP pipe	y = 1.3757e-0.135x	0.925
PVC Pipe	y = 1.3655e-0.148x	0.927
HDPE pipe	y = 1.3763e-0.207x	0.969

From the present scenario with water containing 1.50 mg/L of NOM and 1.60 mg/L of chlorine, it was found that k_{OR} was in a range: 0.135 h⁻¹ < k_{OR} < 0.366 h⁻¹.

Contrary to scenario 1, the second-order decay equation was used for the first phase (0-6 hours) instead of (0-2 hours) and the first-order decay equation for the second phase (6-8 hours) instead of (2-8 hours). Table 5 shows the results for polypropylene pipe. Once again it can be seen that the combined second- and first-order model provided good results with a relative error ranging from 9 to 21%.

Table 5. Comparison of measured and estimated chlorine concentration for scenario 2

POLYPROPYLENE PIPE								
Time [hrs]	Cl ₂ [mg/L]	k _{OR} [h ⁻¹]	Cl ₂ measured [mg/L]	Cl ₂ estimated [mg/L]	D = Cl ₂ measured – Cl ₂ estimated [mg/L]	D ² [mg/L]	Absolute Error	Relative error
SECOND-ORDER EQUATION								
0	1.60	0.135	1.60	1.60	0.00	0.0000	0.0030	0%
2	1.60	0.135	0.92	1.12	0.20	0.0383	0.2122	21%
4	1.60	0.135	0.71	0.86	0.15	0.0223	0.2107	21%
6	1.60	0.135	0.64	0.70	0.06	0.0035	0.0921	9%
FIRST-ORDER EQUATION								
8	1.60	0.135	0.50	0.54	0.05	0.0022	0.0948	9%

Results for scenario 3 are presented in Tables 6 and 7.

Table 6. Regression equation for the relationships between initial chlorine concentration and the overall reaction coefficient for different pipe materials (scenario 3, Cl₂ initial = 0.71 mg/L)

PIPE MATERIAL	REGRESSION EQUATION	R ²
GS pipe	$y = 1.3337e-1.641x$	0.90
PP pipe	$y = 0.9271e-0.749x$	0.91
PVC pipe	$y = 0.7388e-0.52x$	0.99
HDPE pipe	$y = 1.492e-1.641x$	0.87

From the present scenario with water containing 1.50 NOM and 0.71 mg/L of chlorine, it was found that k_{OR} was in a range: 0.52 h⁻¹ < k_{OR} < 1.64 h⁻¹. Table 7 shows the results for polypropylene pipe.

Table 7. Comparison of measured and estimated chlorine concentration for scenario 3

POLYPROPYLENE PIPE								
Time [hrs]	Cl ₂ [mg/L]	k _{OR} [h ⁻¹]	Cl ₂ measured [mg/L]	Cl ₂ estimated [mg/L]	$D = Cl_{2\text{measured}} - Cl_{2\text{estimated}}$ [mg/L]	D ² [mg/L]	Absolute error	Relative error
SECOND-ORDER EQUATION								
0	0.71	0.749	0.71	0.71	0.00	0.0000	0.0014	0%
2	0.71	0.749	0.35	0.34	0.01	0.0001	0.0294	3%
FIRST-ORDER EQUATION								
4	0.71	0.749	0.04	0.04	0.00	0.0000	0.0000	0%
6	0.71	0.749	0.00	0.01	0.01	0.0001	0.0000	0%
8	0.71	0.749	0.00	0.00	0.00	0.0000	0.0000	0%

The second-order decay equation was used for the first phase (0-6 h) instead of (0-2 h) and the first-order decay equation for the second phase (6-8 h) instead of (2-8 h). Again it can be seen that the combined second- and first-order model provided good results with a relative error of 3%.

V. CONCLUSION

Results of the experimental work performed on four pipe sections of different materials (steel, PVC, polypropylene and high-density polyethylene), different initial chlorine concentration and amount of natural organic matter (NOM) led to three conclusions.

- 1) The overall reaction coefficient (k_{OR}) was observed to vary with the initial chlorine concentration. For the range of 1.21 mg/L of initial chlorine concentration used in the first scenario of this study, k_{OR} ranged from 0.197 h⁻¹ to 0.807 h⁻¹. In the second scenario with the range of 0.71 mg/L of chlorine and 1.50 mg/L of NOM, k_{OR} ranged from 0.52 h⁻¹ to 1.64 h⁻¹. Finally, in the third scenario with the highest initial chlorine concentration (1.60 mg/L), k_{OR} ranged from 0.135 h⁻¹ to 0.366 h⁻¹.
- 2) The overall reaction coefficient was observed to show significant variation with pipe material. It has been observed increasing with steel pipe. It was found that the highest value of k_{OR} was obtained in steel pipes followed by HDPE, PVC and PP pipes, respectively.
- 3) A combined second- and first-order model provided good results with a relative error ranging from 3 to 5% in scenario 1, 9 to 21% in scenario 2 and 3% in scenario 3.

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REFERENCES

- [1] Biswas P. and Clark R.M. (1993) A model for chlorine concentration decay in pipes. *Water Res.* 27, 1715-1724.
- [2] Chambers, V.K., Creasy, J.D and Joy, J.S. (1995). Modelling free and total chlorine decay in potable water distribution systems *J. Water Sci. Res. Technol.: Aqua*, 44 (1995), pp. 60–69
- [3] Clark R.M., Grayman W.M., Goodrich J.A., Deininger R.A. and Skov K. (1994) Measuring and modelling chlorine propagation in water distribution systems. *J. Water Resources Planning Manage.* 120, 871-887.
- [4] EPA. Drinking Water Treatability Database: Chlorine. 2014.
- [5] Hua, F., West, J.R., Barker, R.A and Forster, C.F. (1999). Modeling of chlorine decay in municipal water supplies. *Water Res.*, 33 (1999), pp. 2735–2746
- [6] Powell, J.C., Hallam, N.B., West, J.R., Forster, C.F and Simms, J. (2000). Factors which control bulk chlorine decay rates. *Water Res.*, 34 (2000), pp. 117–126
- [7] Nejjaria, F., Puiga, V., Perez, R., Quevedo, J., Cugeroa, M. A., Sanza, G. & Miratsb, J. M. (20014). Chlorine decay model calibration and comparison: Application to a real water network. *Procedia Engineering* 70, 1221–1230

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How Effective is Marketing Mix in Influencing Retailers' Buying Decision

(A Lesson from MOTUL Lubricant Sales in Jabodetabek)

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ABSTRACT

Motul relies on retailers' in selling its lubricant product instead of marketing directly to the end customer is this strategy effective or not because the focus of this study. The purpose of this study is to analyse the affect of retailers' perceptions on marketing mix toward buying decisions as and to formulate strategies to increase sales of Motul products. This study uses primary data obtained from interviews using a questionnaire to retailers. The number of respondents was 125 respondents. The result is that the product, distribution and promotion have a significant positive effect on buying decision, with distribution as the most dominant variable. The retailers' perception of the marketing mix and buying decision of Motul products is good, but the sales strangely continue to decline. This may due to either the retailers' perception toward competitor products is even better than Motul products, or the end consumers of lubricant may not follow the recommendations of retailers.

Keywords: Marketing Mix, Buying Decision, SEM Analysis, Sales.

I. INTRODUCTION

Development of transportation means in this day and age is very high, one of them being the automotive field. The people of Indonesia have perceived that motor vehicles are no longer expensive modes of transportation and are also low-cost in maintenance as well as having economical fuel usage. The high demand of motor vehicle buying power is due to the affordable price and increasing ease to own a motor vehicle, therefore the volume of sales raises from year to year. With the increase of motor vehicle demand, the increase of lubricant in Indonesia is also affected.

The number of motor vehicles that drives through the streets of Jakarta rises each year. Total of the motor vehicles excluding the national army, police, and diplomatic corps from year to year continues to grow. Traffic in Jakarta in the year 214 was dominated by motorcycles (76.66%), passenger cars (18.64%), load-bearing cars (3.84%), buses (2.07%) and lastly emergency vehicles which are around 0.79%. (Statistik Transportasi DKI Jakarta 2015) [10].

Table 1 Total of Registered Motor Vehicles (excluding the national army, police, and diplomatic corps) According to the Type of Vehicles, 2010-2014

Vehicle Type	2010	2011	2012	2013	2014	Growth per year (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Motorcycle	8 764 130	9 861 451	10 825 973	11 949 280	13 084 372	10.54
Passanger Car	2 334 883	2 541 351	2 742 414	3 010 403	3 266 009	8.75
Load-bearing Car	565 727	581 290	561 918	619 027	673 661	4.46
Bus	332 779	363 710	358 895	360 223	362 006	2.13
Emergency vehicle	-	-	129 113	133 936	137 859	-
Total	11 997 519	13 947 802	14 618 313	16 072 869	17 523 967	9.93

Source: Ditlantas Polda Metro Jaya

The growth of motor vehicles in the period of five years reached 9.93% per year. When specified according to the type of vehicle, motorcycles have the highest growth which is 10.54% per year. Following that, passenger cars experienced growth of 8.75% per year, load-bearing cars 4.46% per year, and bus had smaller growth of 2.13% per year. Meanwhile for ransus, the growth cannot be observed because the data of the previous year are not available.

Since 2001 the lubricant market in Indonesia has opened as Republic of Indonesia Presidential Decree No. 21 Year 2001 was released [5]. Private business entities can open to market their lubricants in Indonesia. Lubricants importer are only subject to

import tax up to 10% of the import value according to Decree 31 Year 2015. With the amount of tax issued by the government, other brand holders, especially international lubricant brand holders, are given limits in competing in Indonesia's lubricant market.

Taken into account that Motul is a lubricant imported from Singapore, hence there should be a good marketing management in order to compete with other brands. Several general consumers compare variety of products based on the price without looking into whether the products have good quality or not. Building an integrated perception is needed that products that are marketed have various components that are high of value.

Retailers is an important link in the process of goods distribution and is the last link in a distribution process. Through retailers, a product can have a direct encounter with its users. The retailer industry here is defined as an industry that sells products and services that have given added value to fulfill the personal needs in a family, group or end user. In the last 3 years, Motul lubricant seller retailers in Jabodetabek (Jakarta, Bogor, Depok, Tangerang, Bekasi) region experienced decline in sales as low as 57%, lower than in 2014 which was 64%. In 2013 Motul sales are relatively high compared to 2014-2015, reaching 80%.

Table 2 Motul Lubricant Sales Volume (Liter/Year)

Month	2013	2014	2015
January	10 869	10 955	9 008
February	15 951	7 964	5 909
March	10 323	8 146	6 876
April	11 610	10 180	6 620
May	12 470	9 793	5 748
June	10 534	10 424	10 638
July	18 268	11 464	5 988
August	30 445	9 750	12 268
September	1 788	9 928	10 884
October	4 337	8 234	8 016
November	7 345	7 812	10 428
December	8 104	9 762	8 228
Total	142 044	114 412	100 611
% Target	80	64.4	56.7

The purpose of this research is (1) Analyzing retailers' perception of marketing mixture and buying decision. (2) Analyzing the influence of marketing mixture towards the decision in buying Motul products. (3) Formulating strategies to increase sales of Motul oil products.

II. RESEARCH METHOD

This research is limited by the analysis of the influence of marketing mix towards the buying of Motul products, with the population of 180 retailers, which were made into sample of 125 retailers. Method in obtaining sample in distributing questionnaires and in-depth interview through *non probability sampling* approach with *purposive sampling* method was used. The research was conducted in the Jabodetabek region, with retail consumer respondent that are still active in buying Motul products.

The research was using the Structural Equation Modeling (SEM) to analyse the data. The data was generated from the questionnaire and in-depth interview.

III. RESULT AND DISCUSSION

Validity and Reliability Testing

From the results of the distribution of questionnaires about the marketing mix and buying decisions, validity and reliability data were produced. On the validity and reliability testing, software SPSS 17 was used. According to Cooper & William (1999) [1], validity is used to examine whether the test that was measured had been suitable with the object being measured. From the above result, all of the statement is said to be valid if $r_{count} > r_{table}$. $Df = N - 2$, in this data $N = 125$ was used. Therefore $df = 125 - 2 = 123$, so that the r_{table} for 123 is 0.1757. The outcome of the questionnaires distribution is that the entire statement is valid.

Reliability testing according Ghozali (2005) [3] is beneficial for establishing whether the instruments, which in this research are questionnaires, which can be used more than once, at least by the same respondents, will generate consistent data. Reliability testing in this research was applied by using Cronbach's Alpha method. On the result of the distribution of questionnaires, it was obtained that all of the variables on each statements are reliable. Research variables are said to be reliable when having the value of $\alpha > 0.60$.

Retailer Perception towards Marketing Mix and Buying Decision

When seen on Table 3, all of the respondents voted on 'agree'. The product ability indicator (X_{14}) has the highest average value of 4.22, which means Motul has good product capability and is durable in lubricating vehicle machine. Furthermore, the product quality indicator (X_{11}) has an average value of 4.16, meaning that Motul has good product quality and is safe to use by various kinds of vehicles. The product variety indicator (X_{12}) has the average value of 3.96, which means the variety of Motul

products offered are sufficient enough corresponding to vehicle specifications. Product benefit (X_{13}) has an average value of 3.91, meaning that retail consumers feel quite satisfied selling Motul products, both on the quality and benefits that are felt by the consumers. Corresponding to the research from Victor (2014) [12], performance, distinction, reliability, durability and quality impression have good perception towards lubricant products.

Table 3 Retailer Perception of Motul Product

Indicator	Mode	Mean	Remarks
Product quality	S	4.16	Good
Product variety	S	3.96	Enough
Product benefit	S	3.91	Quite satisfied
Product ability	S	4.22	Good

In Table 4, it can be seen that the price variable has the mode result of 'agree'. Standard price indicator (X_{21}) on the mode of 'agree' has the average value of 4.22, which is because a few retail consumers have an opinion that the price offered is suitable with the quality that the end consumers felt. The after sale indicator (X_{22}) has an average value of 4.14 on the 'agree' mode, meaning some retail consumers experienced gained from selling Motul products. As for the shipping-included price indicator (X_{23}), it has an average value of 4.08 with the mode result of 'agree', which means that the price offered to the retail consumers have included shipping fee however many Motul products are bought by the retail consumers.

Table 4 Retailer Perception towards Product Price

Indicator	Mode	Mean	Remarks
Standard price	S	4.22	Suitable
After sale price	S	4.14	Beneficial
Shipping-included price	S	4.08	Cheap

As seen on Table 5, a lot of the whole respondents vote on 'agree'. In the product shipping time (X_{31}), the average value is 4.08, meaning that the product shipping arrives to the consumers on time. On its distribution, Motul gives a maximum of 3 days from the time of order; this is to show fast and accurate service. Subsequently the salesperson indicator (X_{34}) has an average of 3.92, which means the retail consumers felt that the salespeople always give a quite responsive service, both when ordering products and asking about the specifications of every Motul products. Product ordering process indicator (X_{33}) has an average of 3.87. That is because the retail consumers felt that it is relatively easy to order Motul products since the Motul salespeople will come to the retail consumers every week to offer Motul products. Other than that, the retail consumers can easily order by contacting the salesperson. For the product availability indicator (X_{32}), the average value is 3.85, which means some of the retail consumers have an opinion that the availability of Motul products in retail gives ease to the end consumers that are looking for Motul products.

Table 5 Retailer Perception towards Product Distribution

Indicator	Mode	Mean	Remarks
Product shipping time	S	4.08	On time
Product availability	S	3.85	Quite easy
Product ordering process	S	3.87	Quite easy
Salesperson	S	3.92	Quite responsive

It can be seen in Table 6, that the indicator for opening stand in exhibitions (X_{41}) has an average data of 4.10 with the mode of 'agree', which means that the retail consumers felt helped in selling Motul products because the end consumers who are buying the Motul product already know the benefits, since Motul always introduces its products to the consumers both in the form of certain events and opening exhibition stand at certain retail workshops to help market Motul products to end consumers. On the indicator of providing product information (X_{42}), the average value is 3.96, meaning the retail consumers do not find it difficult to find out information about Motul products, because Motul has a website that can be accessed by anyone to find data sheet of every Motul product offered. On the indicator of product-purchasing promotion (X_{43}), the value has an average of 3.94, which means the retail consumers felt the promotion offered by Motul always varies so that the retail consumers can choose a preferred promotion that matches the number of Motul products purchased. The indicator of reward give away (X_{44}) has an average value of 3.65 with the vote of 'agree', meaning Motul gives rewards to retail consumers by looking at the amount of Motul products being sold. A few of the rewards that were offered are 1 unit of motorcycle, or a free ticket to see motoGP.

Table 6 Retailer Perception towards Product Promotion

Indicator	Mode	Mean	Remarks
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Opening stand in exhibitions	S	4.10	Often
Providing product information	S	3.96	Easy
Product-purchasing promotion	S	3.94	Update
Reward give away	S	3.65	Quite interesting

In the buying decision variable on Table 7, many of the respondents voted 'agree'. The indicator of habit (Y_{12}) has an average value of 4.42, denoting that a few of the retail consumers said that the influence in deciding on the purchase of Motul products is because buying Motul products has become a habit; the consumer has already known Motul product for quite some time and also its quality. The product reliability indicator (Y_{11}) has an average value of 4.24, which signifies that retail consumers stated that the influence in deciding to purchase a product is caused by Motul's good product quality; hence retail consumers are not afraid of problems occurring by selling Motul products to end consumers. The need of product indicator (Y_{13}) has an average value of 4.17, which means the consumers said that one of the things that influenced the buying decision of Motul products is because there are lot of end consumers that look for Motul products thus retailers always provide Motul products in their workshop. Lastly, the repurchase indicator (Y_{14}) has an average value of 3.92, meaning that the retail consumers are satisfied with Motul products both with the service and quality, which makes retail consumers into repurchasing Motul products.

Table 7 Retailer Perception towards Decision

Indicator	Mode	Mean	Remarks
Product reliability	S	4.24	Reliable
Habit	S	4.42	Habitual
Need of product	S	4.17	Need
Repurchase	S	3.92	Often enough

The questionnaires distribution that was conducted on retail workshops with using several variables that are already specified in advance according to theory - relevant theory, that is marketing mi (product, price, distribution and promotion) and buying decision. When seen on tables above, the majority of the consumers' perception are positive towards the marketing mix and buying decision through the result form the respondents where many voted 'agree' on the questions asked.

SEM Model Goodness of Fit

The conformity testing performed was compared between sample co-variant matrix and SEM model estimation co-variant matrix. According to Ramadiani (2010) [7], if the model does not conform with the data, then the cause should be looked for on the model, also the way to modify the model so that better data compatibility can be obtained [14]. It can be seen in Table 8 the result of SEM model conformity criteria based on the Goodness of Fit table.

From the result in Table 8, the result of the conformity testing of the whole SEM model can be observed. The results of the testing are respectively; the Chi-square value which is 152.71 in the good fit category - the significant requirement on the chi-square test is the smaller the result and its P-Value ≥ 0.05 , the better. The GFI (Goodness of Fit Index) value is 0.85 in the category of marginal fit. The RMSEA is 0.025 in the category good fit - RMSEA describes the tendency of the chi-square rejecting models with large number of samples.

Table 8 Result of SEM Model Conformity Criteria

Model Accuracy Index	Accepted Level of Compatibility	Model Index	Remarks
Absolute Fit Measures			
Chi Square	The smaller the better (P-values $\geq 0,05$)	152.71 (P = 0.25)	good fit
Goodness of Fit Index (GFI)	GFI $\geq 0,90$ = good fit, and $0,80 \leq GFI < 0,90$ = marginal fit	0.89	marginal fit
Adjusted Goodness of Fit Index (AGFI)	AGFI $\geq 0,90$ = good fit $0,80 \leq AGFI < 0,90$ = marginal fit	0.85	marginal fit
Root Mean Square Residual (RMR)	RMR $\leq 0,05$ = good fit	0.020	good fit
Standardized RMR (SRMR)	SRMR $\leq 0,05$ = good fit $0,05 < SRMR \leq 0,1$ = acceptable fit SRMS $> 0,1$ = poor fit	0.067	acceptable fit

Root Mean Square Error of Approximation (RMSEA)	0,05<RMSEA≤0,08 = quite good and RMSEA≤0,05 = good fit	0.025	good fit
Expected Cross Validation Index (ECVI)	Small value and closer to saturated ECVI	M = 2.01 S = 3.06 I = 12.03	good fit
Incremental Fit Measures			
Normed fit Index (NFI)	NFI≥0,90	0.89	less fit
Non-normed Fit Index (NNFI)	NNFI≥0,90	0.99	good fit
Relative Fit Index (RFI)	RFI≥0,90	0.87	less fit
Incremental Fit Index (IFI)	IFI≥0,90	0,99	good fit
Comparative Fit Index (CFI)	CFI≥0,90	0,99	good fit

Based on Table 8, Goodness of Fit (GOF) showed that most indicators demonstrated that the SEM Model already fits.

The Effect of Marketing Mix towards Buying Decision

This research uses SEM because statistical method is deemed to be able to answer the objectives of this research that are dimensional (Ferdinand, 2002) [2]. This research uses SEM analysis to find out the effect between constructs, which in this case are marketing mix and buying decision. With the aid of the analysis tool, the value of effect between indicators constructs of the marketing mix and buying decision can be identified. The following is the t count shown in Figure 1.

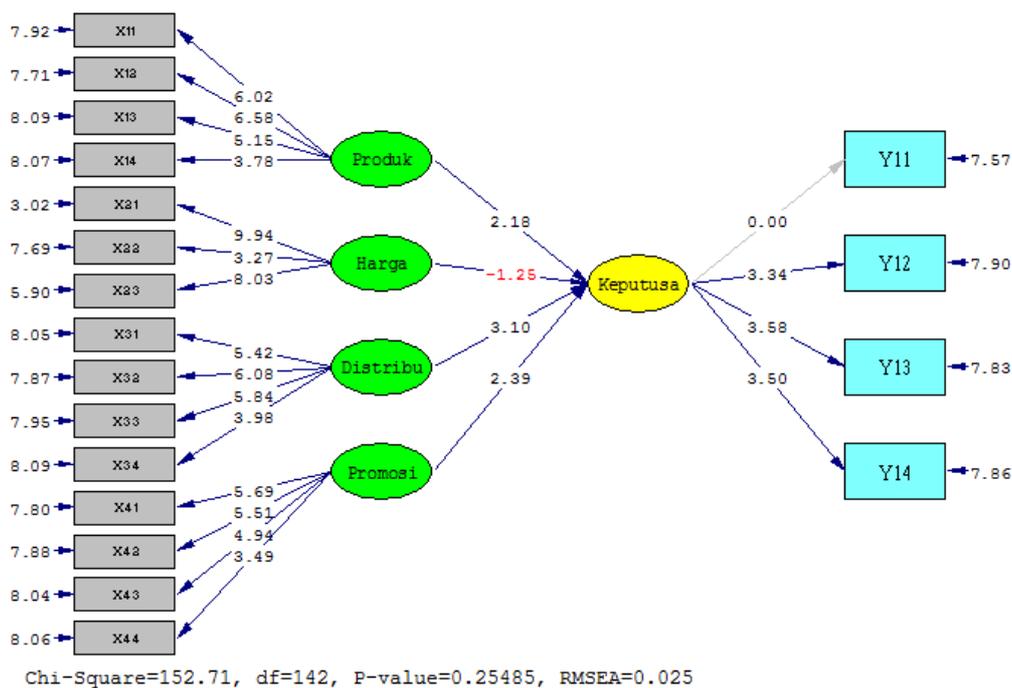


Figure 1 t-value

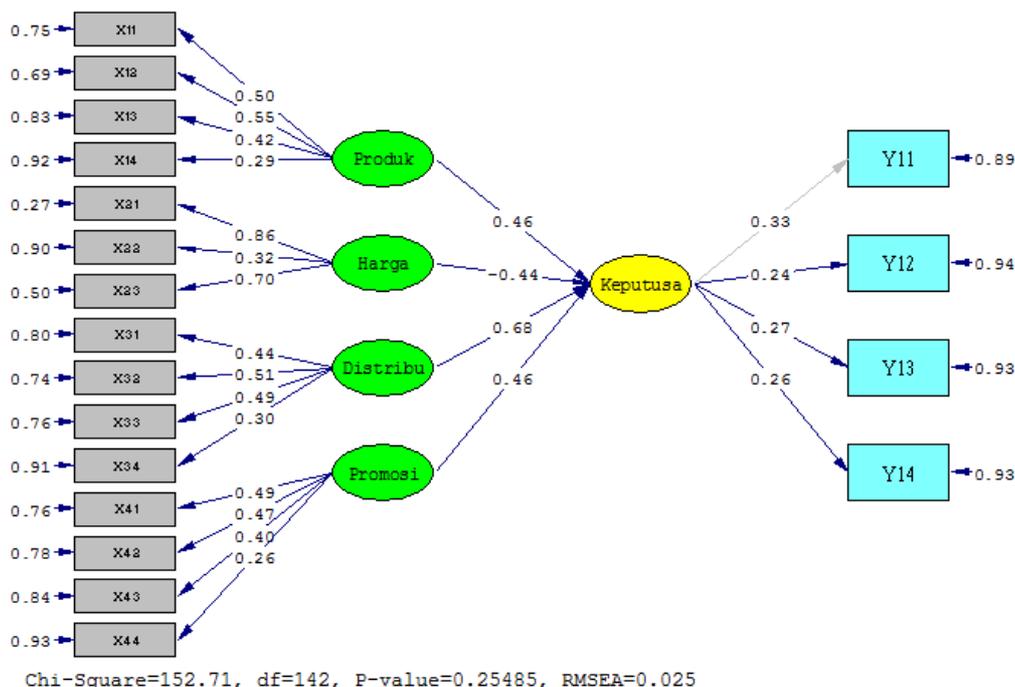


Figure 2 Standardized Loading Factor

Figure 1 shows that the value of t-value identifies the values of each construct. Product has t-value of 2.18 which denotes that it is significant and positive towards buying decision. For distribution effecting buying decision a value of 3.10 was acquired, indicating it is significant and positive. And the promotion obtained value of 2.39, meaning the effect is significant positive towards buying decision. The price has value of -1.25, stating that it does not affect buying decision. Indicators according to Tjiptono (2010) [11], is defined as the buying decision of consumer is affected by dimensions of rational and attraction. The rational dimension, such as price, quality, distribution and so forth, can drive consumers to buy a product with rational reasons. Meanwhile, the attraction dimensions are the scent of the product, color, shape, taste and so on. Y₁₁ is the symbol of product reliability, Y₁₂ is the habit indicator, Y₁₃ is the need of product indicator and Y₁₄ is the repurchase indicator.

After being processed in the Lisrel software, the contribution value of each construct towards the factor dimension is obtained. Variety indicator of latent product variable (X₁₂) has the highest score of 0.55, followed by quality indicator (X₁₁) with value of 0.50, benefit indicator (X₁₃) with value of 0.42 and lastly ability indicator (X₁₄) with the lowest score of 0.29. Variety indicator came out to be the most dominant dimension compared to other product indicators. Product variety consisting of form, price, appearance and materials influence buying decision (Nurrahman dan Dian, 2016) [6].

On the price latent variable, the standard price indicator (X₂₁) attained the highest value of 0.86, then followed by the shipping-included price indicator (X₂₃) with value of 0.70 and lastly the after sale price indicator (X₂₂) with the lowest score of 0.32.

On the distribution latent variable, availability indicator (X₃₂) has the highest result which is 0.51, product ordering process indicator (X₃₃) is 0.49, product shipping time indicator (X₃₁) is 0.44 and last the salesperson indicator (X₃₄) is 0.30. The availability indicator is the most dominant dimension in the distribution variable. Product availability will determine when and where the consumers will decide to buy a product (Saragih, 2013) [8].

Promotion latent variable, on the exhibition stand opening (X₄₁) obtained the highest score of 0.49, followed by product information indicator (X₄₂) with value of 0.47, product purchase promotion (X₄₃) with value of 0.40 and reward give away indicator (X₄₄) with score of 0.26. Exhibition promotion is an attractive media to market a product, either through printed media, brochure, event or exhibition to give information that corresponds to the facts (Widyasari dan Ffilia, 2009) [13].

On the buying decision latent variable, the product reliability indicator (Y₁₁) has the highest value which is 0.33, subsequently the need of product indicator (Y₁₃) has the coefficient number of 0.27, repurchase (Y₁₄) has value of 0.26 and the habit indicator (Y₁₂) 0.24. The reliability indicator is the most dominant in the buying decision variable.

Table 9 Analysis on the Effect of Marketing Mix towards Buying Decision

Hypothesis	Coeff.	t-value	Remarks
Product → Buying Decision	0.46	2.18	Significant
Price → Buying Decision	-0.44	-1.25	Not Significant
Distribution → Buying Decision	0.68	3.10	Significant
Promotion → Buying Decision	0.46	2.39	Significant

From the research result of retailers' perception and coefficient on the product variables, it is shown that the indicators with the most dominant dimension and having a good retailer perception are the product variation (X₁₂) and product quality (X₁₁).

Meanwhile, the indicator with the highest retailer perception but having the lowest loading factor coefficient is product ability (X_{14}). This is because the retailers think that the product ability is the superiority from Motul but also its weakness in terms of selling. The product's quite long durability will slow down the pace of product sales. Next the retailers' perception and coefficient on the distribution variable shows the indicator with the most dominant dimension and has a good retailer perception is the ordering process (X_{33}) and shipping time (X_{31}) indicators. Meanwhile the indicator that has a low retailer perception but has the highest loading factor coefficient is the product availability indicator (X_{32}). Retailers' perception of Motul's product availability is affected by the shipping of Motul products. The retailers' perception is when the shipping is not optimal, it will affect the availability of Motul products in the market. Lastly, the result of retailers' perception and the coefficient value on the promotion variable shows that the indicators with the most dominant dimension and having a good retailer perception are the exhibition stand opening (X_{41}), product information (X_{42}) and purchase promotion (X_{43}) indicators. The exhibition stand opening is the most effective in promoting Motul products. With the exhibition, the distributors can provide a more detailed information about the Motul products that they are going to be selling. On the purchase promotion, Motul distributors always give attractive promotions to increase product sales.

Strategy to Increase Sales

From the result of the respondent analysis, the marketing mix perception that was given by the Motul distributors is already quite good. However, the product sales still declines, as seen in 2013-2015 sales data. Therefore the causes of the decline in sales can be concluded as: (a) Retailer's perception of competing products is higher than Motul products, or (b) End consumers do not really follow the retailer's recommendation. Several strategy formulations can be conducted in increasing Motul product sales, such as:

1. On the distribution variable, indicators that play a role in affecting buying decision are the ordering process (X_{33}) and the shipping time (X_{31}). Ease in access when ordering Motul lubricants is a part to help increase sales. With an easy ordering process, retailers do not need to put a lot of effort to look for Motul products. Hence the role of Motul distributors is needed to ensure the ease of access to Motul products. Not only that, the speed of Motul product delivery also needs to be improved, to maintain the availability of Motul product in the market.
2. On the variable of promotion, indicators that play a role in the promotion variable towards buying decision are the opening stand in exhibitions (X_{41}), product information (X_{42}) and product-purchasing promotion (X_{43}). Opening stand in exhibition is the most efficient promotion; the consumers can easily get information about Motul products and get price that are lower than the market. Moreover, consumers are also entertained by games that Motul distributors organized and merchandises that are given out as well. Other than that, more attractive promotions are needed in order to improve sales. And because of that, it is Motul distributors' main duty to give attractive promotions to the retailers by always giving updates on the newest promotion to avoid falling behind other competing products. Distributors also need to come up with appealing promotions so that the consumers are drawn into buying Motul products.
3. The result form the analysis shows that indicators on the variable of products that play a role in influencing buying decisions are product quality (X_{11}) and product variety (X_{12}). The right strategies are needed to increase Motul sales, therefore Motul distributors need to maintain the product quality in the market and increase the product variety corresponding to vehicle specifications in Indonesia. The ability of the product is a part of the Motul product itself, but changing the perception of the consumers about the lubricant's long durability is needed. It can be done by adjusting the lubricant change to be done with the predetermined periodical service.

IV. CONCLUSION AND RECOMMENDATION

Conclusion

1. Result of the research is the retailers have good perception towards Motul products' marketing mix and buying decision. The perception is seen from: good perception on the product, price, distribution, promotion and Motul products buying decision.
2. Marketing mixes that affects the buying decision are the product mix variable with the major indicator being product quality and product variety. Secondly, distribution variable with the major indicator being the ordering process and shipping time. Finally the promotion variables with the major indicator being opening stand in exhibition, product information and product purchase promotion. Price is proved to be not significantly effective sales.
3. Recommended strategy to increase sales are based on several factors:
 - a. Distribution: Speeding up Motul product shipping time to retailers and easing the access to order Motul products.
 - b. Promotion: Opening stands in exhibitions, providing easy access to Motul's product information, always updating the promotions and giving promotions / merchandises to consumers.
 - c. Product: Maintaining Motul products' quality and increasing the variety of Motul products corresponding to vehicle specifications.

Recommendation

1. Comparative analysis of retailers' perceptions of Motul products and competitor product is required, also what indicators that needs to be analyzed to increase the retailers' perception.
2. Required analysis of consumer behavior regarding buying decision Motul product in Jabodetabek to know consumer decision in buying oil whether influenced by retailer or not.

DAFTAR PUSTAKA

- [1] Cooper Donald R, Emory C Wiliam. 1999. *Business Research Methods*. Ed ke-5. Jakarta(ID): Erlangga
- [2] Ferdinand A. 2002. *Structural Equation Modelling in Management Research*. Semarang(ID): FE UNDIP
- [3] Ghozali I. 2005. *Multivariate Analysis Application with SPSS*. Semarang(ID): Universitas Diponegoro
- [4] Indriantoro, Supomo. 2002. *Business Research Methodology for Accounting and Management* Ed ke-1. Yogyakarta(ID): BPFE.
- [5] Decree of the President of the Republic of Indonesia 21 Year 2001 about on the Provision and Service of Lubricant. Jakarta(ID): Ministry of Energy and Mineral Resources
- [6] Nuurrahman I, Utama DH. 2016. The Effect of Product Variety on Buying Decision (Survey on the Buying of Nokia Series X Smartphone). *Journal of Business Management and Entrepreneurship Education*. 1(1): 54-63
- [7] Ramadiani. 2010. *SEM and Lisrel for Multivariate Analysis*. *Journal Sistem Informasi (JSI)*. 2(1): 179-188
- [8] Saragih CV. 2013. The Influen Product Quality, Product Availability and Lifestyle to the Buying Decision Product Body Scrubs Sumber Ayu. *Journal MIX*. 3(2): 231-246
- [9] Soliha E. 2008. The Analysis Industry Retailers' in Indonesai. *Journal Business and Economi (JBE)*. 15(2): 128-129
- [10] Statistics Transportation DKI Jakarta 2015. Jakarta(ID): Badan Pusat Statistik
- [11] Tjiptono F. 2010. *Marketing Strategy*. Ed ke-3. Yogyakarta(ID): Andi
- [12] Victor I. 2014. Descriptive Study of Product Quality of Castrol Oil 1 4T, Based on Consumer Perceptions in Surabaya *Jurnal Ilmiah Mahasiswa Universitas Surabaya*. 3(1): 2-3
- [13] Widiasari S, Fifilia ET. 2009. Analysis of the Influence of Product, Price, Promotion and Location (Case Study on Semarang aesthetics Graha Housing). *TEMA*. 6(2): 159-169
- [14] Wijanto SH. 2008. *Structural Equation Modeling with LISREL 8.8*. Ed ke-1. Yogyakarta(ID): Graha Ilmu

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Comparison of Turbulence Models for Computational Fluid Dynamics Simulation of Wind Flow on Cluster of Buildings in Mandalay

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Abstract- CFD (Computational Fluid Dynamics) simulation is the main research method for assessing the wind environment around building complexes. In this paper, a comparison of different turbulence models in simulating wind environment around building complexes is conducted to discuss their precision of simulation. Present work used a three dimensional scale down model of buildings where steady flow analysis has been done. It has been implemented through ANSYS Fluent 17.0 using SIMPLE algorithm as solver. The turbulence models used as the RANS based model: the standard k-epsilon model, RNG k-epsilon model and Realizable k-epsilon model. Firstly, the CFD simulation results for single high rise building showed good agreement of approximately 99% in C_p compared to the experimental results obtained from Tokyo Polytechnic University "New frontier of Education and Research in Wind Engineering". Secondly, the CFD simulation results for the surrounding effect of building are investigated. The effects of the surroundings significantly reduce the surface pressure coefficients. Thirdly, For the existing cluster of building in Mandalay, Wind pressure coefficients are compared with the three different turbulence models in Fluent. The Standard k-epsilon model and Realizable k-epsilon model appear to produce exactly prediction wake recirculation zone. The RNG k-epsilon model greatly over predicts the size of the recirculation zone and a strong wake flow among buildings. The standard k-epsilon, RNG k-epsilon, realizable k-epsilon models produce similarly shaped contour map of pressure but with significant differences in magnitude.

Index Terms- Computational Fluid Dynamics; RANS; Single High Rise Building; Surrounding Effect; Existing Cluster Of Building.

I. INTRODUCTION

Wind is an important issue on high-rise buildings. Wind causes aerodynamic pressures on the surfaces of the buildings. These wind induced aerodynamic pressures also vary randomly with time and space. There is a huge demand for high rise buildings in developing countries and developed countries. With the development in technology taller and taller structures are being designed and constructed to care of the local need and desire. Such structures have a significant effect on the surrounding wind patterns. High rise buildings in urban areas should be designed to ensure comfort of their inhabitants and users. The construction of a building inevitably changes the outdoor environment around the building. These changes include wind speed, wind direction, air pollution, driving rain and heat radiation. The change of these quantities depends on the shape, size and orientation of the building and on the interdependence of the buildings with surrounding buildings. This causes many environmental problems in nearby areas such as accelerated wind flow at the ground level impacting the comfort, and sometimes safety, of the users of the building and the pedestrians in the surrounding street canyons. For a safe structural design of any particular structure, it is necessary to consider wind effects. Although one cannot see the wind, it is a common observation that its flow is quite complex and turbulent in nature and has a tendency to exert differential velocity and pressure field around any obstacle likely to obstruct its flow path. The generalized estimation of wind loading is carried out by defining pressure coefficients. Pressure coefficients are non-dimensional parameter which is used to assess magnitude. Pressure coefficients are influenced by various parameters like, shape, structural geometry, incident wind profile, terrain roughness, turbulence in the wind, location of a particular structure etc [1].

Modelling the wind atmosphere associated with proposed or existing buildings is of great importance for the wind engineering, Civil Construction sectors as well as Structural Engineering Sectors. Computational Wind Engineering (CWE) as a branch of Computational Fluid Dynamics (CFD) has been developed rapidly over the last three decades to evaluate the interaction Computational Fluid Dynamics (CFD) simulations are being widely used by engineers for various wind engineering studies such as determine wind loads on buildings, evaluating wind flow patterns in built areas, predicting pollutants depression patterns in urban areas, evaluate pedestrian level wind comforts, etc. CFD (Computational Fluid Dynamics) simulation methods are employed as the main methods for studying the outdoor wind environment today. The precision of simulation results is influenced by many factors, such as algorithms, boundary conditions and turbulence models.

Due to the time and cost issues involved in wind tunnel testing, CFD is now widely employed for the prediction of flow fields. The first CFD techniques were introduced in the early 1950s, made possible by the advent of the digital computer [Chung, 2002]. CFD is a computer-based mathematical modeling tool capable of dealing with fluid flow problems and predicting physical fluid flows and heat transfer [2]. While traditionally thought of as exclusively for use in aerodynamic research, CFD analysis is now being applied in many

other fields, including marine engineering, electrical and electronic engineering, biomedical engineering, chemical engineering, environmental engineering, wind engineering, hydrology, oceanography, meteorology, and nuclear power [2].

In this journal, the wind pressure characteristics are investigated with the following three cases:

(1) A single high rise building case is first considered with three different turbulence models and is compared with the experimental results obtained from Tokyo Polytechnic University “New frontier of Education and Research in Wind Engineering”, to explain the method used to validate our CFD simulations.

(2) And then, a high rise building with surrounding buildings cases are investigated to predict wind characteristics of the flow field.

(3) Finally, existing cluster of buildings case is considered with CFD simulation by using ANSYS Fluent to predict wind pressure coefficients and wind pressure distributions with height on the L-shape building and to investigate the flow path of the velocity distributions within actual existing cluster of buildings in Mandalay.

II. METHODOLOGY

When performing a simulation, the user typically chooses target variables, the approximate form of the governing equations, the turbulence model, the level of detail in the geometrical representation of the buildings, the size of the computational domain, the type and resolution of the computational grid, the boundary conditions, the discretization schemes, and the iterative convergence criteria.

A. Computational Fluid Dynamics

Modeling the wind atmosphere associated with proposed or existing buildings is of great importance for the wind engineering, Civil Construction sectors as well as Structural Engineering Sectors. Computational Wind Engineering (CWE) as a branch of Computational Fluid Dynamics (CFD) has been developed rapidly over the last three decades to evaluate the interaction Computational Fluid Dynamics (CFD) simulations are being widely used by engineers for various wind engineering studies such as determine wind loads on buildings, evaluating wind flow patterns in built areas, predicting pollutants depression patterns in urban areas, evaluate pedestrian level wind comforts, etc. Numerical simulations are more flexible and robust in terms of simulating wind flow conditions together with detailed surrounding features such as buildings, mountains, tree, etc. CFD techniques have been adopted for the estimation of wind flow around building. Progress in high-speed processing by personal computer and rapid propagation of software for numerical analysis of fluid dynamics in recent years have enabled prediction of the pedestrian wind environment around high-rise buildings based on CFD. CFD simulations would be a smart tool for practicing engineers to analyses wind conditions in vicinity of a high-rise building.

In Myanmar, wind engineering is not as much as developed compared the other branches of civil engineering. Nowadays, the concern of wind engineering is increasing among Myanmar engineers due to increase of damages due to frequent occurrence of high wind events and construction of many high-rise buildings in city center, which are more susceptible to wind load. Environmentally, wind, sunlight, natural light, air, noise, skyline, landscape and traffic are the major physical factors that are affected from high-rise existence. These parameters affect quality of life and the conditions under which people live and work. The use of natural ventilation is highly constrained by its surrounding environments. The sheltering effect of the surrounding built-up environment can reduce pressure differences across a building which is necessary to produce adequate ventilation rates.

Computational Fluid Dynamics (CFD) represents the science and methodology of predicting fluid flow by solving governing equations using a numerical algorithm and necessary empirical models. CFD was made possible with the advent of the computer and is continually benefited by increased processor speeds and memory allowance. There are three main components to the implementation of CFD methodology: grid generation, algorithm development, and turbulence / empirical modeling. Grid generation refers to segregating the flow domain into individual cells or elements. The grid is used to calculate derivatives and fluxes for the numerical algorithm. The numerical algorithm refers to how the derivatives and fluxes are calculated i.e. central differenced or up-winded and order of accuracy etc. Models are used to reduce computational requirements (such as processor speed and memory) involved in resolving turbulent flow.

B. Governing equations

Wind engineers study more about the lower part of the atmosphere though entire earth atmosphere extends few kilometers above the earth surface. This lower part of the atmosphere is called as atmospheric boundary layer (ABL), which is directly under influence of earth surface itself such as shape, friction, thermal with time scales of less than a day and turbulent motion length scales of the order of boundary layer depth [3]. This boundary layer depth can be varying from several hundred meters to more than a kilometer aloft. Thus, most of manmade structures are well within the atmospheric boundary layer, governing flow equations can apply in this layer easily. However, both time and length scales of atmospheric flows have large variations. Thus, numerical simulations are divided in to micro-scale and meso-scale based on time and length scale for easiness of study. In this study, term CFD simulation is strictly used to describe the simulation of smaller length (~10 cm - 100 m) and time scales (~1 minute – 1 hour), thus probably in the category of micro-scale modelling. Most of governing equations in fluid dynamics can be applied to the atmospheric flows. The main governing equations are about conservation of mass (equation 1) and momentum (equation 2). The latter is also known as Navier-Stokes equation for motion of the fluid.

$$\frac{\partial \rho}{\partial t} + \frac{\partial(\rho u_i)}{\partial x_i} = 0 \quad (1)$$

$$\frac{\partial \rho u_i}{\partial t} + \frac{\partial(\rho u_i u_j)}{\partial x_j} = \frac{\partial P}{\partial x_i} + \frac{\partial}{\partial x_j} \left[\mu \left(\frac{\partial u_i}{\partial x_j} + \frac{\partial u_j}{\partial x_i} \right) \right] \quad (2)$$

Where, u_i, u_j are velocity components, ρ is air density, P is air pressure, μ is dynamic viscosity, and t is time. In this equation, Coriolis force and buoyance force are not considered as their effect is negligible in smaller length and time scale, which is valid for micro-scale CFD simulations.

C. Turbulence Models

Turbulence modeling is the computational procedure to solve and analyze the fluid flow introducing some approximations in the governing differential equations so that required solution is obtained approximately consuming feasible computational memory and time. Turbulence modeling is based on the assumption that the real flow field may be substituted by an imaginary field of mathematically defined continuous functions. The objective of the turbulence modeling is to develop a set of constitutive relations valid for any general turbulent flow problem which yield sufficiently reliable predictions and offer a degree of universality sufficient to justify their usage in terms of computational effort and accuracy. Many turbulence modeling techniques deal with an approximation to the Navier-Stokes equations in form of averaging the different ranges of turbulent eddy scales. For prediction of turbulent flows, the available approaches of turbulence modeling are (i) Direct Numerical Simulation (DNS) (ii) Large Eddy Simulation (LES) (iii) Reynolds Averaged Navier Stokes solution (RANS). The most common approach in CWE is RANS. Therefore, this section focuses on the turbulence models used in RANS. The equations of the RANS models calculate the transport equations only for the average quantities of the air flow, for which all the turbulence scales are simulated. By the early 1950's, four main categories of turbulence models had developed:

- (1) Algebraic (Zero-Equation) Models
- (2) One-Equation Models
- (3) Two-Equation Models
- (4) Second-Order Closure Models

With increased computer capabilities beginning in the 1960's, further development of all four of these classes of turbulence models has occurred.

Among them, Two-equation models have been the most popular models for a wide range of engineering analysis and research. These models provide independent transport equations for both the turbulence length scale, or some equivalent parameter, and the turbulent kinetic energy. With the specification of these two variables, two-equation models are complete; no additional information about the turbulence is necessary to use the model for a given flow scenario. While this is encouraging in that these models may appear to apply to a wide range of flows, it is instructive to understand the implicit assumptions made in formulating a two-equation model. Specifically, most two-equation models make the same fundamental assumption of local equilibrium, where turbulent production and dissipation balance. This assumption further implies that the scales of the turbulence are locally proportional to the scales of the mean flow; therefore, most two equation models will be in error when applied to non-equilibrium flows. Though somewhat restricted, two-equation models are still very popular and can be used to give results well within engineering accuracy when applied to appropriate cases [4].

The K-epsilon model is one of the most common turbulence models. It is a two equation model, which means, it includes two extra transport equations to represent the turbulent properties of the flow. This allows a two equation model to account for history effects like convection and diffusion of turbulent energy. The first transported variable is turbulent kinetic energy, k . The second transported variable in this case is the turbulent dissipation, ϵ . It is the variable that determines the scale of the turbulence, whereas the first variable, k , determines the energy in the turbulence. To calculate boundary conditions for K-epsilon models see turbulence free-stream boundary conditions are;

- (1) Standard k-epsilon model
- (2) Standard k-epsilon hybrid model
- (3) Realizable k-epsilon model
- (4) Realizable k-epsilon hybrid model
- (5) RNG k-epsilon model
- (6) RNG k-epsilon hybrid model

In this study, models have been selected for numerical simulation for wind load prediction using three different turbulence models which are standard k- ϵ model, RNG k- ϵ model and Realizable k- ϵ model.

(1) Standard k- ϵ Model

Two-equation turbulence models allow the determination of both, a turbulent length and time scale by solving two separate transport equations. The standard k - ϵ model in ANSYS FLUENT falls within this class of models and has become the workhorse of practical engineering flow calculations in the time since it was proposed by Launder and Spalding. Robustness, economy, and reasonable

accuracy for a wide range of turbulent flows explain its popularity in industrial flow and heat transfer simulations. It is a semi-empirical model, and the derivation of the model equations relies on phenomenological considerations and empiricism.

The standard k - ε model is a model based on model transport equations for the turbulence kinetic energy (k) and its dissipation rate (ε). The model transport equation for k is derived from the exact equation, while the model transport equation for ε was obtained using physical reasoning and bears little resemblance to its mathematically exact counterpart.

In the derivation of the k-ε model, the assumption is that the flow is fully turbulent, and the effects of molecular viscosity are negligible. The standard k - ε model is therefore valid only for fully turbulent flows.

As the strengths and weaknesses of the standard k-ε model have become known, modifications have been introduced to improve its performance. Two of these variants are available in ANSYS FLUENT: the RNG k -ε model and the realizable k-ε model.

The turbulence kinetic energy, k, and its rate of dissipation, ε, are obtained from the following transport equations:

$$\frac{\partial}{\partial t}(\rho k) + \frac{\partial}{\partial x_i}(\rho k u_i) = \frac{\partial}{\partial x_j} \left[\left(\mu + \frac{\mu_t}{\sigma_k} \right) \frac{\partial k}{\partial x_j} \right] + G_k + G_b - \rho \varepsilon - Y_M + S_k \quad (3)$$

and

$$\frac{\partial}{\partial t}(\rho \varepsilon) + \frac{\partial}{\partial x_i}(\rho \varepsilon u_i) = \frac{\partial}{\partial x_j} \left[\left(\mu + \frac{\mu_t}{\sigma_\varepsilon} \right) \frac{\partial \varepsilon}{\partial x_j} \right] + C_{1\varepsilon} \frac{\varepsilon}{k} (G_k + C_{3\varepsilon} G_b) - C_{2\varepsilon} \rho \frac{\varepsilon^2}{k} + S_\varepsilon \quad (4)$$

In these equations, G_k represents the generation of turbulence kinetic energy due to the mean velocity gradients, calculated as described in Modeling Turbulent Production in the k- ε Models. G_b is the generation of turbulence kinetic energy due to buoyancy, calculated as described in Effects of Buoyancy on Turbulence in the k- ε Models. Y_M represents the contribution of the fluctuating dilatation in compressible turbulence to the overall dissipation rate, calculated as described in Effects of Compressibility on Turbulence in the k- ε Models. $C_{1\varepsilon}$, $C_{2\varepsilon}$, and $C_{3\varepsilon}$ are constants. σ_k and σ_ε are the turbulent Prandtl numbers for k and ε, respectively. S_k and S_ε are user-defined source terms.

The turbulent (or eddy) viscosity, μ_t , is computed by combining k and ε as follows:

$$\mu_t = \rho C_\mu \frac{k^2}{\varepsilon} \quad (5)$$

Where, C_μ is a constant

The model constants $C_{1\varepsilon}$, $C_{2\varepsilon}$, C_μ , σ_k and σ_ε have the following default values: $C_{1\varepsilon}=1.44$, $C_{2\varepsilon}=1.92$, $C_\mu=0.09$, $\sigma_k=1.0$ and $\sigma_\varepsilon=1.3$.

(2) RNG k- ε Model

The RNG k-ε model was derived using a statistical technique called renormalization group theory. It is similar in form to the standard k- ε model, but includes the following refinements:

- (a) The RNG model has an additional term in its ε equation that improves the accuracy for rapidly strained flows.
- (b) The effect of swirl on turbulence is included in the RNG model, enhancing accuracy for swirling flows.
- (c) The RNG theory provides an analytical formula for turbulent Prandtl numbers, while the standard k- ε model uses user-specified, constant values.

The RNG-based k-ε turbulence model is derived from the instantaneous Navier-Stokes equations, using a mathematical technique called “renormalization group” (RNG) methods. The analytical derivation results in a model with constants different from those in the standard k - ε model, and additional terms and functions in the transport equations for k and ε.

The RNG k-ε model has a similar form to the standard k-ε model:

$$\frac{\partial}{\partial t}(\rho k) + \frac{\partial}{\partial x_i}(\rho k u_i) = \frac{\partial}{\partial x_j} \left[\alpha_k \mu_{eff} \frac{\partial k}{\partial x_j} \right] + G_k + G_b - \rho \varepsilon - Y_M + S_k \quad (6)$$

and

$$\frac{\partial}{\partial t}(\rho \varepsilon) + \frac{\partial}{\partial x_i}(\rho \varepsilon u_i) = \frac{\partial}{\partial x_j} \left[\alpha_\varepsilon \mu_{eff} \frac{\partial \varepsilon}{\partial x_j} \right] + C_{1\varepsilon} \frac{\varepsilon}{k} (G_k + C_{3\varepsilon} G_b) - C_{2\varepsilon} \rho \frac{\varepsilon^2}{k} - R_\varepsilon + S_\varepsilon \quad (7)$$

In these equations, G_k represents the generation of turbulence kinetic energy due to the mean velocity gradients, calculated as described in Modeling Turbulent Production in the k- ε Models. G_b is the generation of turbulence kinetic energy due to buoyancy, calculated as described in Effects of Buoyancy on Turbulence in the k- ε Models. Y_M represents the contribution of the fluctuating dilatation in compressible turbulence to the overall dissipation rate, calculated as described in Effects of Compressibility on Turbulence in the k- ε Models. $C_{1\varepsilon}$, $C_{2\varepsilon}$, and $C_{3\varepsilon}$ are constants. The quantities α_k and α_ε are the turbulent Prandtl numbers for k and ε, respectively. S_k and S_ε are user-defined source terms.

The scale elimination procedure in RNG theory results in a differential equation for turbulent viscosity:

$$d\left(\frac{\rho 2k}{\sqrt{\varepsilon\mu}}\right) = 1.72 \frac{\hat{v}}{\sqrt{\hat{v}^3 - 1 + C_v}} d\hat{v} \tag{8}$$

Where;

$$\hat{v} = \frac{\mu_{eff}}{\mu}, \quad C_v \approx 100$$

Equation 8 is integrated to obtain an accurate description of how the effective turbulent transport varies with the effective Reynolds number (or eddy scale), allowing the model to better handle low-Reynolds number and near-wall flows.

In the high-Reynolds number limit, Equation 8 gives

$$\mu_t = \rho C_\mu \frac{k^2}{\varepsilon}$$

With $C_\mu = 0.0845$, derived using RNG theory. It is interesting to note that this value of C_μ is very close to the empirically-determined value of 0.09 used in the standard k - ε model.

The inverse effective Prandtl numbers, α_k and α_ε are computed using the following formula derived analytically by the RNG theory:

$$\left| \frac{\alpha - 1.3929}{\alpha_0 - 1.3929} \right|^{0.6321} \left| \frac{\alpha + 2.3929}{\alpha_0 + 2.3929} \right|^{0.3679} = \frac{\mu_{mol}}{\mu_{eff}} \tag{9}$$

Where, $\alpha_0 = 1.0$. In the high-Reynolds number limit ($\frac{\mu_{mol}}{\mu_{eff}} = 1$), $\alpha_k = \alpha_\varepsilon \approx 1.393$.

The main difference between the RNG and standard k - ε models lies in the additional term in the equation given by

$$R_\varepsilon = \frac{C_\mu \rho \eta^3 \left(1 - \frac{\eta}{\eta_0}\right)}{1 + \beta \eta^3} \frac{\varepsilon^2}{k} \tag{10}$$

Where, $\eta \equiv \frac{Sk}{\varepsilon}$, $\eta_0 = 4.38$, $\beta = 0.012$.

The effects of this term in the RNG ε equation can be seen more clearly by rearranging Equation 7. Using Equation 10, the third and fourth terms on the right-hand side of Equation 7 can be merged, and the resulting equation can be rewritten as

$$\frac{\partial}{\partial t}(\rho\varepsilon) + \frac{\partial}{\partial x_i}(\rho\varepsilon u_i) = \frac{\partial}{\partial x_j} \left[\alpha_\varepsilon \mu_{eff} \frac{\partial \varepsilon}{\partial x_j} \right] + C_{1\varepsilon} \frac{\varepsilon}{k} (G_k + C_{3\varepsilon} G_b) - C_{2\varepsilon}^* \rho \frac{\varepsilon^2}{k} \tag{11}$$

Where, $C_{2\varepsilon}^*$ is given by

$$C_{2\varepsilon}^* \equiv C_{2\varepsilon} + \frac{C_\mu \eta^3 \left(1 - \frac{\eta}{\eta_0}\right)}{1 + \beta \eta^3} \tag{12}$$

In regions where $\eta < \eta_0$, the R term makes a positive contribution, and $C_{2\varepsilon}^*$ becomes larger than $C_{2\varepsilon}$. In the logarithmic layer, for instance, it can be shown that $\eta \approx 3.0$, giving $C_{2\varepsilon}^* \approx 2.0$, which is close in magnitude to the value of $C_{2\varepsilon}$ in the standard k-ε model (1.92). As a result, for weakly to moderately strained flows, the RNG model tends to give results largely comparable to the standard k - ε model.

In regions of large strain rate ($\eta > \eta_0$), however, the R term makes a negative contribution, making the value of $C_{2\varepsilon}^*$ less than $C_{2\varepsilon}$. In comparison with the standard k-ε model, the smaller destruction of ε augments ε, reducing k and, eventually, the effective viscosity. As a result, in rapidly strained flows, the RNG model yields a lower turbulent viscosity than the standard k-ε model.

The model constants $C_{2\varepsilon}^*$ and $C_{2\varepsilon}$ in Equation 7 have values derived analytically by the RNG theory. These values, used by default in ANSYS FLUENT, are constants $C_{1\varepsilon} = 1.42$, $C_{2\varepsilon} = 1.68$.

(3) Realizable k- ε Model

The realizable k-ε model differs from the standard k-ε model in two important ways:

- (a) The realizable k-ε model contains an alternative formulation for the turbulent viscosity.
- (b) A modified transport equation for the dissipation rate, ε, has been derived from an exact equation for the transport of the mean-square vorticity fluctuation.

The term “realizable” means that the model satisfies certain mathematical constraints on the Reynolds stresses, consistent with the physics of turbulent flows. Neither the standard k-ε model nor the RNG k-ε model is realizable.

The realizable k-ε model proposed by Shih et al was intended to address these deficiencies of traditional k-ε models by adopting the following:

- (a) A new eddy-viscosity formula involving a variable originally proposed by Reynolds.
- (b) A new model equation for dissipation (ε) based on the dynamic equation of the mean-square vorticity fluctuation.

The modeled transport equations for k and ε in the realizable k-ε model are

$$\frac{\partial}{\partial t}(\rho k) + \frac{\partial}{\partial x_j}(\rho k u_j) = \frac{\partial}{\partial x_j} \left[\left(\mu + \frac{\mu_t}{\sigma_k} \right) \frac{\partial k}{\partial x_j} \right] + G_k + G_b - \rho \varepsilon - Y_M + S_k \tag{13}$$

and

$$\frac{\partial}{\partial t}(\rho \varepsilon) + \frac{\partial}{\partial x_i}(\rho \varepsilon u_i) = \frac{\partial}{\partial x_j} \left[\left(\mu + \frac{\mu_t}{\sigma_\varepsilon} \right) \frac{\partial \varepsilon}{\partial x_j} \right] + \rho C_1 S \varepsilon - \rho C_2 \frac{\varepsilon^2}{k + \sqrt{\nu \varepsilon}} + C_{1\varepsilon} \frac{\varepsilon}{k} C_{3\varepsilon} G_b + S_\varepsilon \tag{14}$$

Where,

$$C_1 = \max \left[0.43, \frac{\eta}{\eta + 5} \right], \eta = S \frac{k}{\varepsilon}, S = \sqrt{2 S_{ij} S_{ij}}$$

In these equations, G_k represents the generation of turbulence kinetic energy due to the mean velocity gradients, calculated as described in Modeling Turbulent Production in the k-ε Models. G_b is the generation of turbulence kinetic energy due to buoyancy, calculated as described in Effects of Buoyancy on Turbulence in the k-ε Models. Y_M represents the contribution of the fluctuating dilatation in compressible turbulence to the overall dissipation rate, calculated as described in Effects of Compressibility on Turbulence in the k-ε Models. C_2 and $C_{2\varepsilon}$ are constants. σ_k and σ_ε are the turbulent Prandtl numbers for k and ε, respectively. S_k and S_ε are user-defined source terms.

As in other k-ε models, the eddy viscosity is computed from

$$\mu_t = \rho C_\mu \frac{k^2}{\varepsilon} \tag{15}$$

The difference between the realizable k-ε model and the standard and RNG k-ε models is that C_μ is no longer constant. It is computed from

$$C_\mu = \frac{1}{A_0 + A_s \frac{k u^*}{\varepsilon}} \tag{16}$$

Where,

$$U^* \equiv \sqrt{S_{ij} S_{ij} + \overline{\Omega_{ij} \Omega_{ij}}} \tag{17}$$

and

$$\overline{\Omega_{ij}} = \Omega_{ij} - 2 \varepsilon_{ijk} \omega_k, \quad \Omega_{ij} = \overline{\Omega_{ij}} - \varepsilon_{ijk} \omega_k$$

Where; $\overline{\Omega_{ij}}$ is the mean rate-of-rotation tensor viewed in a moving reference frame with the angular velocity ω_k . The model constants A_0 and A_s are given by

$$A_0=4.04, \quad A_s = \sqrt{6} \cos \phi$$

Where,

$$\phi = \frac{1}{3} \cos^{-1} \left[\sqrt{6W} \right], W = \frac{S_{ij} S_{ik} S_{ki}}{S^3}, \hat{S} = \sqrt{S_{ij} S_{ij}}, S_{ij} = \frac{1}{2} \left(\frac{\partial u_j}{\partial x_i} + \frac{\partial u_i}{\partial x_j} \right) \tag{18}$$

It can be seen that C_μ is a function of the mean strain and rotation rates, the angular velocity of the system rotation, and the turbulence fields (k and ε). C_μ in Equation 16 can be shown to recover the standard value of 0.09 for an inertial sublayer in an equilibrium boundary layer.

The model constants C_2 , σ_k and σ_ε have been established to ensure that the model performs well for certain canonical flows. The model constants are $C_{1\varepsilon}=1.44$, $C_2=1.9$, $\sigma_k=1.0$ and $\sigma_\varepsilon=1.2$.

D. Computational domain

The size of computational domain depends on the region that shall be represented by the simulation [5]. Domain should be large enough to avoid reflecting of fluid streams, which may cause abnormal pressure fields around the model. For an accurate simulation, it is important to reproduce the influence of the surroundings as accurately as possible in the computational) being adhered to by workers when modelling low-rise buildings. For such low-rise buildings, where H-B-L (with B and L being the cross- and along wind

building dimensions respectively), these requirements produce domains that are both acceptable in physical and computational terms. By "acceptable in computational terms", it is meant that the domain boundaries are not so distant from the building that the number of computational cells required to fill the domain to ensure a reasonable level of accuracy becomes too large.

Various dimensions of the simulation volume are recommended in the literature:

- (1) The blocking ratio should not exceed 3% [6]. The blocking ratio is the ratio between the buildings vertical surfaces exposed to the wind and the surface formed by the height and width of the simulated field which is generally the air inlet surface in the simulation.
- (2) A blocking ratio less than 3% is recommended, even for large groups of buildings. The shape of the section of the simulation volume should preferably follow that of the buildings vertical surface exposed to the wind [5].
- (3) The minimum length of the simulation field is $5 * \min(L, 2H)$ upstream of the building and $8 * \min(L, 2H)$ downstream of it, taking L equal to the length of the building and H equal to its height [7].
- (4) The minimum dimensions of the simulation field are: 5H upstream of the building, 5H on each building side, 5H above it and 15 H downstream of the building. For a complex of buildings, the height H is the height of the highest building: Hmax [Hall 1997][8].

E. Boundary Conditions

Boundary conditions represent the influence of surroundings that have been cut off by the computational domain. The boundary conditions for inlet, outlet and outer walls should be provided. Various papers recommend the following boundary conditions for the simulation limits [Baetke et al 1990 ; Hall 1997 ; Blocken & al 2004 ; Francke & al 2004]:

- (1) symmetries on the edges and the upper surface of the volume,
- (2) "outflow" or a condition of zero pressure for the surface by which air leaves the simulation volume. The "outflow" boundary condition imposes a fully developed airflow at the exit, so it is important that the distance between building and exit is sufficiently long.
- (3) a profile of wind speed varying with the height at the air entrance of the simulation field.

According to them, we used the symmetries and outflow boundaries for our simulations.

The inlet boundary conditions of the domain are defined by the vertical profile. The inlet wind vertical profile is represented in the power law profile form

$$U(z) = U_{ref} \left(\frac{z}{z_{ref}} \right)^\alpha \quad (19)$$

where, U(z) is the velocity at height z above the ground, Uref the basic wind speed at reference height, Z_{ref} the reference height above the ground, generally 10 m, and α is constant exponent power law, varying for different terrains.

F. Meshing

A good mesh requires great precision. The mesh should be highly refined at pedestrian level and in areas where strong wind gradients are planned. Adapting the mesh is an effective way to model accurately separation and attachment flow details without too many calculations [9].

With regard to the geometry of the region of interest, the computational grids that discretize the computational domain should be fine enough to provide an adequate resolution of the geometrical and expected flow features [10]. Generally, the greater the number of cells the better the CFD results, but as the number of cells increases, the calculation time also increases. The maximum number of cells that can be created for the solution depends on the computing resources available. According to the AIJ guidelines [Tominaga et al., 2008], the grid resolution must be at least 1/10 the building scale within the region that includes the evaluation points around the building of interest [11]. COST [Franke et al., 2007] also recommends a minimum of 10 cells per building side and at least 10 cells per cube root of building volume should be used for the initial grid resolution. To boost the accuracy of the simulation, local grid refinement can be used. Some commercial codes provide algorithms to adjust the local grid resolution according to numerical criteria obtained from the flow solution. However this accuracy comes at a cost, as any increase in the number of cells also increases the computer storage required and the run-time of the simulation. Thus, it is important to determine the optimum mesh size taking into account the available computer storage and run-time.

COST [Franke et al., 2007] suggests that grid stretching should be small in regions of high gradients, keeping the truncation error small. The shape of the grids can be categorized as either an unstructured or structured mesh. COST [Franke et al., 2007] consider hexahedral cells to be preferable to tetrahedral cells because hexahedral cells produce smaller truncation errors and provide better iterative convergence. They also note that when using tetrahedral cells, prismatic cells must be used at the wall and tetrahedral cells away from the wall since the grid lines should be perpendicular to the wall. Tominaga et al. [2008] also indicate that it is important to arrange that prismatic cells are parallel to walls and ground surfaces when using tetrahedral cells. Thus, both hexahedral and tetrahedral mesh can be used for CFD applications for wind flow around buildings. In addition, at least 10 cells per cube root of building volume are recommended for the initial grid resolution.

III. NUMERICAL SETUP

CFD code Fluent v17 is used to solve the 3D Reynolds-Average Navier-Stokes (RANS) equations and continuity equation, using the finite volume method. Standard k-ε model, RNG k-ε model and Realizable k-ε model with standard wall functions are used for turbulence modelling. SIMPLE algorithm is used for pressure-velocity coupling. As pressure based solver is used, second-order upwind discretization schemes are used for the convection terms and the viscous terms of the governing equations, i.e. conservation of mass and momentum equations.

IV. WIND FLOW AROUND A SINGLE BUILDING

In this study, the single high-rise building case is first considered. The building chosen for this work is a 1: 100 scale rectangular prism with a full scale size of 30.48 m (L)× 30.48 m (W) × 91.44 m (H). The arbitrary domain size shows in figure 1 to simulate the building within the atmospheric boundary layer. The dimensions of the computational domain are 518.16m × 274.32m×1097.28m in lateral, vertical and flow directions respectively.

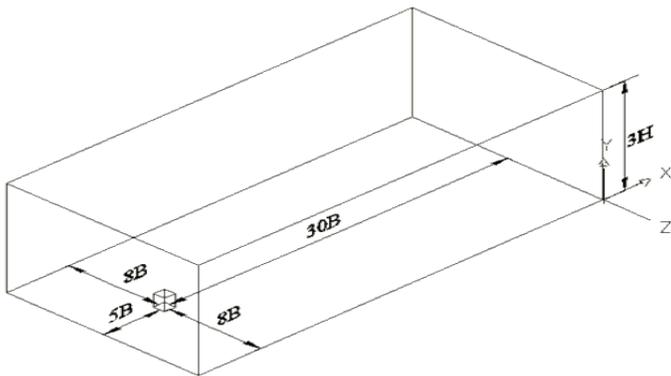


Figure 1: arbitrary domain size

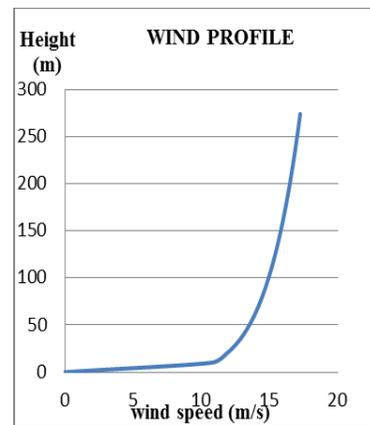


Figure 2: vertical profile for inlet boundary conditions

These dimensions respected a 1.96% blockage ratio (ratio of the front area of the building over the inlet area). Meshing is another important stage of a CFD simulation, which corresponds to accurate simulation of the atmosphere boundary layer as well as fluid motion near the ground. This mesh has over 1260000 nodes and over 1220000 elements by using MultiZone Meshing Method. The maximum cell size was 0.05m and minimum cell size was 0.001m. In this simulation, the aspect ratio of rectangular prism is 1:3 and the basic wind speed is considered 10.7535 m/s which are similar to the values simulated in the wind tunnel. The inflow wind velocity profile are computed by power law equation and imposed by UDF (C+ program). The vertical profile for inlet boundary condition is show in figure 2 and the summary of the data required for computation through ANSYS FLUENT is shown in Table 1.

Table .1: Input Parameter

S.N	Parameters	Values
1	Vertical Velocity Profile	$10.7535 \times \left(\frac{z}{10}\right)^{1/7}$
2	Basic Wind Speed (m/s)	10.7535
3	Power Law Coefficient, α	1/7
4	Turbulent Viscosity Ratio	10
5	Density of air (kg/m ³)	1.225
6	Viscosity of air (kg/m-s)	1.7594×10^{-5}
7	Solver	Pressure –based steady state
8	Models	standard k-ε model
9	Solution Method	SIMPLE pressure velocity coupling

A. SIMULATION RESULTS

Figure.3 is show the prediction of wind pressure distribution by simulation. The maximum wind pressure of the windward face of the building is 113.791 [pa], which are found two third of the building height. The minimum wind pressure of the building is -109.736 [pa] and is found at the corner of the building.

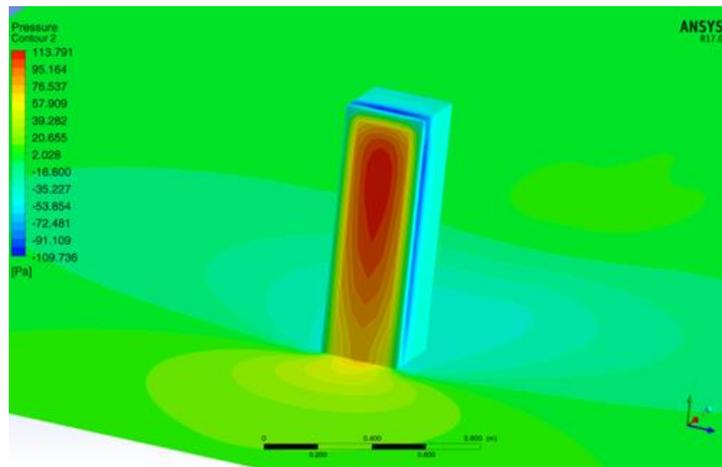


Figure 3: Contour Map of Pressure distributions

B. VALIDATION ON CFD SIMULATION

Figure 4 describes comparison of wind pressure coefficients on the windward wall obtained from this analysis and the experimental results obtained from TOKYO POLYTECHNIC UNIVERSITY “New frontier of Education and Research in Wind Engineering” for single high rise building case. The pressure coefficients follow a similar trend with the wind tunnel results on the windward wall. The results obtained in this research are matching with an average variation of 1% with wind tunnel result. Therefore, Computational fluid dynamics simulations programs are also very powerful tools for modeling the wind around buildings. They give a quantitative and qualitative wind flow representation of the whole volume simulated.

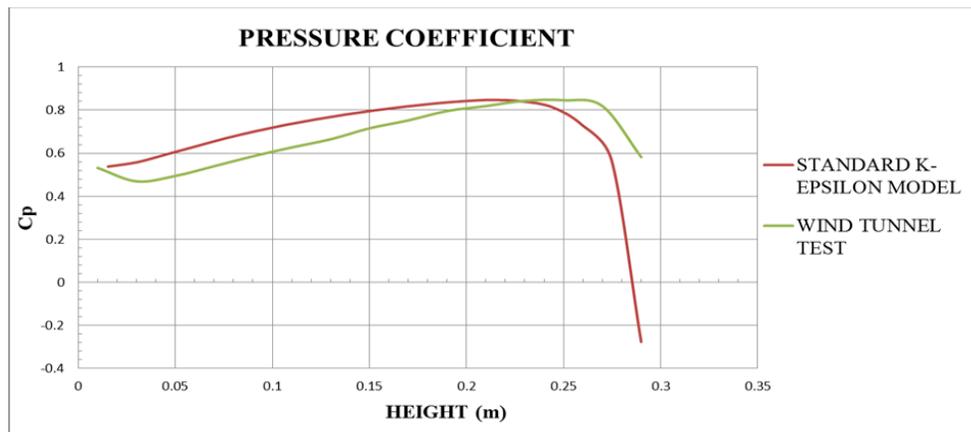


Figure 4: Comparison of pressure coefficients for the windward wall

V. WIND FLOW AROUND SURROUNDING BUILDINGS

Secondly, a high rise building with surrounding buildings cases are considered. A simple model with the urban area consider as arrays of identical building blocks with one high rise building in the center as show in figure 5. The target building has a size of 30.48 m (L)× 30.48 m (W) × 91.44 m (H) in full scale and the surrounding lower buildings have the same footprint with reduced height of 18.2888 m. figure 5a represents a single high-rise building with the same height while figure 5b describes target building with array one row lower buildings which have eight numbers of the building with the same height while figure 5c with target building with array two rows lower buildings which have twenty-four numbers of the building with the same height. The size of the computational domain, the value of input for boundary conditions and the numerical set up are similar with single building case.



Figure 5a: Single High Rise Buildings



Figure 5b: Target Building with Array One Row Lower Buildings

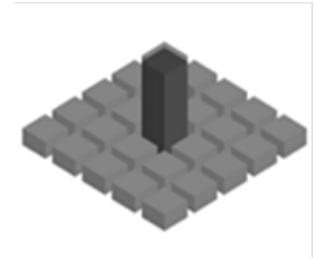


Figure 5c: Target Building with Array Two Rows Lower Buildings

A. SIMULATION RESULTS

The simulation results of wind pressure coefficient for (a) Single High rise Building (b) Target building with array one row lower buildings (c) Target building with array two rows lower buildings are shown in figure 6. For all three cases, it can be seen that the maximum wind pressure coefficient occurred to be at the middle of windward surface with height of about $0.73H$ and the minimum wind pressure coefficient generates at the corner of the flow separation. But, the single high rise building case is the highest value of wind pressure coefficient other than the two cases and the target building with array two rows surrounding buildings is the lowest value of wind pressure coefficient due to the sheltering effects around the building.

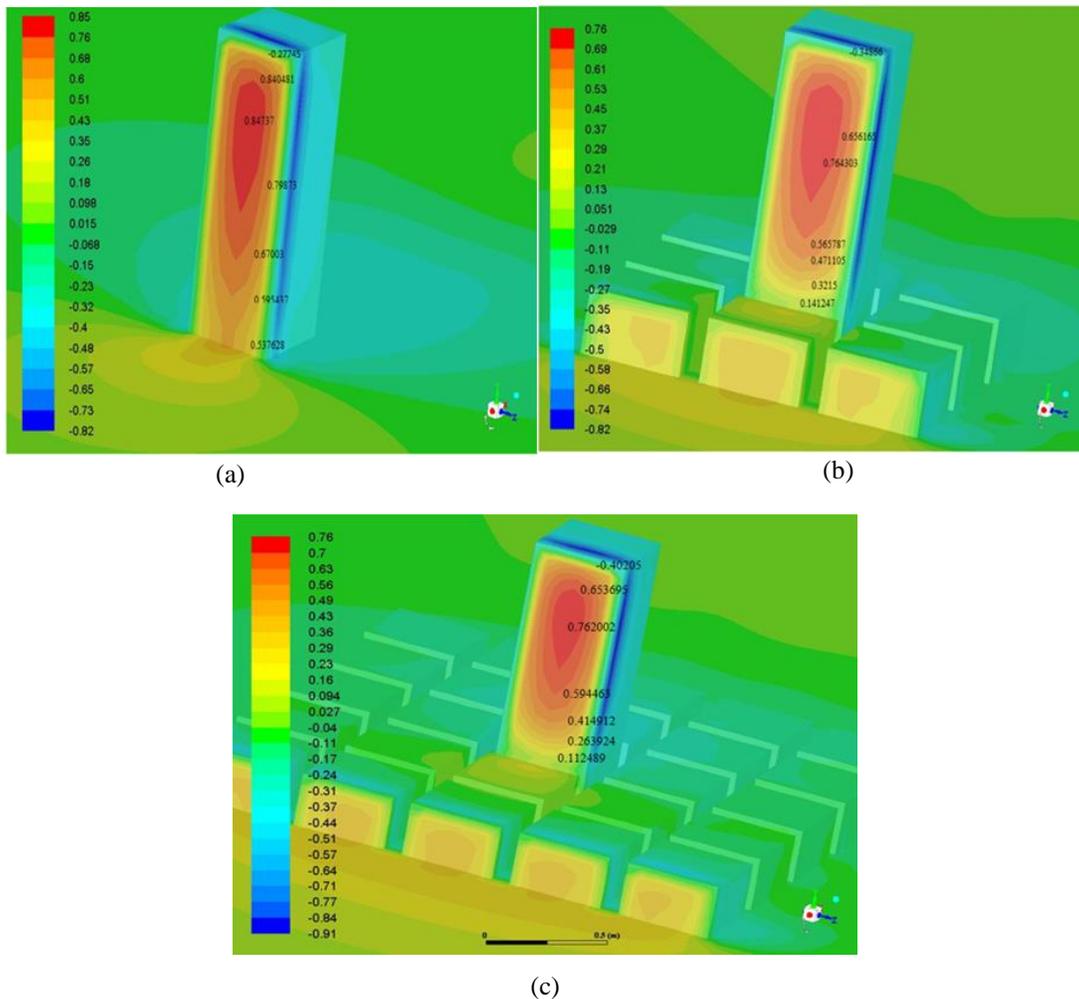


Figure 6: Comparison of pressure coefficient for (a) Single High rise Building (b) target building with array one row lower buildings (c) target building with array two rows lower buildings

VI. WIND FLOW AROUND CLUSTER OF EXISTING BUILDINGS

In this study, the arbitrary domain size is shown in figure 7 to simulate the building within the atmospheric boundary layer. The length of the simulation volume extends upstream of buildings over a distance of $5H$, downstream over a distance of $20H$, summaries side of the buildings over a distance of $5.5H$ and height of the domain size over a distance of $5H$, H being the height of the target building. The full scale dimensions of the computational domain are $571.15\text{m} \times 228.5\text{m} \times 1236.3$ in lateral, vertical and flow directions respectively. In this study, This mesh has over 2930000 nodes and over 285000 elements by using MultiZone Meshing Method. . The maximum cell size for all three domains was 0.02m and minimum cell size was 0.0001m .

In these simulation, the basic wind speed, U_{ref} , is 38.16 m/s in Mandalay from Myanmar National Building Code (2016) and exponent power law, α , is $1/7$ for exposure categories B, urban and suburban areas, from ASCE 7-05. The vertical profile for inlet boundary condition is show in figure 8 and the summary of the data are similar with above the CFD simulation.

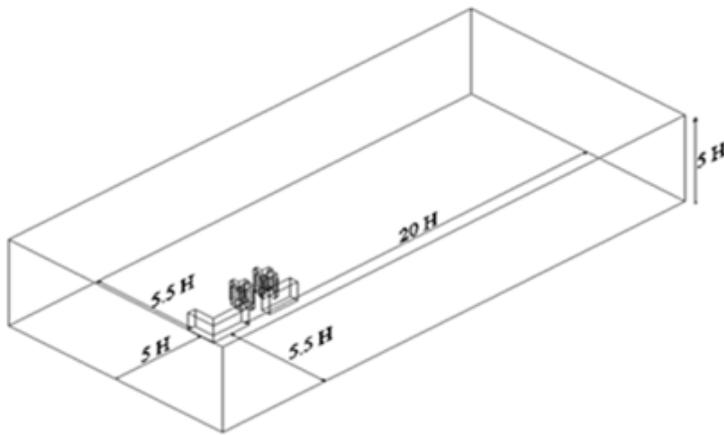


Figure 7: Arbitrary Domain Size

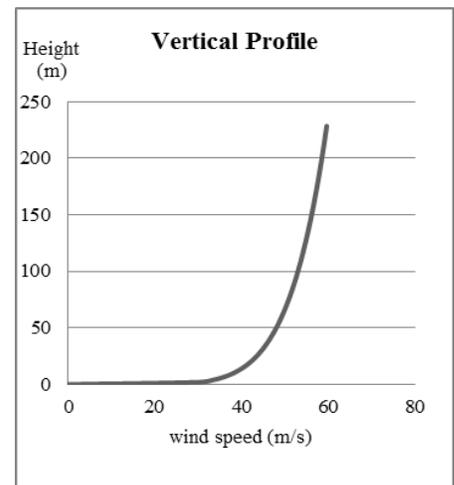
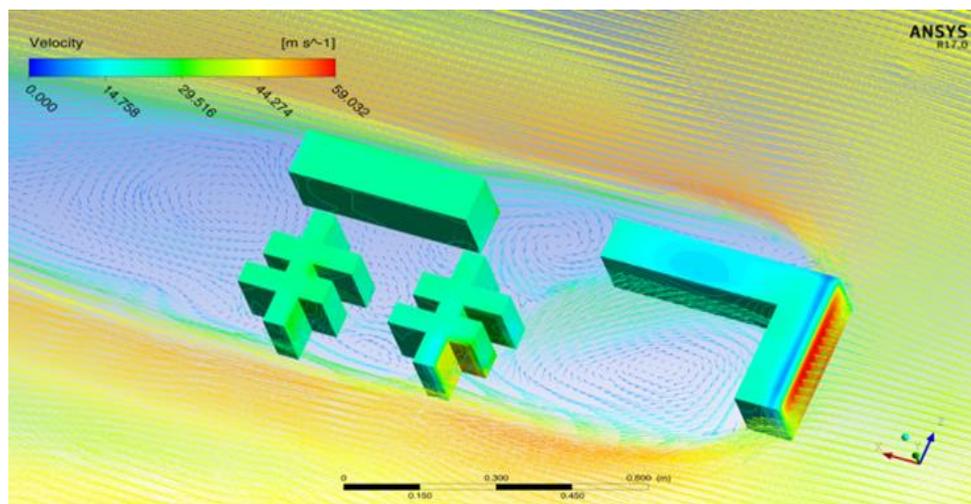


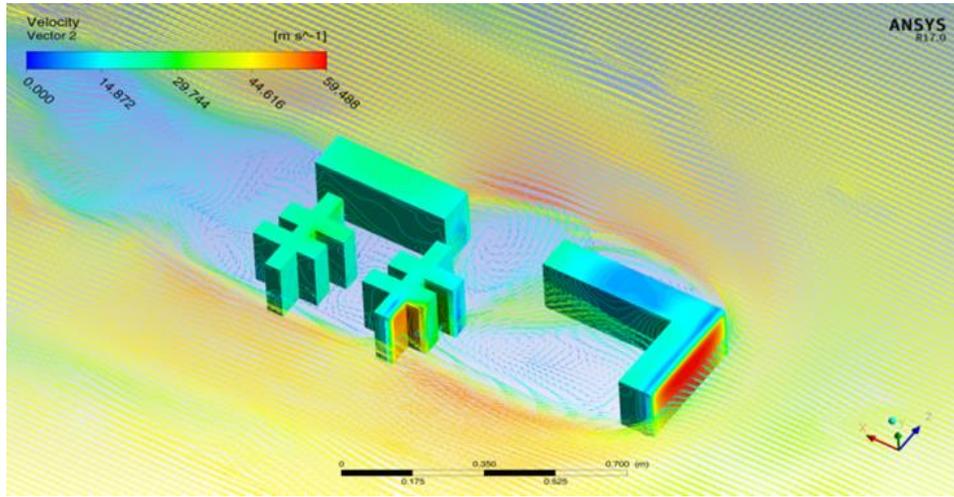
Figure 8: vertical profile for inlet boundary conditions

A. SIMULATION RESULTS

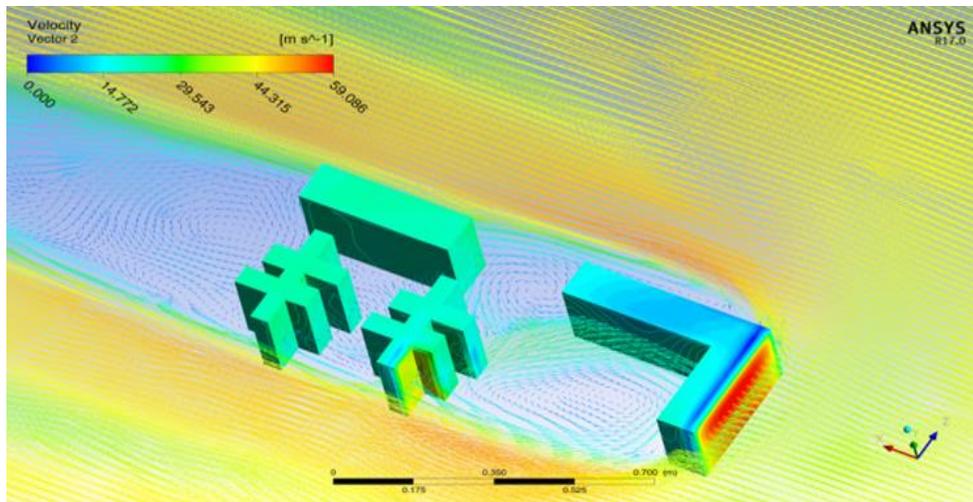
To examine the airflow process, figure 9 and figure 10 demonstrate close up view of stream line pattern of the velocity on the horizontal plane at the middle height of the L-shape building and close up view of the pressure contours of wind field for directing the airflow (a) standard $k-\epsilon$ model, (b) RNG $k-\epsilon$ model and (c) Realizable $k-\epsilon$ model.



(a) standard $k-\epsilon$ model

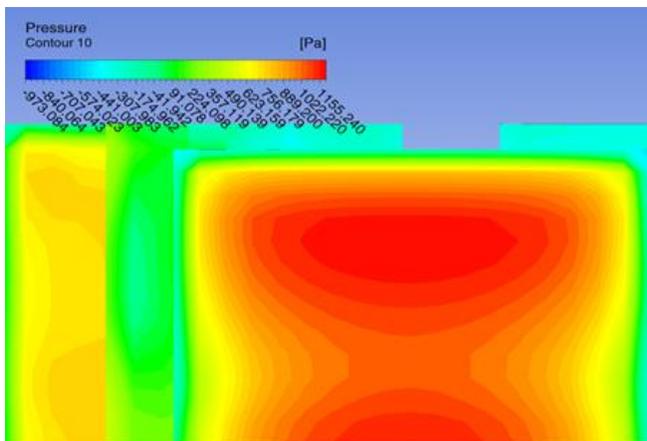


(b) RNG k-ε model

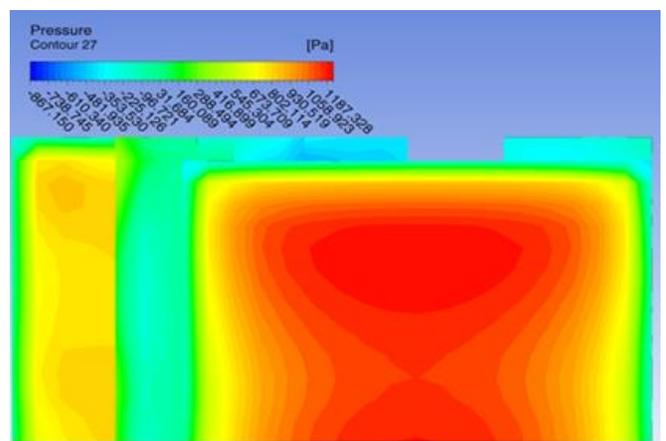


(c) Realizable k-ε model

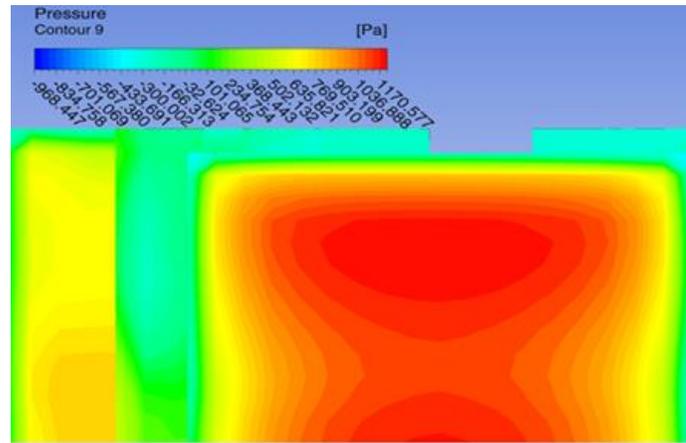
Figure 9: Close up view of stream line pattern on the horizontal plane at the middle height of the L-shape building (a) standard k-ε model, (b) RNG k-ε model and (c) Realizable k-ε model



(a) standard k-ε model



(b) RNG k-ε model



(c) Realizable k-ε model.

Figure 10: Close up view of the pressure contours of wind field for directing the airflow (a) standard k-ε model, (b) RNG k-ε model and (c) Realizable k-ε model.

It can be found that the Standard k-ε model and Realizable k-ε model predict similarly the magnitude of the maximum velocity while the RNG k-ε model is the most value of the maximum velocity other than two models. The Standard k-ε model and Realizable k-ε model appear to produce exactly prediction wake recirculation zone. The RNG k-ε model greatly over predicts the size of the recirculation zone and a strong wake flow among buildings. The standard k-ε, RNG k-ε, realizable k-ε models produce similarly shaped contour map of pressure but with significant differences in magnitude. For three different turbulent models, the maximum wind pressure are obtained 1197.63, 1230.13, 1217.15 [pa] and the minimum pressure are obtained -958.755, -867.15, -948.491[pa], respectively.

The comparison of pressure coefficients for the windward wall of the L-shape building with different turbulent model demonstrated in figure 11.

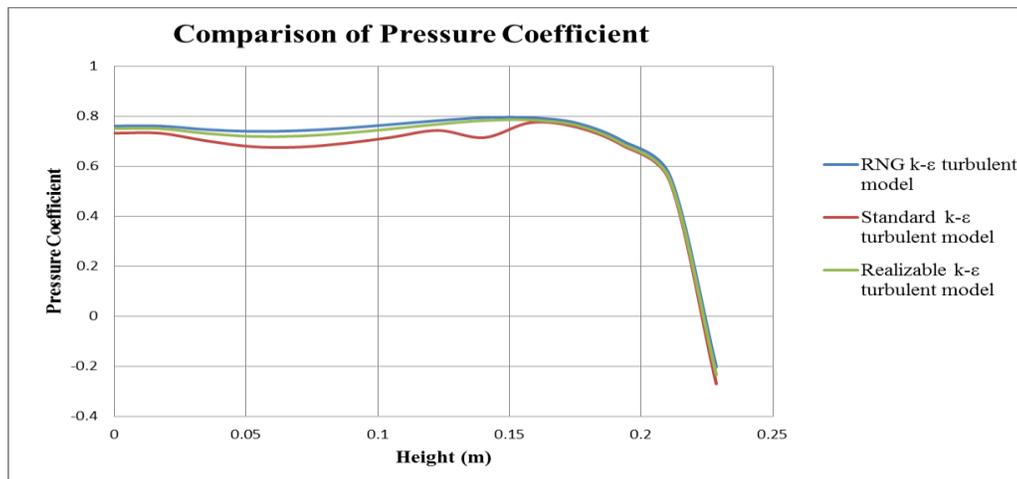


Figure 11: Comparison of pressure coefficients for the windward wall of the L-shape building with different turbulent model

It can be easily found that in three turbulence models, RNG k-ε model is the highest pressure coefficient other than turbulence models. The maximum wind pressure coefficients of the windward wall of the L-shape building with different turbulent model are 0.79, 0.77, 0.78, respectively, which are close to the value of 0.8 stipulated in the Myanmar National Building Coad.

VII. CONCLUSION

Applying the CFD as an effective tool to simulate the urban wind flowing across the neighborhood, city planners can better understand a conceivable physical environment of the urban areas with the predicted streamlines, velocity and pressure distribution at the pedestrian level. This journal has presented a CFD simulation for the evaluation of wind pressure coefficient and safety in urban areas, the use of CFD solutions related to environmental concerns has been demonstrated through three case studies.

We considered a special case of urban area with a high-rise building in the center surrounded by multiple layers of identical lower

buildings to understand the sheltering effect of the surroundings on the surface wind pressure distribution, which is needed for natural ventilation design and optimizing design. The more layers of the surrounding buildings, the less surface pressure coefficients on the target building. The maximum wind pressure coefficient occurred to be at the middle of windward surface with height of about 0.73H and the minimum wind pressure coefficient generates at the corner of the flow separation. Vortices occur in both windward and leeward sides of the L-shape building and inside the surrounding buildings. In the center of these vortices, the suction is large, possibly leading to structural severe damage. Among three different models, the Realizable k- ϵ model is the most suitable model for numerical simulation of wind flow around building in ANSYS Fluent.

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REFERENCES

- [1] S., Bungale, Taranath, Wind and Earthquake Resistant Buildings, 2005.
- [2] Daeung Kim, (2013, December 11), "The Application of CFD to Building Analysis and Design: A Combined Approach of an Immersive Case Study and Wind Tunnel Testing" Architecture and Design Research, Blacksburg, Virginia.
- [3] Garatt, J. R., Hess, G. D., Physick, W. L., Bougeault, P., The Atmospheric Boundary Layer – Advances in Knowledge and Applications, Boundary Layer Meteorology, 78, pp 9 – 37, 1996.
- [4] Ismail B. Celik, (1999, December), "Introductory Turbulence Modeling" Mechanical & Aerospace Engineering Dept, West Virginia University, P.O. Box 6106, Morgantown, WV 26506-6106.
- [5] J., Franke, Recommendations of the Cost Action c14 on the use of CFD in Predicting Pedestrian Wind Environment. In: the 4th International Symposium on Computational Wind Engineering, Japan Association for Wind Engineering, 2006.
- [6] F., Baetke, H., Warner, (1990), Numerical Simulation of Turbulent Flow over Surface Mounted Obstacle with Sharp Edges and Corners, Journal of Wind Engineering and Industrial Aerodynamics, 1990.
- [7] B., Blocken, J., Carmeliet, T., Stathopoulos, CFD Evaluation of the Wind Speed Conditions in passages between Buildings- Effect of Wall-function Roughness Modifications on the Atmosphere Boundary Layer Flow. Journal of Wind Engineering and Industrial Aerodynamics, 2007.
- [8] H., K., Veersteeg, W., Malalasekara, W., An Introduction to Computational Fluid Dynamic, Prentice Hall, 1995.
- [9] MERONEY Robert N., LEITL Bernd M., RAFAILIDIS Stillianos, SCHATZMANN Michael, Wind-tunnel and numerical modelling of flow and dispersion about several building shapes, Journal of Wind Engineering and Industrial Aerodynamics, 81, 1999, 333-345, Elsevier.
- [10] Casey, M., & Wintergerste, T. (2000). Best Practice Guidelines, ERCOFTAC Special Interest Group on Quality and Trust in Industrial CFD. ERCOFTAC, Brussels.
- [11] Y., Tominagaa, A., Mochida, M., Yoshikawa, T., Shirasawa, AIJ Guidelines for Practical Applications of CFD to Pedestrian Wind Environment around Buildings, Journal of Wind Engineering and Industrial aerodynamics ,2008.

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Evaluation of Structural Stability Improvement Systems for Existing RC Buildings

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Abstract- Inadequate attention during design and construction of some of reinforced concrete (RC) buildings has been raised questions about the performance levels of these existing buildings under future earthquakes. This study aims to improve seismic design of existing RC buildings under various deficiencies. Total of twelve existing RC buildings in major seismicity zone, Mandalay city, are targeted as case study buildings. Two possible improvement solutions such as steel bracings and RC shear walls are defined as proposed systems in this study. Linear static analysis is carried out for structural stability checking of existing structures based on UBC 97 code. According to the checking results, deficiencies of P- Δ effect are found in three existing pinned based buildings and deficiencies of torsional irregularity are also found in two existing buildings. Firstly, structural improvements under linear static analysis are performed to correct these deficiencies. Then, nonlinear static (pushover) analysis is carried out for performance evaluation of existing structures. Seismic performance enhancement of the proposed existing buildings is evaluated to achieve basis safety objective performance level described in FEMA 356. Results show that RC shear wall is more appropriate not as economic solution for more deficient buildings (Model 8, 10, 11 and 12) whereas steel bracing is effective solution for less deficient buildings (Model 1, 2, 3, 4, 5, 6, 7 and 9).

Index Terms- Existing RC Buildings, Linear Static and Nonlinear Static Analysis, Structural Stability Improvement Systems, Steel Bracings, RC Shear Walls

I. INTRODUCTION

Earthquake is unavoidable natural disaster which causes severely damages, and high casualties depends on the intensity of earthquake, distance from the earthquake source and site condition. Destructive earthquakes have happened in Myanmar and tectonic evidences show that they will happen again in the future.

In Myanmar, Mandalay lies closed to the most active fault along the Sagaing Fault as shown in Fig.1 [5]. Earthquake resistant existing buildings must be ensured during and after an earthquake. Nowadays, it is necessary to enforce a more rational approach for the seismic improvements of existing structures. Thus, deficient buildings should be reliably identified and conceived improvement interventions aimed at the most critical deficiencies only [6].

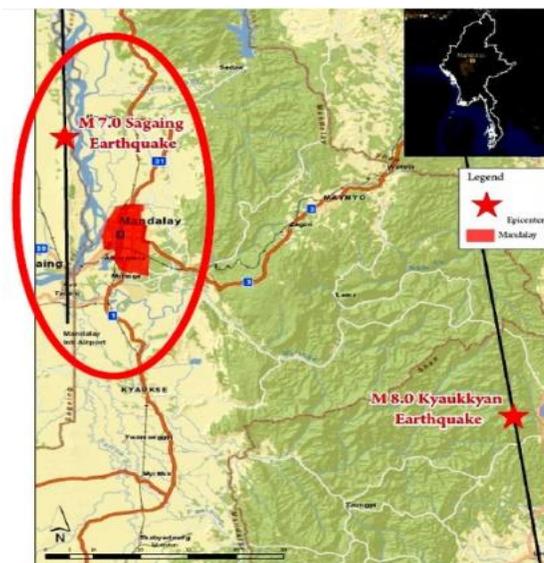


Figure 1: Location of Sagaing Fault from Mandalay City

II. METHODOLOGY

In the present study, twelve case studies of existing RC buildings located in four townships of Mandalay city, namely Chan Mya Thar Zi, Aung Myay Tharzan, Mahar Aung Myay and Pyi Gyi Tagon townships, have been used. First, design conditions of existing structures are checked to meet actual existing condition based on complete set design requirements. Next, existing structures are analyzed under linear static condition by using ETABS software. Structural deficiencies of existing structures have been determined from stability checking results based on UBC 97 code. For these buildings, improvement solutions such as steel bracings or RC shear walls are used to correct these deficiencies. Then, nonlinear static analysis is carried out to meet performance objective requirement described in FEMA 356. Seismic improvements of existing structures have been evaluated in terms of strength, ductility, capacity values (spectral acceleration) and performance points. Flowchart diagram for seismic design improvement of existing buildings is shown in Fig.2.

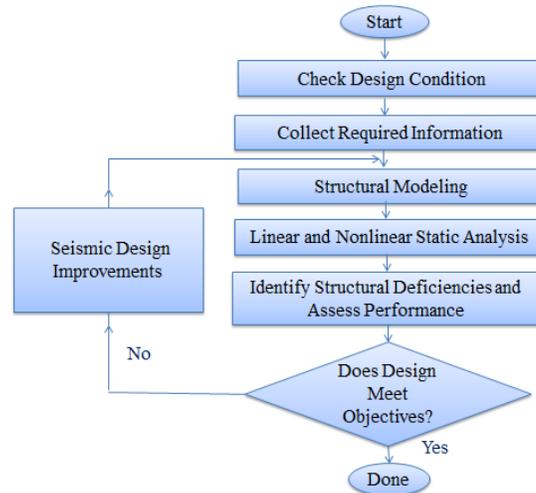


Figure 2: Implementation Procedures for Seismic Design Improvements of Existing Buildings

A. Determination of Performance Level

Performance level is the permissible amount of damage, given that design earthquake hazards are experienced, defined from FEMA 356 as follows:

- Operational (O) - Backup utility services maintain function; very little damage
- Intermediate Occupancy (IO) - The buildings remain safe to occupy; any repairs are minor
- Life Safety (LS) - Structures remain stable and has significant reserve capacity; hazardous nonstructural damage is controlled
- Collapse Prevention (CP) - The buildings remain standing but only barely; any other damage or loss is acceptable

B. Determination of Seismic Hazard Level

In considering earthquake hazard environment of Mandalay City, the probability of exceedance in 50 years is 50% for the operational earthquake level (SE), 10% for the design basic earthquake level (DBE) and 2% for the maximum considered earthquake level (MCE) [3].

$$P = 1 - \left[1 - \frac{I}{T_R} \right] \quad (1)$$

Where, P is probability of exceedance in 50 years and T_R is return period [4]. The moment magnitude is expected from the Sagaing Fault and peak ground acceleration is calculated with the source distance, 25km [10].

$$\ln(PGA) = -0.152 + 0.859M_w - 1.803 \ln(R + 25) \quad (2)$$

Where, PGA is peak ground acceleration, M_w is moment magnitude and R is source distance, km [10].

Table 1: Estimated seismic hazard level for Mandalay City

Earthquake Type	Return Period (T_R)	Probability (P)	Magnitude (M_w)	Peak Ground Acceleration PGA (g)
SE	72	0.0139	6.5	0.2
DBE	475	0.0021	7.3	0.4
MCE	2457	0.0004	7.8	0.6

C. Determination of Performance Objectives

According to FEMA 356, there are three types of performance objectives; basic safety objective, enhanced objective and limited objective as shown in Table 2. In the present study, performance objectives are basic safety performance objective; life safety building performance under DBE hazard level and collapse prevention performance under MCE hazard level [4].

Table 2: Performance objectives

		Target Building Performance Levels			
		Operational	Intermediate Occupancy	Life Safety	Collapse Prevention
Earthquake Hazard Level	50%/50 year	a	b	c	d
	20%/50 year	e	f	g	h
	DBE (10%/50 year)	i	j	k	l
	MCE (2%/50 year)	m	n	o	p

Notes: 1. Each cell in the above table represents discrete rehabilitation objectives.
 2. Three specific rehabilitation objectives are defined in FEMA-356.

- Basic Safety Objectives = cell k + p,
- Enhanced Objectives = cell k + p + any of a, e, i, b, f, j or n,
- Limited Objectives = cell c, g, d, h, l.

III. SEISMIC IMPROVEMENT TECHNIQUES

The purpose of seismic improvement is to provide existing structure more resistance to ensure safety of the structures. There are several improvement techniques used in existing structures as shown in Fig 3. Conventional improvement options such as shear walls, bracings, infill walls, wall thickening and mass reduction are mostly used in existing structures. Among them, improvement solutions such as steel bracings or shear walls are considered in this study.

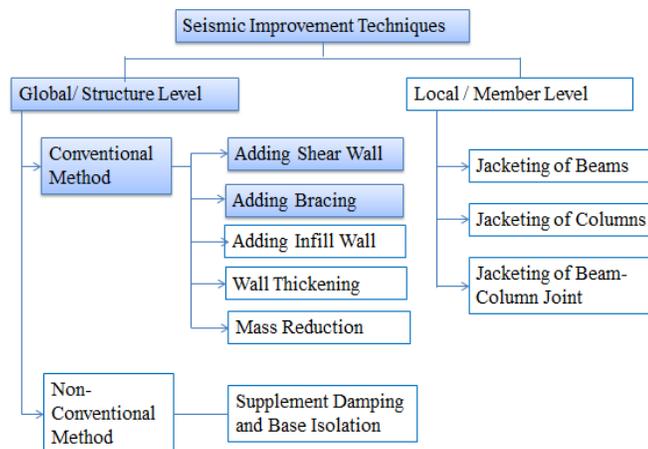


Figure 3: Classification of Seismic Improvement Techniques [4]

A. Application of Steel Bracings

The steel bracing is highly efficient and economic method to increase the resistance of existing structure against lateral forces. Steel Bracings improves the performance of frame structure by increasing its lateral stiffness, ductility and capacity. Through braces load can be transferred out of frame to braces bypassing the weak columns while increasing strength. Steel bracings are easy to apply and they can be applied externally without disturbance to the building’s occupants [7]. In this study, X-type concentric steel bracings (W8×24) are used.

B. Application of RC Shear Walls

The application of new reinforced concrete shear wall is most common practice to enhance the seismic resistance of existing building. This method has been proved more effective in controlling global drifts and structural damages in frame structures. The added elements can be either cast in place or pre cast elements. The optimal location of new elements should be considered while placing, which may align to the full height of building to minimize torsion [7].

In this study, 10"thickness, uniform reinforcing pier section type RC shear walls are used. Shear walls are provided with the same grade of materials as that of frame elements and reinforcing steel as per design requirements.

IV. DESCRIPTION OF EXISTING RC BUILDINGS

In this study, twelve existing RC buildings in Mandalay were selected for analysis. All selected existing buildings are mid-rise reinforced concrete buildings situated in four townships of Mandalay, namely Chan Mya Thar Zi, Aung Myay Tharzan, Mahar Aung Myay and Pyi Gyi Tagon townships. Structural detailed design data and drawings of proposed buildings are available from Mandalay City Development Committee (MCDC). Mandalay is located in major seismicity zone with a peak ground acceleration of 0.4g. The proposed existing buildings are composed of special moment resisting frames and are designed as per American Concrete Institute Committee [1] and Uniform Building Code [2] for loading. Case studies and origin design categories of proposed existing buildings are shown in Table 3 and Table 4 respectively.

Table 3: Locations and configurations of existing RC buildings

Model	No of Storey	Shape	Building Dimension (L×B×H)	Townships	Location	
					Latitude	Longitude
1	6	Regular	87'×58'×79'	Pyi Gyi Tagon	21 53.880'	96 06.360'
2	7	Regular	51'×36'×90'	Chan Mya TharZi	21 55.999'	96 05.676'
3	7	Regular	51'×36'×92'	Chan Mya TharZi	21 55.905'	96 06.637'
4	7	Regular	79'×32'×89'	Aung Myay Thar Zan	21 59.369'	96 04.189'
5	7	Regular	47'×30'×100'	Aung Myay Thar Zan	22 00.306'	96 05.058'
6	8	Regular	73'×32'×92'	Aung Myay Thar Zan	21 59.283'	96 04.792'
7	8	Regular	128'×57'×103'	Chan Mya Thar Zi	21 57.153'	96 05.122'
8	8	Regular	100'×65'×102.5'	Aung Myay Thar Zan	21 59.166'	96 07.200'
9	8	Regular	42'×31'×104'	Mahar Aung Myay	21 54.321'	96 06.723'
10	8	Irregular	133'×76'×116'	Chan Mya TharZi	21 56.955'	96 04.538'
11	8	Irregular	148'×120'×118'	Mahar Aung Myay	21 58.012'	96 05.462'
12	8	Irregular	194'×63'×115'	Pyi Gyi Tagon	21 55.260'	96 05.580'

Table4: Original design categories of existing RC buildings

Model	Support Condition		Earthquake Load		Wind Load	
	Foundation Type	Column Base	Source Type	R	Speed (mph)	Type
1	Isolated	Pinned	A	8.5	N/A	N/A
2	Isolated	Pinned	A	8.5	80	B
3	Mat	Fixed	A	8.5	N/A	N/A
4	Isolated	Pinned	A	8.5	N/A	N/A
5	Mat	Fixed	B	8.5	N/A	N/A
6	Mat	Fixed	A	8.5	N/A	N/A
7	Mat	Pinned	A	6.5	N/A	N/A
8	Mat	Pinned	A	8.5	N/A	N/A
9	Mat	Fixed	B	8.5	N/A	N/A
10	Mat	Fixed	A	8.5	N/A	N/A
11	Mat	Fixed	A	8.5	N/A	N/A
12	Mat	Fixed	A	8.5	N/A	N/A

From Table 3, original design categories of proposed existing RC buildings should be modified to meet the actual condition of existing structures based on structural design provisions as shown in the following cases:

- Seismic source type should be used Type A instead of Type B for building Model 5 and 9 because Mandalay is near the Sagaing Fault that is capable of producing large magnitude and that have a rate of seismic activity [2].
- It should be permitted to consider the structure to be fixed at the base instead of pinned base for building Model 6 and 7 because column supported by a continuous footing foundation mat should be assumed fixed at their lower ends [3].

V. STRUCTURAL STABILITY CHECKING OF EXISTING RC BUILDINGS

Existing RC buildings were analysed under linear static condition and have been checked for structural stability such as storey drift, P-Δ effect, overturning moment, sliding and torsional irregularity according to UBC-97 code [2] as shown in Table 5.

Table 5: Structural stability checking of existing RC buildings

Model		Storey Drift	P-Δ Effect	Overturning Moment	Sliding	Torsional Irregularity
		$\Delta_M(\text{in}) < 0.025h$	Drift Ratio $< 0.02/R$	$FS_{OM} > 1.5$	$FS_{Sliding} > 1.5$	$\Delta_{max}/\Delta_{avg} > 1.5$
1	X	2.364	0.0028	6.68	3.09	1.19
	Y	2.043	0.0024	10.94	3.09	1.09
2	X	2.912	0.0041	5.64	4.05	1.03
	Y	2.795	0.0039	11.88	4.05	1.07
3	X	1.537	0.0018	2.93	2.76	1.34
	Y	1.206	0.0014	4.93	2.62	1.07
4	X	2.463	0.0029	6.76	3.27	1.00
	Y	2.465	0.0029	17.08	3.27	1.00
5	X	0.855	0.0011	4.13	2.44	1.00
	Y	1.100	0.0014	5.14	2.44	1.02
6	X	0.959	0.0019	4.06	2.36	1.08
	Y	0.664	0.0014	5.49	2.36	1.06
7	X	1.195	0.0019	14.33	3.22	1.10
	Y	1.329	0.0021	4.99	2.96	0.84
8	X	1.199	0.0017	3.96	4.48	1.16
	Y	1.103	0.0012	4.12	3.55	1.02
9	X	1.679	0.0019	12.58	3.01	1.15
	Y	1.158	0.0014	9.84	3.01	1.19
10	X	1.199	0.0017	3.96	4.48	1.16
	Y	1.103	0.0012	4.12	3.55	1.02
11	X	1.953	0.0020	13.35	5.99	1.03
	Y	2.145	0.0022	19.14	5.61	1.18
12	X	0.783	0.0022	7.89	3.06	1.20
	Y	0.749	0.0021	7.89	3.06	1.02

From these checking, deficiencies of structural stability are found in five existing buildings (Model 1, 2, 3, 4 and 12). Deficiencies of P-Δ effect are found in three existing pinned-base buildings (Model 1, 2 and 4) and Model 2 is also unsatisfied in storey drift. Deficiencies of torsional irregularities are also found in two existing buildings (Model 3 and 12).

VI. SEISMIC IMPROVEMENT UNER LINEAR STATIC ANALYSIS

Based on linear static analysis results, five existing RC buildings (Model 1, 2, 3, 4 and 12) are needed to correct deficiencies of structural stability. So, improvement solutions such as steel bracings are considered to apply in existing structures according to appropriate locations to meet structural stability as shown in Table 6.

Table6: Location of steel bracings for existing RC buildings

Model	Steel Bracings (W8×24)	
	Floor level	Location
1	Basement	- All sides
	1F	- All corner
2	Basement	- All sides
	1F	- All corner
3	Basement	- All sides
	1F	- All sides (Diagonal)
4	Basement	- Front & back center
		- Left & Right corner
12	Basement	- All sides

A. Structural Weight

Structural weights for five existing building models before and after improvements are presented in Table 7.

Table 7: Structural weight of existing RC buildings before and after improvements

Model	Structural Weight (kips)		% Increase
	Existing	Steel Bracings	
1	3841.9	3866.2	0.63
2	1649.9	1664.2	0.87
3	1829.2	1843.2	0.77
4	2712.5	2725.9	0.49
12	12207.4	12284.7	0.63

From Table 7, it can be seen that existing buildings after improvement show a slight increase in structural weight (not more than 1% increase).

B. Torsional Irregularity

Existing building models 3 and 12 are not satisfied in torsional irregularity. For these buildings, torsional irregularity checking before and after improvements is presented in Table 8.

Table 8: Torsion irregularity checking before and after improvements

Model	Direction	Point		$\Delta_{max}/\Delta_{avg}$	Limit	Remarks
		A	B			
Existing	X	0.001050	0.001794	1.34	1.2	Unsatisfied
	Y	0.001212	0.001401	1.07	1.2	Satisfied
Steel Bracings	X	0.001033	0.001438	1.16	1.2	Satisfied
	Y	0.000962	0.001120	1.08	1.2	Satisfied
Existing	X	0.001430	0.001618	1.06	1.2	Satisfied
	Y	0.001656	0.000585	1.5	1.2	Unsatisfied
Steel Bracings	X	0.001413	0.001256	1.06	1.2	Satisfied
	Y	0.000898	0.000584	1.2	1.2	Satisfied

From Table 8, it can be seen that application of steel bracings correct deficiencies of torsional irregularity.

C. Storey Drift

The maximum drift ratio in both X and Y directions before and after improvements is presented in Table 9 and 10 respectively.

Table 9: Storey drift in X direction before and after improvements

Model	Storey Drift in X Direction (in)		% Decrease
	Existing	Steel Bracings	
1	0.0028	0.0013	53.57
2	0.0041	0.0017	58.54
3	0.0018	0.0014	22.22
4	0.0029	0.0006	79.31
12	0.0016	0.0014	13.25

Table 10: Storey drift in Y direction before and after improvements

Model	Storey Drift in Y Direction (in)		% Decrease
	Existing	Steel Bracings	
1	0.0024	0.0010	58.33
2	0.0039	0.0013	66.67
3	0.0014	0.0011	21.43
4	0.0029	0.0004	86.21
12	0.0017	0.0015	11.31

From Tables 9 and 10, it can be seen that application of steel bracings show a significant decrease in storey drifts in both directions which satisfy deficiencies of P- Δ effect and storey drifts.

D. StoreyShear

The maximum storey shear in both X and Y directions before and after improvements are presented in Table 11 and 12 respectively.

Table 11: Storey shear in X direction before and after improvements

Model	Storey Shear in X Direction (Kips)		% Increase
	Existing	Steel Bracings	
1	279.94	281.07	0.41
2	107.41	132.67	23.52
3	149.01	149.77	0.51
4	186.41	186.88	0.25
12	987.83	991.19	0.34

Table 12: Storey shear in Y direction before and after improvements

Model	Storey Shear in Y Direction (Kips)		% Increase
	Existing	Steel Bracings	
1	279.94	281.92	0.41
2	107.41	132.67	23.52
3	156.89	157.70	0.51
4	186.41	186.88	0.25
12	905.42	908.05	0.29

From Tables 11 and 12, it can be seen that in both X and Y direction, application of steel bracings shows a slight increase in storey shear not more than 1% but for Model 2, nearly 25% increase.

VII. SEISMIC IMPROVEMENTS UNDER NONLINEAR STATIC ANALYSIS

After satisfying structural stability under linear static condition, improved structures do not meet performance objectives under nonlinear static condition. It is also found that capacity values of all proposed buildings are less than demand-DBE. This means that these building's ability is not good under DBE earthquake level. So, steel bracings or RC shear walls are needed to add in existing structures until these structures meet performance objectives.

Eight existing buildings are satisfied for required performance by using steel bracings but four existing buildings are only satisfied with RC shear walls. According to the required locations, locations of steel bracings and RC shear walls under nonlinear static analysis are presented in Table 13 and Table 14 respectively.

Table 13: Location of steel bracings for existing RC buildings

Model	Steel Bracings (W8x24)	
	Floor level	Location
1	Basement	- All sides
	1F to 3F	- All corner
2	Basement	- All sides
	1F to 4F	- All corner
3	Basement	- All sides
	1F to 3F	- All sides
4	Basement to RF	- Front & back center
		- Left & right corner
5	Basement	- All sides
	1F	- Back corner (Diagonal) - Left & Right corner
6	Basement	- All sides
	1F to 4F	- All corner
7	Basement	- All sides
	1F to RF	- Front & back center - All corner
9	Basement	- All sides
	1F to 3F	- All sides (Diagonal)

Table 14: Location of shear walls for existing RC buildings

Model	Shear Walls (10" thickness)	
	Floor level	Location
8	Basement	- Front & back center two bay - Left & right sides/ Lift sides
	1F to RF	- Left & Right center / Lift sides
10	B to RF	- Stair & Lift sides
11	Basement	- All corner
	1F to RF	- Front & right corner - Lift & stair sides
12	Basement	- Left & right center - Lift & stair sides
	1F to RF	- Lift & stair sides

A. Capacity Curve

The force and deformation curves or capacity (pushover) curves for proposed existing buildings before and after rehabilitation are plotted to assess the global response of structures. The health of the structure is judged by capacity curve [4]. Capacity curves of eight existing buildings improved with steel bracings are shown from Fig.4 to Fig.7 and four existing buildings improved with RC shear walls are shown from Fig.8 to Fig.9.

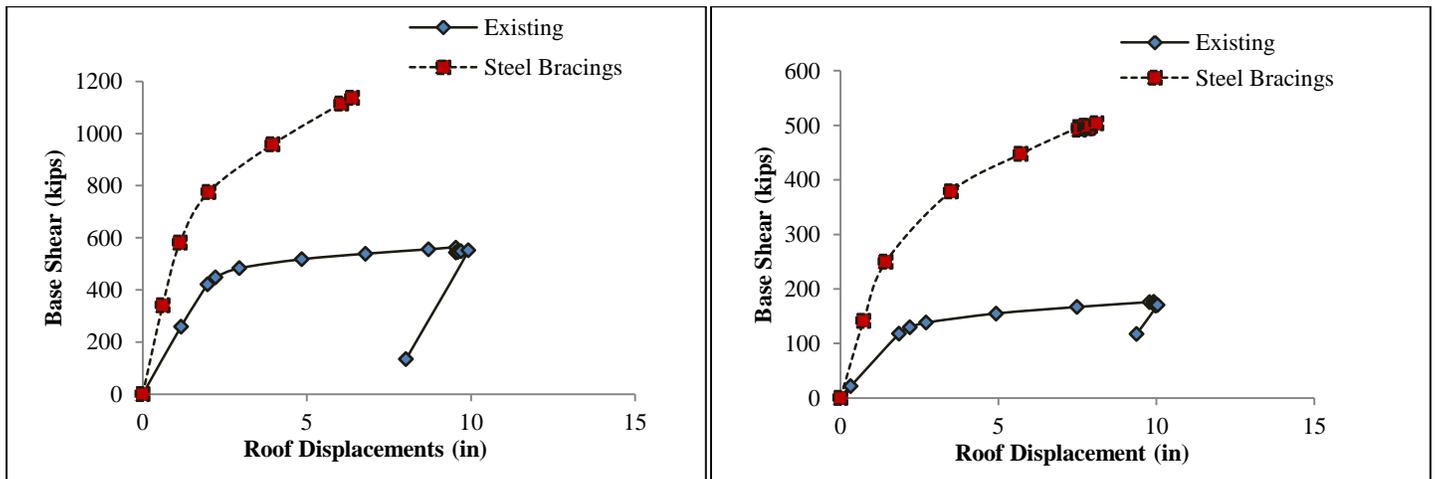


Figure 4: Capacity Curves before and after Improvements (Model 1 and Model 2)

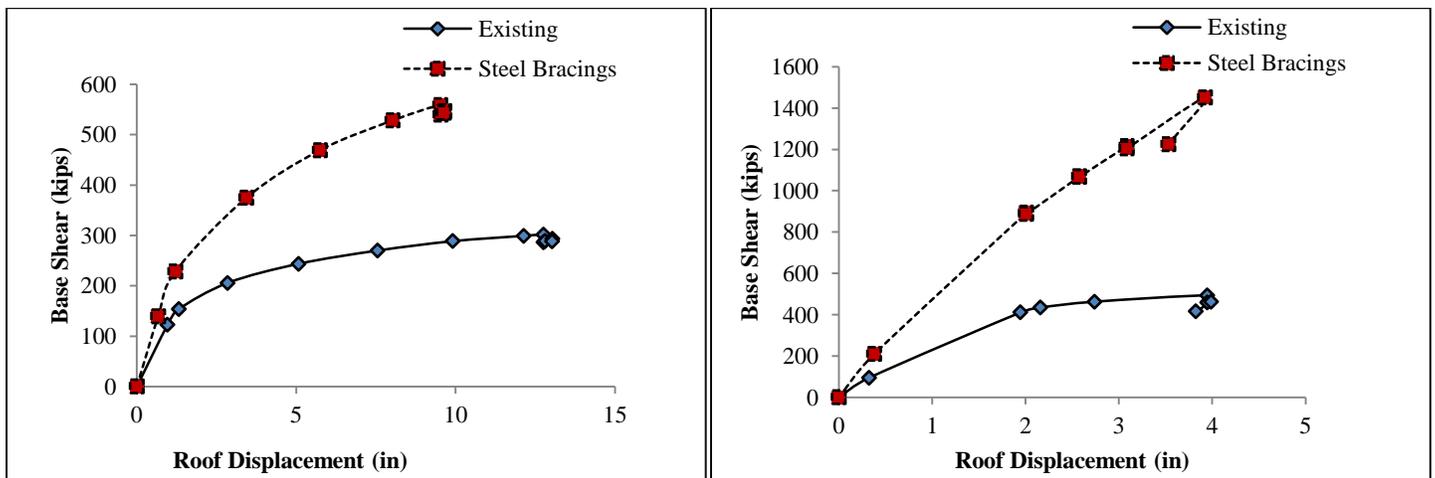


Figure 5: Capacity Curves before and after Improvements (Model 3 and Model 4)

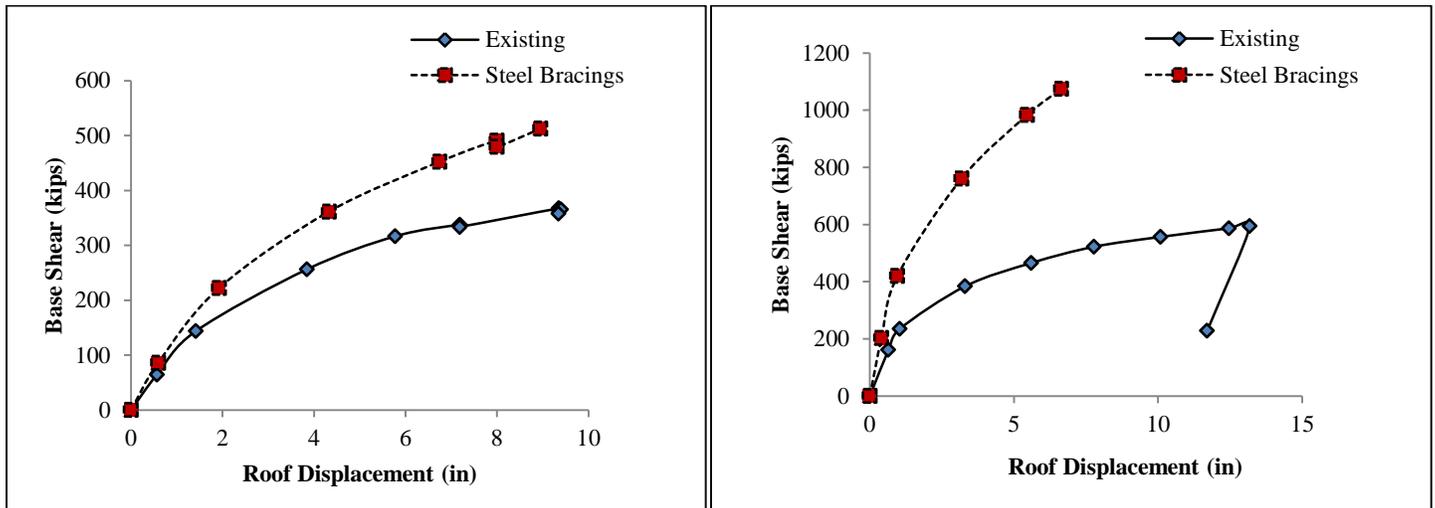


Figure 6: Capacity Curves before and after Improvements (Model 5 and Model 6)

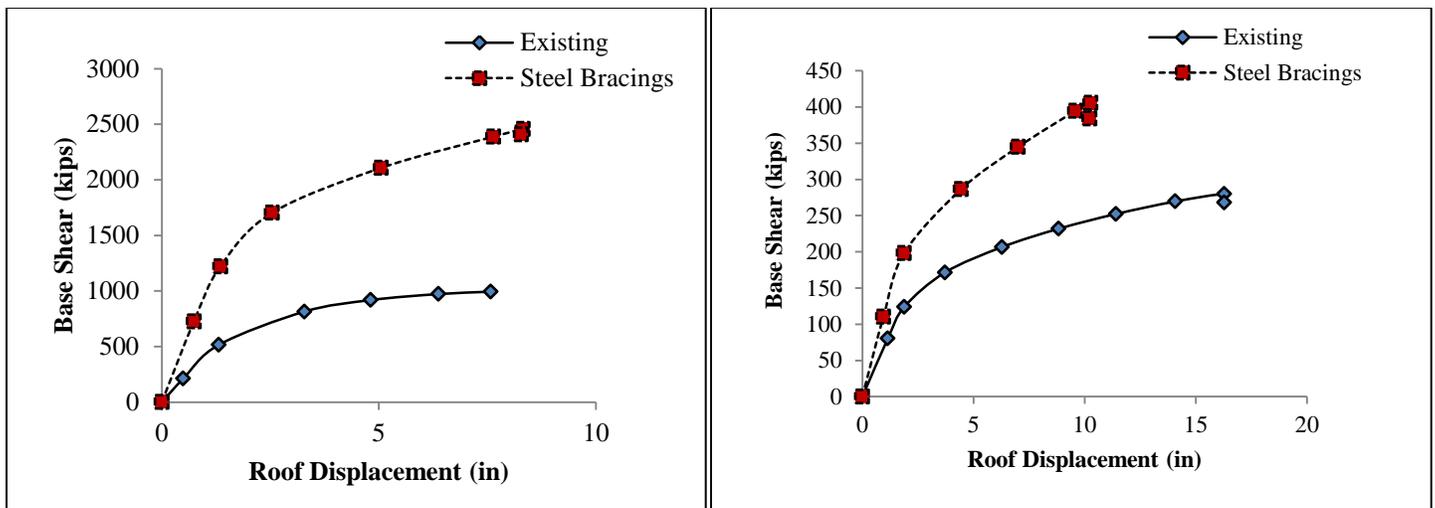


Figure 7: Capacity Curves before and after Improvements (Model 7 and Model 9)

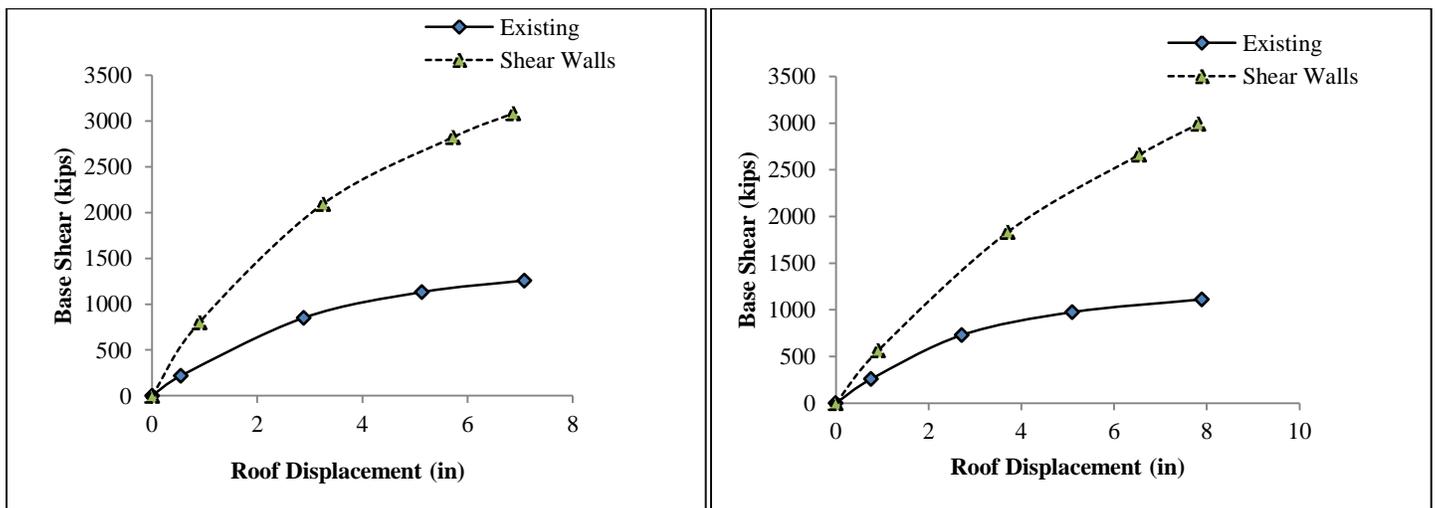


Figure 8: Capacity Curves before and after Improvements (Model 8 and Model 10)

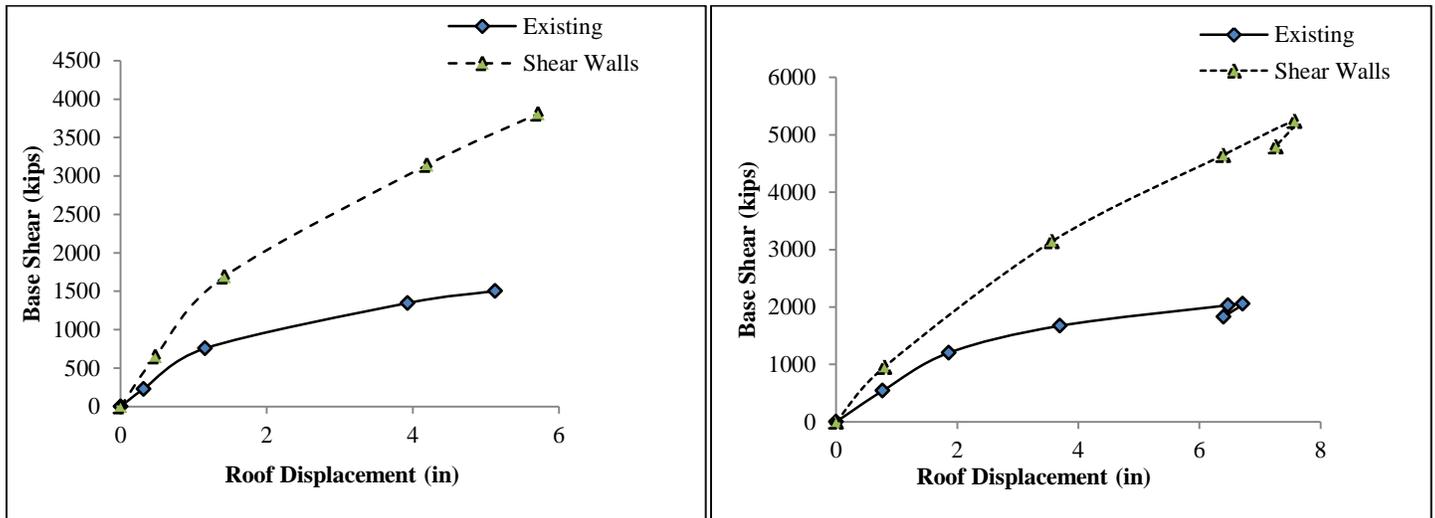


Figure 9: Capacity Curves before and after Improvements (Model 11 and Model 12)

From Fig.4 to Fig.9, it can be seen that existing buildings improved with steel bracings and shear walls show a significant increase in strength.

B. Ductility

Ductility is the structural property that will need to be relied on in most structures if satisfactory behavior under damage control and survival limit state is to be achieved.

$$\mu = \frac{\Delta_{max}}{\Delta_y} \tag{3}$$

Where, μ is structural ductility, Δ_{max} is maximum displacement and Δ_y is yield displacement. Ductility of proposed existing building before and after improvements is shown in Table 15.

Table 15: Ductility of existing RC buildings before and after improvements

Model	Existing Structure			Improved Structure		
	Δ_y	Δ_{max}	μ	Δ_y	Δ_{max}	μ
1	1.976	9.926	5.023	1.133	6.383	5.634
2	1.855	10.038	5.411	1.436	8.112	5.649
3	1.323	13.035	9.852	1.208	9.649	7.988
4	0.678	3.827	5.645	0.379	3.926	10.359
5	1.420	9.348	6.583	1.925	8.951	4.649
6	1.043	13.188	12.644	0.403	6.644	16.486
7	1.314	7.579	5.768	1.347	8.318	6.175
8	0.800	7.080	8.850	0.700	6.871	9.816
9	1.888	16.282	8.624	1.149	10.270	8.938
10	0.922	7.897	8.565	0.913	7.823	8.568
11	1.156	5.128	4.436	1.000	5.713	5.713
12	1.860	6.715	3.610	0.799	7.265	9.093

From Table 15, it can be seen that application of steel bracings increase the ductility of existing structures but for Model 3 and 5, ductility is slightly decreased. It is observed that application of shear walls shows a significant increase in ductility of existing buildings.

C. Structural Capacity

Demand is a representation of the earthquake ground motion. Capacity is a representation of the structure’s ability to resist seismic demand [4]. Comparison of capacity and demand for proposed buildings models before and after improvements is shown in Fig.10.

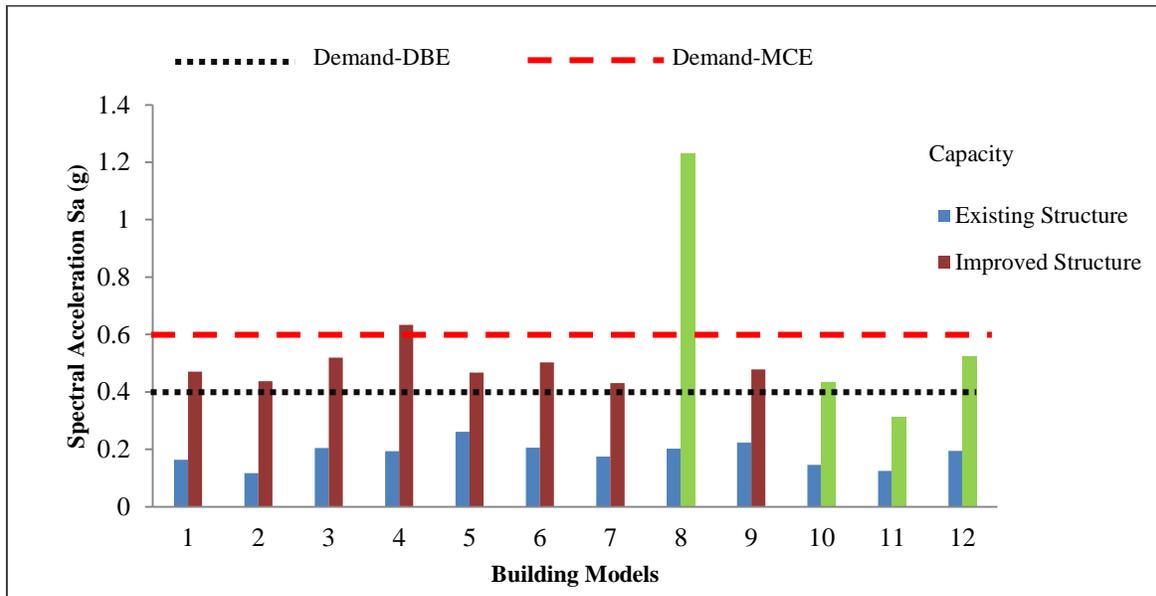


Figure 10: Capacity and Demand before and after Improvements

From Fig.10, it can be seen that application of steel bracings shows increase in capacity more than demand-DBE for eight existing buildings (Model 1, 2, 3, 4, 5, 6, 7 and 9). For Model 4, capacity value exceeds demand-MCE. Application of shear walls also shows a significant increase in capacity more than demand-DBE for three existing buildings (Model 8, 10, 11 and 12). For Model 8, capacity value exceeds demand-MCE but for Model 11, capacity value less than demand-DBE.

D. Performance Point

Performance point of the building is the intersection of capacity and demand curves. Based on the location of this performance point, performance level of the building is determined. The performance points of proposed existing buildings under DBE and MCE earthquake level are shown in Table 16.

Table 16: Performance points of existing RC buildings before and after improvements

Model		Performance Point		Performance Level	EQ Level	Performance Objectives
		Sa	Sd			
1	Existing	0.149	3.713	CP	DBE	No
		0.162	7.090	CP	MCE	
	Steel Bracings	0.338	2.326	LS	DBE	Yes
		0.418	3.755	CP	MCE	
2	Existing	0.106	5.210	CP	DBE	No
		N/A	N/A	N/A	MCE	
	Steel Bracings	0.286	3.047	LS	DBE	Yes
		0.365	4.828	CP	MCE	
3	Existing	0.171	3.497	CP	DBE	No
		0.199	6.304	CP	MCE	
	Steel Bracings	0.330	2.600	LS	DBE	Yes
		0.425	4.169	CP	MCE	
4	Existing	0.190	4.103	CP	DBE	No
		N/A	N/A	N/A	MCE	
	Steel Bracings	0.535	2.175	LS	DBE	Yes
		0.763	3.341	CP	MCE	

5	Existing	0.213	3.612	CP	DBE	No
		0.249	5.772	CP	MCE	
	Steel Bracings	0.298	3.032	LS	DBE	Yes
		0.382	4.767	CP	MCE	
6	Existing	0.187	3.425	CP	DBE	No
		0.205	5.989	CP	MCE	
	Steel Bracings	0.394	2.320	LS	DBE	Yes
		0.480	3.251	CP	MCE	
7	Existing	N/A	N/A	C	DBE	No
		N/A	N/A	C	MCE	
	Steel Bracings	0.325	2.315	LS	DBE	Yes
		0.372	3.688	CP	MCE	
8	Existing	N/A	N/A	N/A	DBE	No
		N/A	N/A	N/A	MCE	
	Shear Walls	0.685	1.928	LS	DBE	Yes
		0.943	2.883	CP	MCE	
9	Existing	0.162	4.122	CP	DBE	No
		0.196	7.023	CP	MCE	
	Steel Bracings	0.296	2.990	LS	DBE	Yes
		0.375	4.692	CP	MCE	
10	Existing	N/A	N/A	N/A	DBE	No
		N/A	N/A	N/A	MCE	
	Shear Walls	0.309	3.674	LS	DBE	Yes
		0.409	5.499	CP	MCE	
11	Existing	N/A	N/A	N/A	DBE	No
		N/A	N/A	N/A	MCE	
	Shear Walls	0.178	1.485	LS	DBE	Yes
		0.282	3.079	CP	MCE	
12	Existing	N/A	N/A	N/A	DBE	No
		N/A	N/A	N/A	MCE	
	Shear Walls	0.368	2.953	LS	DBE	Yes
		0.495	4.502	CP	MCE	

From Table 16, application of steel bracings are satisfied for eight existing buildings (Model 1, 2, 3, 4, 5, 6, 7 and 9) to meet performance objective requirements but only RC shear walls are satisfied in four existing buildings (Model 8, 10, 11 and 12).

VIII. DISCUSSION AND CONCLUSION

In this study, twelve existing RC buildings are evaluated for structural stability improvements under seismic loads by using linear static and nonlinear static (pushover) analysis. Steel bracings and RC shear walls are used as improvement systems.

Under linear static condition, structural improvements are evaluated based on structural stability as defined in UBC code. Deficiencies of structural stability are found in five existing buildings (Model 1, 2, 3, 4 and 12). For these buildings, additions of steel bracings are satisfied to overcome these deficiencies.

Under nonlinear static condition, structural performance improvements are evaluated based on structural capacity and expected performance of the building to meet performance objective requirements. All the proposed existing buildings are required to improve seismic performance. Steel bracings are used as improvement solutions for eight existing buildings (Model 1, 2, 3, 4, 5, 6, 7 and 9) and

RC shear walls are used in four existing buildings (Model 8, 10, 11 and 12) for required performance.

Application of steel bracings or shear walls shows a significant increase in strength of existing structures. Both improved systems show increase in ductility but slightly decrease for building Model 3, 5 and 6. Moreover, application of steel bracings or RC shear walls shows increase in structural capacity more than demand-DBE. It is observed that both methods improve the building performance to meet performance objectives but for Model 8, 10, 11 and 12, only application of RC shear walls is satisfied.

In this study, it can be concluded that the use of steel bracings is effective solution for seismic improvements of existing reinforced concrete structures (Model 1, 2, 3, 4, 5, 6, 7 and 9) as it is not only economical method but also easy to install. For Model 8, 10, 11 and 12, only RC shear walls are satisfied for required seismic performance.

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REFERENCES

- [1] Anonymous 1997. "Building Code Requirements for Structural Concrete" (ACI 318-99) and Commentary (ACI 318-99) USA: American Concrete Institute 1999.
- [2] International Conference of Building Officials. 1997. "Structural Engineering Design Provision" Volume 2. Uniform Building Code UBC (1997).
- [3] ATC 1996. Seismic Evaluation and Retrofit of Concrete Buildings. Volume 1, ATC-40 Report, Applied Technology Council, Redwood City, California
- [4] FEMA. 2000. Prestandard and Commentary for the Seismic Rehabilitation of Buildings. FEMA 356, Federal Emergency Management Agency, Washington, D.C.
- [5] Peeranant Towashiraporn, Earthquake risk assessment of Mandalay city, Asian Disaster Preparedness Center(2012).
- [6] Tutor Prof. Gaetano Manfredi, Conditional assessment of seismic rehabilitation techniques on the full scale spear structure(2012).
- [7] Yaseer Alashkar, Sohaib Nazar, Mohammad Ahmed, Comparative study of seismic strengthening of RC building by steel bracings and shear walls, International journal of civil and structural research Vol. 2, Issue 2, pp: (24-34), Month: October 2014 - March 201512
- [8] Kadid and A. Boumrkik, Pushover analysis of reinforced concrete framed structures, Asian journal of civil engineering (Building and Housing) Vol.9, No.1(2008).
- [9] Cornell, C.A., Banon, H., Shakal, A.F., Seismic Motion and Response Prediction Alternatives, Earthquake Engineering and Structural Dynamics, 1979.
- [10] Myo Thant, Nwai Le Ngai, Soe Thura Tun, Maung Thein, Win Swe and Than Myint, Seismic Hazard Assessment for Myanmar, Myanmar Earthquake Committee (MEC), Myanmar Geosciences Society (MGS), March 5, 2012.
- [11] ETABS User's Manual, "Integrated Building Design Software", Computer and Structures Inc. Berkeley, USA.

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Synthesis, Characterization and Antibacterial Activity of Substituted Benzothiazole Derivatives

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Abstract- Various substituted 2-aminobenzothiazoles have been synthesized by cyclocondensation of various substituted anilines with ammonium thiocyanate in presence of bromine. The title product 5-[(1E)-N-(1,3-benzothiazol-2-yl)ethanimidoyl]-4-(furan-2-yl)-3,4-dihydropyrimidin-2(1H)-thione is synthesized by using 2-aminobenzothiazole. The structure of the synthesized compounds have been established on the basis of their spectral data. All micro-wave synthesized compounds results into good yield as compared to conventional method. Synthesized compounds were screened for their antibacterial activities.

Index Terms- 2-Aminobenzothiazole, dihydropyrimidin-2-thiones and Antibacterial activity.

I. INTRODUCTION

Benzothiazole is a privileged bicyclic ring system. It contains a benzene ring fused to a thiazole ring.^[1] The small and simple benzothiazole nucleus is present in compounds involved in research aimed at evaluating new products that possess interesting biological activities like antimicrobial, antitubercular^[2], antitumor^[3], antimalarial^[4], antimicrobial^[5], anthelmintic^[6], antidiabetic^[7], anticonvulsant^[8], analgesic^[9] and anti-inflammatory^[10] activity. In addition, the benzothiazole ring is present in various marine or terrestrial natural compounds, which have useful biological activities. Due to their importance in pharmaceutical utilities, the synthesis of various benzothiazole derivatives is of considerable interest.

Today 3,4-dihydro-pyrimidin-2(1H)-ones (DHPM) and its derivatives have received considerable amount of attention due to its several biological activities such as antiviral, antibacterial, antitumor and anti-inflammatory properties^[11]. Many of these compounds act as α -1a-antagonist calcium channel and antihypertensive agent^[12,13]. Therefore the synthesis of this heterocyclic moiety has gained an immense importance in organic synthesis.

The Benzothiazole and Schiff base moieties are crucial functionalities due to their wide variety of biological activities and have a wide range of therapeutic properties. Keeping in view the importance of these organic moieties, a new series of 2-aminobenzothiazole containing novel Schiff bases derivatives were synthesized by sequential reaction. The structures of the synthesized compounds were confirmed by their analytical and spectral data. The synthesized compounds were evaluated for their in vitro antibacterial activity

against gram positive and gram negative bacteria. Synthesized compounds showed significant activity against microorganism, which can be correlated with the privileged heterocyclic scaffolds.

II. MATERIALS AND METHODS

All air reactions were carried out in oven dried (120⁰C) or flame dried glassware. Analytical thin layer chromatography was performed with Merck silica gel plates (0.25mm thickness) with PF₂₅₄ indicator. Compounds were visualized under UV lamp. Column chromatography was carried out using 60-120 mesh silica gel and technical grade solvents. ¹H-NMR spectra were recorded on at 200,300 and 400 MHz instruments with tetramethylsilane as an internal standard. IR spectra were recorded on Shimadzu Hyper IR Instruments.

III. EXPERIMENTAL

Synthesis of 2-amino -1, 3-benzothiazol (compound 1)

Compound 1 was prepared by reported method [19]. To a solution of (0.1 mol) of substituted Anilines and (0.4 mole) of Ammonium thiocyanate was dissolved in absolute ethanol containing 4 N HCl. To this mixture, bromine in glacial acetic acid was added and the reaction mixture was refluxed for 1 hour, then it was cooled in ice bath and basified with liquor ammonia to get the precipitate. The precipitate obtained was filtered washed with cold water and dried. The crude product was recrystallized from ethanol.

Synthesis of 1-[4-(furan-2-yl)-6-methyl-2-sulfanylidene-1, 2,3,4-tetrahydropyrimidin-5-yl]ethan-1-one (compound 2)

Furfuraldehyde (1mol), acetyl acetone (1mol) and thiourea (1.5 mol) taken in ethanol and added with few drops dilHCl and heated in water bath for 8 hrs. Then completion of reaction check with TLC (ethyl acetate + hexane 9:1) The reaction mixture pour with ice cold water solid filter wash with sufficient water and recrystallization from methanol

Synthesis of 5-[(1E)-N-(1,3-benzothiazol-2-yl)ethanimidoyl]-4-(furan-2-yl)-3,4-dihydropyrimidine-2(1H)-thione(compound 3)

3a. Conventional method:

In a round bottom flask, Compound Compound1(1mol), compound 2 (1 mol), dissolve in ethanol then add few drops of glacial acetic acid. The reaction mixture was reflux for about 8 hrs till the completion of the reaction. Progress of the reaction was checked with TLC (Hexane: Ethyl acetate – 4:1) Then it was cooled with ice cold water. It was filtered and washed with cold water and dried the crude product was recrystallized from ethanol.

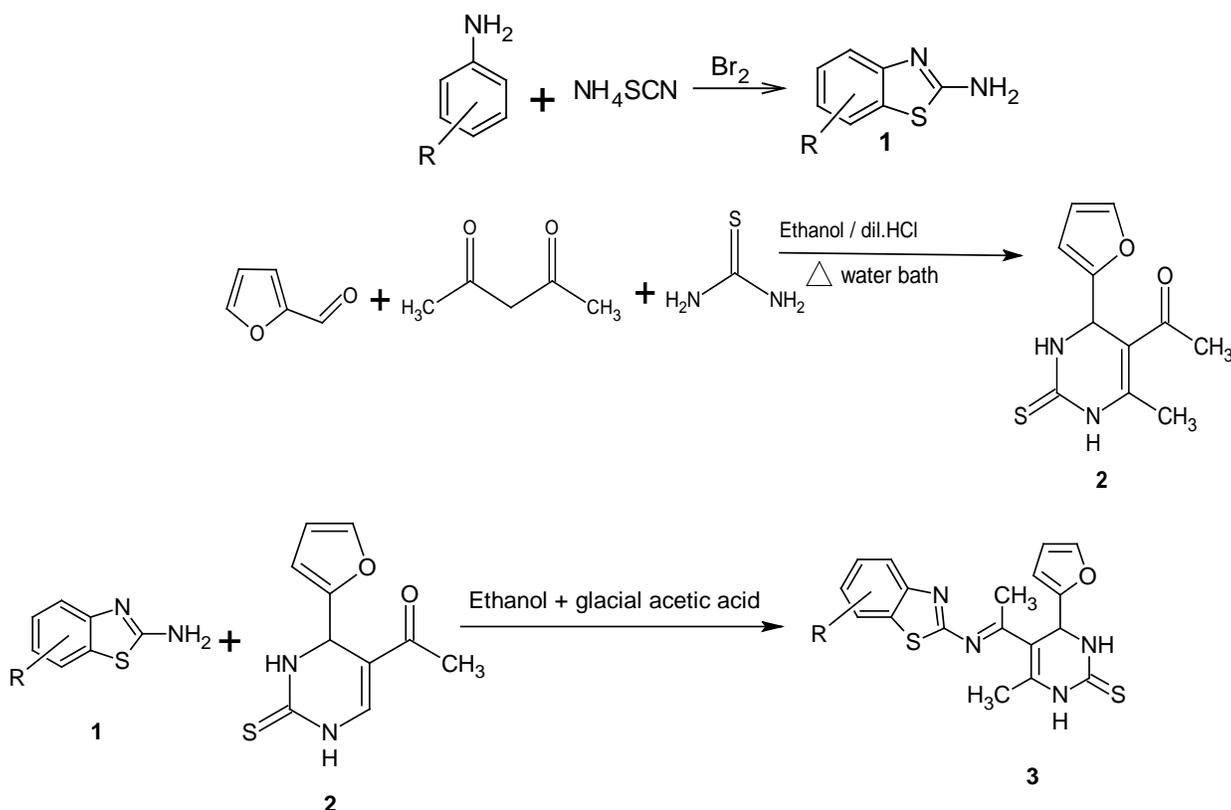
3b. Microwave irradiation method:

A mixture of Compound 1(1mol), compound 2 (1 mol), and few drops of DMF were added in a hard glass tube and irradiated in microwave oven at appropriate power and time Completion of the reaction was monitored by

TLC, mixture was cooled and poured with ice cold water. And the resulting Solid filtered dried and recrystallized from ethanol.

5-[(1*E*)-*N*-(1,3-benzothiazol-2-yl)ethanimidoyl]-4-(furan-2-yl)-3,4-dihydropyrimidine-2(1*H*)-thione IR (KBr) cm^{-1} : 3294 (-NH);1612 (C=C); 1535(C=C), 817,748, (Ar-CH), $^1\text{H-NMR}$ (DMSO d_6) δ : 9.0 (1H, NH), 1.2(3H,t,CH₃),4.0(2H,q,OCH₂CH₃),2.2 (3H,s,CH₃),2.3(3H, s,CH₃-N),5.37 (1H, d,CH), 6.2, (1H,d,Ar-CH) 6.4, (1H,d,Ar-CH),6.8(1H,d,Ar-CH), 7.1-7.6(3H,m , Ar-H), MS:- $m/z = 368.47(m+)$

Figure 1: Schematic representation of Benzothiazole



Where R=H, -Cl, CH_3 , -Cl, $-\text{NO}_2$, $-\text{OC}_2\text{H}_5$ etc.

Table I: Synthesis 3a-j under conventional and microwave heating.

Entry	R	Conventional heating		Microwave heating			mp. °C
		Time in Hours	% Yields*	Microwave power in Watt	Time in min.	% yield*	
3a	H	8	55	300	3	90	97

3b	6-OC ₂ H ₅	8	56	300	3.5	89	195
3c	5-NO ₂	8	53	450	5	85	228
3d	6-CH ₃	8	58	300	3	92	235
3e	4-Cl	8	61	300	3.5	88	179
3f	4,6,7-Tri Cl	8	63	450	4	91	135
3g	5-CH ₃	8	65	300	3	94	175
3h	4-NO ₂	8	54	300	5	86	170
3i	6- NO ₂	8	58	450	5	87	174
3j	5,6-di-CH ₃	8	66	300	4	95	175

*Yields refer to purified compounds

IV. ANTIBACTERIAL BIOASSAY

0.4% of the MIC (minimum inhibitory concentration) of all the final products were prepared in dimethyl formamide solvent and tested against one gram +ve (*Escherichia coli*) and one gram -ve bacteria (*Staphylococcus aureus*). The composition of nutrient agar medium was bactotryptone (4g), Broth (3.9 g) less than 2%, NaCl (2.9 g) in 100 ml of water (0.9%). After 18h the exponentially growing culture of the 2 bacteria in nutrient broth at 37⁰C were diluted in sterile broth. From each of these diluted culture, 1ml was added to 100ml sterilized and cooled nutrient agar media to give a final bacterial. The plates were set at room temperature and later dried at 37⁰C for 20h. Paper discs (6mm, punched from whatmann No. 41 paper) used for the assays. Discs were soaked in DMF and placed on the inoculated agar media at regular intervals of 6-7 cm, care was taken to ensure that excess solution was not on the discs. All the samples were taken in triplicates. The plates were incubated at 37⁰C in an inverted fusion. Activity as determined by zone showing complete inhibition (mm). Growth inhibition was calculated with reference to positive control.

V. RESULTS

The structure of synthesized compounds was confirmed by IR, ¹H NMR, GC-MS analysis. Compounds (3a-j) were screened against two pathogenic bacteria. One gram negative strains viz., *Escherichia coli* and one Gram positive stains viz., *Staphylococcus aureus* following agar well diffusion procedure as per the reference. The antibacterial activity of the synthesized benzothiazole 3a-3j was corrected with the zone of inhibition of erythromycin as a standard control. (Table 2). The bacterial test result for the newly synthesized benzothiazole analogues revealed that most of the compounds exhibited moderated to good activity against Gram

+ve(Staphylococcus aureus) and Gram –ve bacteria (Escherichia coli). Staphylococcus aureus: compounds 3a and 3g exhibited maximum activity while the other compounds displayed moderate activity. And in case of Escherichia coli, compounds 3f and 3j exhibited good to excellent activity while the remaining compounds displayed moderate and less activity. As all compounds showed antibacterial activity against the bacteria tested. It indicates that this basic moiety can be a potential scaffold for anti bacterial drugs. It may be suggested that the amino benzothiazole derivative with a suitable R group may lead to a good antibacterial agent for all the Escherichia coli and Staphylococcus aureus bacterial strains. Thus further lead optimization is required to get wide spectrum of activity.

Table 2: Result of Antibacterial Bioassay of compounds

Compound No.	R	Zone of Inhibition (mm)	
		Gram -ve	Gram +ve
		E.coli	S. aureus
3a	H	12	11
3b	6-OC ₂ H ₅	10	09
3c	5-NO ₂	11	10
3d	6-CH ₃	13	10
3e	4-Cl	13	10
3f	4,6,7-Tri Cl	15	12
3g	5-CH ₃	12	11
3h	4-NO ₂	13	08
3i	6- NO ₂	11	09
3j	5,6 –di CH ₃	14	11
Standard	Erythromycin	24	22

VI. CONCLUSION

Substituted derivatives of 5-[(1E)-N-(1,3-benzothiazol-2-yl)ethanimidoyl]-4-(furan-2-yl)-3,4-dihydropyrimidine-2(1H)-thiones (3a-3j) were prepared from commercially available 2- amino benzothiazole. Compounds (3a-j) were also synthesized by microwave irradiation method. Yields of microwave assisted synthesis were high. Synthesized compounds were tested for Gram positive and Gram Negative bacterial cultures. All the compounds were found to exhibit good to moderate antibacterial activity.

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REFERENCES

- [1] <http://www.articlesbase.com/medicine-articles/importance-of-benzothiazole-nucleus-in-medicinal-531934.html>(Accesses on 06/04/2010).
- [2] V MGaware, K BDhamak, e j b p; 2015, 2(2), 392-401.
- [3] S kini, S Swain, A Gandhi, Ind J Pharm Sci.; 2007, Jan-Feb, 46-50.
- [4] S Gupta, NAjmera, NGautam, R Sharma, DGautam, Ind J Chem.; 2009, 48B, 853-858.
- [5] R M Kumbhare, V N Ingle, Ind J Chem.; 2009, 48B, 996-1000.
- [6] M Sreenivasa, E jaychand, BShivakumar, K jayraj Kumar, J Vijaykumar, Arch Pharm Sci and Res.; 2009, 1(2), 150-157.
- [7] S Pattan, C Suresh, V Pujar, V Reddy, V Rasal, B Koti, Ind J Chem.; 2005, 44B, 2404-2408.
- [8] MMMagdy, Geneinah, Sci Pharm.; 2001, 69(1), 53-61.
- [9] D S Bele, I Singhvi, Res J Pharm and Tech.; 2008, 1(1), 22
- [10] S N Sawhney, S Bhutani, D Vir, Indian J Chem., 1987, 26B, 348-50.
- [11] (a) P Biginelli, Gazz., Chim. Ital. 1893, 23, 360. (b) C O Kappe, Tetrahedron, 1998, 49, 6937
- [12] T U Mayer, T M Kapoor, S J Haggarty, R W King, S L Schreiber, and T J Mitchison, Science, 1999, 286-971
- [13] K S Atwal, G C Rovnyak, S D Kimball, D M Floyd, S Moreland, B N Swanson, J Z Gougoutas, K M Smille, and M F Malley, J. Med. chem., 1990, 33, 2629

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Organizational Commitment and Job Satisfaction among Staffs in an Oil and Gas Company

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Abstract- *This paper explore organizational commitment relationship towards job satisfaction among staffs in an oil and gas company in Sarawak, Malaysia. Participants included 70 staffs from the engineering department of the company where they responded to a set of questionnaire containing 7 demographic questions, 62 survey items (instruments: Organizational Commitment Questionnaire, Job Satisfaction Survey, and two pre-determined answer questions) hosted by the researcher. Results indicated that only affective commitment was significant and positively related on all aspects of job satisfaction, while normative commitment was only negatively related on one aspects (operating conditions) and continuance commitment on three aspects (operating conditions, promotion, and nature of work) of job satisfaction. The most rewarding aspect of job satisfaction as a staffs in the company was "Pay" (47 responses), and the most frustrating aspect was "operating conditions" (16 responses). A highest number of the respondents were between 26 to 30 years old, Malay, Male, and worked in the company for less than 6 years. Gender was the only demographic variable to have a possible mitigating effect on organizational commitment and job satisfaction.*

Index Terms- Affective Commitment, Continuance Commitment, Normative Commitment, Job Satisfaction, Organizational Commitment, Oil and Gas

I. INTRODUCTION

The price of crude oil was significantly dropped from US\$80 per barrel to US\$30 per barrel and this trending was not seen in over a long time. This sudden and trending fall has had recondite a chain of effect on the entire oil and gas industry all around the world. This cause all of the oil and gas companies in all over the world was highly impacted in terms of financial, mostly. These matters required companies to perform downsizing which includes of restructured, retrenchment and most of the employees were letting go. From the company point of view, little specific method is known to retain the one whom have a better commitment towards organization. Due to current situation occurred where unstable of crude oil price and forecasting for the next 5 years will be maintain low, many who retained are prefer to go for other industries such as manufacturing, construction,

automobile and many more. This caused the inclined of turnover intention among employees. To encounter this problem, the researcher believe that knowing the organizational commitment relationship towards job satisfaction among staffs are vital at this point to ensure Human Resource management (HRM) retaining the skilled and experience ones with the lowest turnover intention.

Many researches have been organized in the area of behavior in organization related to work ethics such as job satisfaction, organizational commitment and organizational culture [1]. The important of organizational commitment was emerged because of its association with the role behavior or behavior outside of its character in any organization such as absenteeism [2]. According to [3], they explained that the variables most general used is organizational commitment as precedents to anticipate job satisfaction which shown less determine of turnover intention.

II. LITERATURE REVIEW

A. Organizational Commitment

Organizational commitment refers to attitude and emotion attached to the mission and vision of an organization, to employee's role, involvement, and identification in an organization [3]. In basis, an appraisal of the conformity between an employees' own values and beliefs are aspects to measure organizational commitment of employees in the organization. Individual's willingness to commit to organizational goals is one of the characteristics of organizational commitment. When employees are provided with opportunity to learn and grow, significantly they perceived commitment to remain in their current organization is higher [4]. According to [5], commitment as "a relation and connection of the employee to the organization with multidimensional construct". Different pattern can be taken by commitment and can be controlled at distinctive constituencies in particular organization. Organizational commitment also can be divided into three elements: affective, continuance and normative.

B. Job Satisfaction

Job satisfaction is a complex construct and describe as a personal's feeling, evaluative and affective impacts towards employee job. Many researches are present which link the job satisfaction with turnover intentions [6]. Job satisfaction and organizational commitment are the most important subjects in the

research of job-related perspective [7]. Job satisfaction can be classify using a one-dimensional model for overall job satisfaction or a multidimensional model capturing the independent aspects that influence the emotional state of job satisfaction. The different aspects are independent and should be measured separately to capture the degree of influence each has on job satisfaction. [8] Utilized seven subscales to measure independent aspects of job satisfaction.

The relationship of organizational commitment towards job satisfaction and turnover intention are more supported by many studies which perceive organizational commitment as a predictor of job satisfaction [9]. As a positive emotional reaction, it is rational to suppose that job satisfaction would be negatively related to behavioral turnover [10]. Consequences of frequent studies have given the proof of a strong negative relationship of job satisfaction with turnover intentions [11]. After an intervention to improve the level of job satisfaction, the reduction of turnover intentions were detected.

III. METHODOLOGY

A. Research Design and Data Collection

Research design employed was a mixed method strategy to explore organizational commitment relationship towards job satisfaction among staffs in an oil and gas company in Sarawak. The quantitative research (descriptive research) method which was determined as main method used to gather the information needed. For this research, questionnaire was divided into four sections to examine the characteristics of the important elements in determine organizational commitment relationship towards job satisfaction among staffs in the engineering department of the company.

In this study, data was collected using a structured questionnaire which consisted of 24 subscale questions which related to the three elements of organizational commitments and 36 subscale questions which related to the nine aspects of job satisfaction. In ensuring the research was conducted smoothly, the researcher was emailed to all staffs and permission to distribute the questionnaire was approved from the head of department. All questions are written in English. The questionnaire was distributed to the selected staffs that represented the population of the engineering department in the company and the researcher explains to the participant their roles to ensure they understand the objectives and the outcome desired from this study. The participants were informed to answer and return the questionnaire to the researcher by hand within one week. It took 15 minutes for participants to answer the questionnaire on average.

B. Data Analysis Methods

Data from the survey were analyzed using Statistical Package for the Social Sciences (SPSS). Pearson correlation and *t*-test were used to examine the relationship between variables. The Cronbach's Alpha for job satisfaction is (0.91) and each

elements of organizational commitment: Affective (0.87), Continuance (0.79), and Normative (0.75).

IV. RESULTS AND DISCUSSION

Male participant were the highest group of respondents for this study at 58.57%. Of the study participants, the largest age group was 26 to 30 years old at 55.71%; nearly half of the staffs were in the younger adulthood age range of 35 years old and below. The highest group of race is Malay with 57.14% followed by Chinese, Others and Indian with 24.29%, 15.71%, and 2.86% respectively. The largest percentage of the respondents, 47.14% had worked 3 to 6 years in the organization. When combined with the next highest frequent length of service, 68.57% had work less than 6 years in the organization. The sample respondents were similar to the population of staffs (provided by HRM) in gender, age, and race; thus the sample can be described as being representative of the population. The correlation matrix, as displayed in Table 1, shows the significant level and the correlations associated with the three elements of organizational commitment and the nine aspects of job satisfaction.

Table 1: Correlation between organizational commitment and job satisfaction

	OCoff	OCnorm	OCcont	JSpay	JSprom	JSsup	JSfrbe	JSrew	JSopc	JScowk	JSnow	JScomm	TotalOC	TotalIS
OCoff	1													
OCnorm	0.298	1												
OCcont	0.154	-0.088	1											
JSpay	0.286	0.057	0.204	1										
JSprom	0.383	0.265	-0.063	0.354	1									
JSsup	0.339	0.320	0.140	0.056	0.263	1								
JSfrbe	0.280	0.093	0.201	0.498	0.062	0.100	1							
JSrew	0.342	0.079	0.132	0.487	0.347	0.375	0.236	1						
JSopc	0.179	-0.069	-0.038	0.152	0.043	0.104	0.002	0.235	1					
JScowk	0.044	0.027	0.012	0.054	-0.176	0.316	0.079	0.056	0.224	1				
JSnow	0.316	0.118	-0.005	0.324	0.071	0.305	0.129	0.358	0.476	0.266	1			
JScomm	0.288	0.128	0.072	-0.022	0.010	0.247	0.152	0.387	0.283	0.189	0.462	1		
TotalOC	0.684	0.555	0.670	0.286	0.256	0.394	0.278	0.274	0.022	0.040	0.193	0.235	1	
TotalIS	0.515	0.221	0.135	0.570	0.427	0.602	0.449	0.698	0.503	0.382	0.688	0.569	0.421	1

The total Organizational Commitment towards total Job Satisfaction shows a moderate relationship (0.421) where affective commitment (0.515), normative commitment (0.221) and continuance commitment (0.135). Affective commitment is the highest correlation towards job satisfaction and were similar with other prior studies in higher education staffs, hotel managers, career counsellors, and certified rehabilitation counsellors [9]. The highest statistical correlation of affective commitment towards job satisfaction were promotion (0.383), contingent rewards (0.342) and supervision (0.339). The findings suggest that staffs of the company who perceived the promotion to be in line with the type of work they desired, were comfortable with their organizations' supervision and chances of contingent rewards, and were more likely to have an affective commitment in this organization. Based on findings of [10], also retrieved a strong relationship of affective commitment towards job satisfaction. The highest positive significant correlation of normative commitment towards job satisfaction were for supervision (0.320), promotion (0.265), and communication (0.128). The findings suggest that staff of the company who felt supported by their supervisor, enjoyed the communication at work, and had promotion options would more likely have a sense of loyalty or normative commitment in this organization.

Negative significant correlations for continuance commitment towards job satisfaction were highest for three aspects of job satisfaction which were promotion (-0.063), operation condition (-0.038), and nature of work (-0.005). The findings suggest that staffs of the company who perceived their workplace to have poor promotion options, were not pleased with the operating condition, and was not comfortable with the nature of work where more likely to have turnover intention in this organization. The researcher believe that the staffs most likely to have turnover intention are low despite this negative relationship translating the lack of promotion, poor operating condition and extreme nature of work, due to the pension or other options were worth staying for and tolerated by knowing that no workplace is ideal.

There were only seven out of nine pre-determined answer were chosen by respondents as their most rewarding aspect. Two answers were not chosen by the respondents were contingent rewards and operating conditions. The highest element of job satisfaction were chosen as rewarding aspect by respondents is pay followed by nature of work and co-workers. All of nine pre-determined answer were chosen by respondents as their most frustrating aspect. The highest element of job satisfaction were chosen as frustrating aspect by respondents is operating conditions followed by supervision and nature of work.

The *t*-test analyses found that there were significantly different between female and male correlation of organizational commitment and job satisfaction by 24.4% and 26.3% respectively at Confidence Interval (CI) at 95%. Some studies have identified that female employees were more committed and satisfied towards their organization compared to male employees [11]. Other control variables such as age, race, organization tenure, and education seemed to have very little linkage with the levels of job satisfaction. This supported by [12] when they stated that age was not related to job satisfaction.

The findings indicated that the staffs had moderate relationship between organizational commitments towards job satisfaction. Based on the observations, the type of jobs the staffs did and their workplace environment may have contributed to this finding. As results suggested that there were several aspects that shall be focusing on by management to ensure the improvement of organizational commitment to increase job satisfaction. For example, staffs perceived that promotion as one of the important aspect because they are fully understand and aware of the requirement to get promoted which are to close gaps in technical assessment, attending skill group trainings, and achieve good rating in Key Performance Indicator (KPI). Little not agree with this requirement because they felt that some of the topics to close gap in technical assessment were not related with the work they did and KPI rating was not always translating the job done. In addition supervision also contributed as one of the important aspect perceived by staffs in the company. By providing the learning opportunities of skill development for

technical managers may have implication on the organizational commitment and job satisfaction among staffs in the company.

V. CONCLUSION

This paper presents an inclusive review on organizational commitment relationship towards job satisfaction among staffs in an oil and gas company. Through survey conducted, it was prevalent that there were significant and positively organizational commitment relationship towards job satisfaction among staffs. The incorporation of improving organizational commitment of staffs in the company would be important step in addressing the job satisfaction among them. The admixture of the results of the relationship could be part of the company success planning, employee policies, staffs training and development, and operating procedures of the oil and gas company.

REFERENCES

- [1] Harun, H. and Salleh, R. "Job Satisfaction, Organizational Commitment and Stress among Offshore Oil and Gas Platform Employees." *Asian Social Science* Vol. 10, No. 11 (2014).
- [2] Nagar, K. "Organizational Commitment and Job Satisfaction among teachers." *Times of Burnout, VIKALPA* Vol. 3, No. 2, (2012): 43-60.
- [3] Okpara, J.O. "Job Satisfaction and Organizational Commitment: Are there Differences between American and Nigerian managers employed?" *Academy of Business & Administrative Sciences*, Briarcliffe College, Switzerland (2004).
- [4] Swailes, S. "Organizational commitment: A Critique of the Construct and Measures." *International Journal of management Reviews* Vol. 4, No. 2 (2002): 155-178.
- [5] Ayeni, C.O. and Phopola, S.O. "Work Motivation, Job Satisfaction, and Organizational Commitment of Library Personnel in Academic and Research Libraries in Oyo State, Nigeria." *Library Philosophy and Practice* (2007).
- [6] Abraham, R. "The Impact of Emotional Dissonance on Organizational Commitment and Intention to Turnover." *The Journal of Psychology* Vol. 133, No. 4 (1999): 441-55.
- [7] Kontoghiorghes, C. and Bryant, N. "Exploring Employee Commitment in a Service Organization in the Health Care Insurance Industry." *Organization Development Journal* Vol. 22, No. 3 (2004): 59-73.
- [8] Hylton, T. E. "The Relationship between Job Satisfaction, Organizational Commitment, and Turnover Intent among Certified Rehabilitation Counselors". Michigan State University, Michigan (2014).
- [9] Susskind et al. "Customer Service Employees' Behavioural Intentions and Attitudes: An Examination of Construct Validity and a Path Model." *International Journal of Hospitality Management* Vol. 19, No. 1 (2000): 53-77.
- [10] Moorman, R. H. et al. "Treating Employees Fairly and Organizational Citizenship Behaviour: Sorting the Effects of Job Satisfaction, Organizational Commitment and Procedural Justice." *Employee Responsibilities and Rights* Vol. 6, No. 3 (1993): 484-489.
- [11] Cunningham, G. B. "The Relationships among Commitment to Change, Coping with Change, and Turnover Intentions." *European Journal of Work and Organizational Psychology* Vol. 15, No. 1 (2006): 29-45.
- [12] Joolideh F. and Yeshodhara K. "Organizational Commitment among High School Teacher of India and Iran." *Journal of Educational Administration* Vol. 47, No.1, (2008): 127-136.

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Role of the Judge in Settling Civil Dispute through Mediation Method in Indonesia

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Abstract- Mediation is an Indonesian philosophy that has been stated in the fourth pillar of *Pancasila*. This fourth pillar specifically states that democracy should be led by the great wisdom and representation. Any dispute resolution should be reconciled based on consensus deliberation. This principle is the highest value stated in the 1945 National Constitution as well as in many other laws. The principle of consensus deliberation is the base value used by the disputing parties in seeking dispute resolution outside the court. This study aims at discussing mediation method as one way to settle dispute. The data and information used in this study is by reviewing relevant materials advanced in the literature, laws and regulation issued in Indonesia as well as other sources. The study argued that mediation is not only a peaceful way in settling disputes, but it is also effective and able to give open access widely to the parties to obtain fair treatment and satisfactory settlements. This method is also easy, quick, and low cost to be implemented. This method can be considered as an integral mechanism in settling the disputes associated with the process of civil judicial cases as mandated by the in the Article 130 HIR / 154 RBg, which encourages the parties to pursue the peace process. Mediation becomes as the court procedure of civil law to strengthen and optimize the function of the judiciary in resolving disputes. Therefore, mediation can be an important method to settle any legal disputes in Indonesia.

Index Terms- Mediation, reconciliation, civil dispute settlements, highest value, consensus deliberation.

I. INTRODUCTION

The 1945 Indonesian Constitution firmly stated that Indonesia is a law state or there is a supremacy law in the country. This means that the Republic of Indonesia is a state based on law (*Rechtsstaat*), not based on power alone (*Machstaat*). According to the Article 1 paragraph 3 of the 1945 Constitution, there are three basic principles that should be upheld by all citizens, namely, the rule of law, equality before the law, and the law enforcement in ways that do not conflict with the law.

Based on the above, the Republic of Indonesia has the characteristics as the law state as written in the 1945 constitution. These characteristics are as follows:

- 1) Recognition and protection of human rights that contain equality in the political, legal, social, economic and cultural.
- 2) The court is independent, impartial and is not influenced by any power and any pressures.
- 3) The legality is in all forms (Muchsin, 2005).

As the law state, the rule of law consequently must be upheld and implemented in good faith, in the sense that all actors, whether they are members of the public or the government officials must submit and should not deviate from the law in Indonesia (Muchsin, 2005). Thus, the rule of law and order conditions are prerequisite for any efforts to create Indonesia peacefully and prosperously. If the law is upheld and the order is realized, there will be certainty of safe and peaceful lives and a living harmony will also be realized. Where there are people, there is law (*Ibis Lus Ibi Societas*).

Law is a set of rules written and unwritten, if it is breached, you will get penalized. Therefore, the law will protect the rights and obligations of any legal subjects in peace, while peace itself is a harmony between order and safe. However, in human life there is always a misunderstanding that can lead to disputes. These disputes can be resolved through the courts (Litigation) and outside the Court (Non Litigation).

This paper aims at discussing three issues. The first is the background of judges (judges court assembly) during the first trial that ordered the parties to resolve their dispute through mediation. The second is to address the mechanism for settling civil disputes through mediation. The third is to examine the role of the judge as a mediator in settling disputes in the mediation process in court. However, before the above issues are discussed in detail the following section deals with the discussion of the elements that can raise disputes and the relevant laws and regulation to settle the disputes in section B as the background analysis. Section C then highlights the theoretical framework of dispute settlement advanced in the literature. Finally, concluding notes are drawn in section D. Note that, the data and information used throughout this paper are taken from materials advanced in the literature, the laws and regulation and other relevant sources.

II. ELEMENTS OF DISPUTES AND THE RELEVANT LAWS

There are at least five elements that can raise disputes. These are detailed as follows. First, disputes can raise because of data conflicts. The data conflicts may occur because of the lack of information, information errors or misinformation, view differences, differences in interpreting the data, and differences in interpreting procedures. Data is very important in an agreement. Therefore, the accuracy of data is critical to the achievement of a good deal. For that, in any negotiations the parties will always try to find data or information that becomes the object of negotiations as completely as possible. Once the data is collected or obtained, it is necessary to have the same understanding and interpretation between the parties. If there are

differences in the views or opinions, the negotiations will not produce an agreement (deadlock).

Second, disputes can arise because of the conflict of interests. This may happen because in doing any activities each of the parties has an interest. Without any interests the parties will not be able to cooperate. The conflict of interest may be due to several factors, namely, (a) competitive feeling or competitive actions; (b) substantial interest of the parties; (c) a procedural interest; and (d) psychological interests.

Third, disputes that are due to relationship conflict. Relationship conflict can occur because of the presence of strong emotions, misperceptions, poor communication, or miscommunication, and repetitive negative behaviour. To avoid this dispute, the parties that have a working relationship must control the emotions through the rules agreed, clarifying the differences in perception, and build a positive perception, then improve the quality and quantity of communication and eliminate the negative behaviour carried out repeatedly.

Fourth, disputes can arise because of structural conflict. This structural conflict may occur because of the destructive patterns of behaviour or interaction, the unequal controls, unequal possession or distribution of resources, unequal power and rules, differences in geography and psychology or other environmental factors that inhibit cooperation, and a limited time. Therefore, the parties in this case are necessary to clarify or reinforce the rules of the game, change of destructive behaviour patterns, reallocate the ownership or control of resources, build a healthy competition, mutual understanding, change the negotiation process of the positional bidding based on interest, change the psychology and environment associated with the parties, and modify outside pressures of the parties and change the limited available time to reliable time availability.

Finally, disputes can arise because value conflict. The value conflicts may occur because of differences in opinion or behaviour of the evaluation criteria, the differences in worldview, ideology, and religion, judgment without regard to the judgment of others. Conflicts of this value should be eliminated. This may be done by avoiding the problems of the term or value and allow the parties to agree or disagree, or create a conducive environment that has one dominant value, and conduct research to seek any results in which all parties gain.

From the above five types of conflicts, the dispute essentially arises due to the conflicting arguments between one party and other parties. Thus, a dispute arose because of a problem that clashed with others which immediately want to solve the problem. This problem is usually not understood by judges in handling cases that are being disputed. Actually, the judge should decide it rather than postpone the case of dispute settlement. If each party has a good intention to solve the problem, then the problem will be resolved easily. But if one of the parties had no intention to settle the dispute, then the solution will also be difficult or even not resolved. The sincerity of the parties will determine success or failure in settling the disputes. However, in the case that the dispute was not possible or not successfully resolved by the parties concerned, it is then necessary to have a third party to help resolve it. These third parties may be of individuals, private organizations or government agencies.

In principle, the parties that have disputes are eager to settle the disputes quickly, accurately, fair and inexpensive. These have become a general principle in the settlement of disputes. However, there has been problem associated with the institutions that are best able to carry out on the issue. In general, the parties who have disputes are prefer to settle the disputes by using the social institutions that exist in the community, whether individual institution or social institutions. In the business world, there is an institution that is able to settle the disputes, This institution is called as the Alternative Dispute Resolution (ADR) in many developed countries (Harahap, 1997).

However, if the ways of the dispute settlement lead to deadlock, then the dispute was taken to court as the last resort of dispute resolution. Note that, not all disputes were solved through existing social institutions. The court is usually as the last solution towards disputes.

The court has been the last method to settle the dispute. Disputes that are brought to court is usually considered as the settlement of litigation. Basically, every case has three components. These components are 1) law element; 2) Elements dispute, and 3) human elements. If one of these elements was missing, the case is then closed. Which elements come first than others? Perhaps, the element of human is the main element appeared before the other elements. This is simply because human being has different interests so human element is the source of the problem leading to disputes. This dispute then comes into contact with the law. Three elements are ultimately integrated together to form one case.

Conventionally, dispute resolution is usually done through litigation or through dispute resolution in the court. The completion was solely as a last resort (*ultimatum remedium*) after another alternative is not able to solve it. For that reason, reconciliation or mediation is an effective way to resolve a dispute or disputes in various fields (e.g. business disputes, labour disputes, disputes in marriage, and other civil disputes). Mediation can produce a win-win solution and without going into court trial.

In explaining the dispute in court, the case will be settled by applying civil law, after the documents to held the court completed and the date of the trial was scheduled. The judge must request in advance to the disputing parties to held mediation as determined in the Article 130 HIR / 154 RBg. This article together with the Rules of the Supreme Court No. 1/2016 was an attempt to organise the disputing parties, so that they can be together again as they should, as winning and losing of this case still will bring consequences to them.

In accordance to the above conditions, the following notes need to be given attention.

1. The Article 130 HIR, which mentioned that :

(1) if the two disputing parties come to the court on the setting day, the Court, through its chairman, will try to reconcile them. (IR. 239)

(2) if the reconciliation was met by the two parties at that setting date, the court needs to make a legal certificate, by which both parties are obliged to fulfil the agreement to have reconciliation. This legal certificate is as the formal statement of the judge that both of the disputing parties agreed to have reconciliation (RV.31; IR.195 etc.).

(3) for that kind of the above decision, there will be no further appeal;

(4) If at the time of reconciliation process, both of the disputing parties need an interpreter, this request has to be fulfilled as mentioned in the articles 131.

2) The Article 158, which reads:

(1) When at the appointed day the two parties come, the court using the hand of chairman mediated the reconciliation of the disputing parties;

(2) If the reconciliation was reached, then at that time the court has to make the legal certificate for that reconciliation. This certificate indeed has a power and should be followed as the joint agreement of the two parties.

(3) for a permanent decision like that, there will be no an appeal.

(4) during the reconciliation, the used of an interpreter is welcome.

3). Chapters in the Civil Law

The Article 1851 in the Civil Law book which reads: "Reconciliation is an agreement of the two disputing parties that have been submitted promise or hold the goods to end a case that is being dependent or prevent the raising of a case. This agreement was not valid if it was not made in writing.

This agreement has many elements as follows:

a. The approval among the parties. This agreement is considered valid if it meets the elements of consent set forth in the Article 1320 of the Civil Code, as follows:

- 1) There is an agreement of the parties;
- 2) The competent parties acting legally
- 3) The agreement on a certain matter
- 4) as a cause that by religion is accepted (halal).

b. The approval to do

The article 1851 of Civil Code limits the legal action towards only permitted cases. The limitations contained in three actions:

- 1) To give up things
- 2) Delivering things
- 3) Arresting things

c. Reconciliation on the existence dispute

In the article 1851 of the Civil Code, it was clearly stated that reconciliation can be made on the present case, in the form the on-going case, or a case that is proposed as long as the case has been recorded in the court.

d. In the written form.

In the Article 1851 of the Civil Code, the reconciliation must be embodied in written form. If not, it should be rejected .

4). *Akta Van Dading and Akta Van Vergelijk*

The used of *akta Van Dading* and *akta van Vergelijk* till now is still in doubt. This is because this term according to the experts referred to reconciliation law. As Retnowulan Sutantio (2003) used the term *Akta Van Dading* to declare reconciliation in Article 130 HIR / Article 158 RBG. Also, it is argued by the

Chief Justice Marianna Sutadi that the terms *Akta Van Dading* to declare reconciliation as in the Article 130 HIR / Article 158 Rbg. Whilst MR Tresna in his book used the terms *Akta Van Vergelijk* to declare reconciliation in Article 130 HIR (Tresna, 1975).

However, many judges are more likely to use the term *Akta Van Dading* for reconciliation letter made by the parties which was not yet confirmed by the Judge, while *Akta Van Vergelijk* is the legal letter after obtaining confirmation from the judge. Reconciliation can only be made in the presence of the parties or by the judge who examined the case. Also, it can be made by the parties outside the court and it was brought to the court concerned to be approved.

From the above discussion, it can be concluded that reconciliation can be divided as follows:

- a. Reconciliation letter as approved by the judge (*Akta van vergelijk*)
- b. Reconciliation letter without the consent of the judge (*akta van Dading*)

However, if the reconciliation is seen from the place where it was made, reconciliation letter or legal certificate can be made as follows:

- a. made in the court (in front of the judge)
- b. made out of the court (not in front of the judge)

But, what are the legal consequences of reconciliation if it is in front of the judge vis a vis if it is not in front the judge?

The answer to this question can be read in the Article 1858 of the Civil Code. In this article it was mentioned: "All reconciliation between the parties is legitimate like a final judge's decision. This reconciliation cannot be declined for reasons either for law ignorance or for any losing of one party. This suggests such reconciliation has a strong legitimate as the formal decision made by the court (*in kracht van gewijsde*).

5. Resistance of third parties on reconciliation.

The term *Res Pro Veritabe* means that there should not two decisions for the same case of the same parties. However, if there is other third party outside the case concern, this condition certainly has different legal consequences. In this case, there will be the same examination process in the court to the present of the third party towards the final judge decision.

6) To empower the first trial court through reconciliation

This is stated in the article 130 HIR / Article 154 RBG and the Supreme Court letter No. 1 of 2002 towards the empowerment of first trial court using Reconciliation organization (ex Article 130 HIR / 154 RBG). The detail of the statements are as follows:

- a. all the judges (Judges' Assembly) should try hard to make the reconciliation done completely, not only to make it done formally as in the Article 130 HIR / 154 Rbg;

- b. Judges appointed can act as a facilitator who helps the parties in terms of time, place and the data collection, prepared arguments for the parties towards reconciliation;
- c. At a later stage if it is required by the parties in conflict, the judge or other party appointed can act as a mediator to held meetings among the disputing parties to seek inputs on the disputed subject and based on the information obtained and desire of each party to reconcile, and write proposal, and consult all these to the parties to obtain mutually beneficial results (win - win solution);
- d. The judge appointed as a facilitator / mediator by the parties cannot become the judge in the court assembly in handling the same cases to maintain objectivity;
- e. The length of time given to the judge who appointed as facilitator and mediator must be a maximum of three (3) months, and may be extended if there is a reason. But this extension should have an approval made by the Chairman of the District Court and the extension time excludes time for settling disputes as in SEMA No. 6 Year 1992 that stated:

"To organise a simple, fast and inexpensive any case court trial, all cases in the District Court or in the High Court needs to be settled within six (6) months. However, in certain cases it can be more than 6 (six) months, and in such circumstances the Chairman of the Court or the High Court is required to report the matter by stating the reasons to the chairman of the Court and the Chief of higher Court.

- f. The agreement of the parties needs to be set forth in a written agreement and signed, then was made in the form of legal reconciliation certificate (Dading), so with that legal certificate the disputing parties will be penalised in case they do not follow what has been agreed / approved.
- g. The success of settling disputes through reconciliation can be used as reward for the judge who became facilitator / mediator;
- h. If the efforts made by the judge is not successful, the judge concerned needs to report to the chairman of the Court / chairman of the assembly and the case examination can be continued by the court without closing the opportunity for the disputing parties to reconcile during the examination process takes place;
- i. The judge who became facilitator or mediator shall make a report to the Chairman of the Court on a regular basis;
- j. If the reconciliation is reached, this reconciliation process can be used as a reason for settling disputes exceeding 6 months.

7) Indonesian Supreme Court Regulation No. 1 Year 2016.

Each Judge, Mediator, the Parties and / or legal representative must follow the procedures for settling disputes through mediation. All civil disputes submitted to the Court, including cases of resistance (verzet) against the decision (verstek) and parties opposing parties (Partij verzet) or third parties (derden verzet) against the implementation of decisions

that have already in permanent legal forms, must be first solved through mediation, unless there is other ways determined by the rules of the Supreme Court.

On the trial day that was attended by the parties, the Examining Judge Case obliges the parties to pursue mediation. The examining judge must explain the mediation procedure to the parties including: definition and the benefits of mediation, obligations of the parties to attend a mediation meeting directly, mediation fees, any options to follow up the reconciliation agreement through a legal certificate or case retractions, obligations of the parties to sign a mediation form. The disputing parties are entitled to choose one or more mediators listed in the mediator list in the court. Mediation process lasts not longer than 30 (thirty) days from the determination of the order mediation. On the basis of the agreement of the parties, the mediation can be extended period of time longer than 30 (thirty) days since ending a period of 30 (thirty) days. Material negotiations in mediation are not limited to *posita* and *petitum* accusation.

Due to the parties and / or attorney agreement, mediator could bring one or more experts, community leaders, religious leaders, or traditional leaders, whichever comes first in which the parties reach agreement towards binding or not binding on the explanation and / or expert assessment and / or community leaders.

If mediation reached an agreement, the parties with the assistance of the mediator must formulate a written agreement in the reconciliation agreement signed by the parties and the mediator. The reconciliation agreement should be against the law, public order and / or morality, harm the third party or unenforceable. The parties through the mediator can apply for a reconciliation agreement to the case examiner judge and it was confirmed in the form of legal certificate. If there is no the legal certificate of reconciliation, the reconciliation agreement may be cancelled.

Mediation process is essentially closed unless the other party wants it open. The meetings of the disputing parties can be conducted via remote audio-visual communication that enables all parties to see and hear each other in person and participate in meetings. Meeting via audio communication remotely was considered as a direct presence. The parties shall attend the mediation meeting directly with or without accompanied by lawyer, obliged to follow the mediation in good faith.

The mediator should report in writing the success of the mediation to the case examiner judge by attaching a reconciliation agreement. Mediator should also declare if the mediation failed to reach an agreement and notify in writing to the Case Examiner judge. In the article 1 PERMA No. 1 2016, it was explained that:

Paragraph (1): Mediation is a way of settling disputes through negotiation process to obtain the agreement of the Parties with the assistance of Mediator;

Paragraph (2): The mediator is a judge or other parties who have certified mediator as a neutral third party who assists the parties in the negotiation process for a wide range of possibilities for the settlement of disputes without using a way of breaking or impose a settlement;

Paragraph (3): mediator certificate is a document issued by the Supreme Court or institutions that have obtained

accreditation from the Supreme Court which states that a person has attended and passed the certification training Mediation;

Paragraph (8): Reconciliation agreement is the result of mediation agreements in the form of documents, which contain provisions for dispute resolution signed by the Parties and the Mediator;

Paragraph (10): The reconciliation certificate is a certificate which contains reconciliation document and the judge's decision that support the reconciliation Agreement.

Paragraph (11): the judge is a judge at the Court of First Instance in general courts and religious courts;

8. The Act No. 30 of 1999 on Arbitration and Alternative of conflict Settlement.

In the article 6 paragraph (1), it is expressed as follows: "a dispute or civil difference of opinion can be resolved by the parties through alternative dispute settlement based on good faith by excluding the settlement of litigation in the District Court".

According Priyatna Abdurrasyid (2002): "Mediation is a dispute resolution process where the disputing parties utilizing the help of an independent third party to act as a mediator-arbitrator, but they were not given authority to take binding decisions".

Using variety of procedures, techniques and skills help the parties to resolve their disputes through negotiations. Mediator is also a facilitator in some form of mediation provides non-binding evaluation of the value of the dispute if necessary, but not authorized opening to make binding decision.

From the above 8 regulation, it is compromised as follows:

- a. The judge serves as mediator
- b. This function is initially set in HIR and Rbg, but then released again in SEMA No. 1 of 2002 and enhanced with PERMA No. 3 of 2003, then refined again with PERMA No. 1 of 2008. Finally, it was amended by PERMA No. 1 of 2016 on Mediation procedure in the court.
- c. In line with the above, in 1999 the Government issued Law No. 30 of 1999 on Arbitration and Alternative Dispute Resolution (APS).

III. THEORITICAL FRAMEWORK

The legal system theories propounded by Lawrence M. Friedman (2001) says that there are three elements of the legal system, namely: structure, substance and legal culture. Structure is concerned with the institutions authorized to make and implement laws (Judiciary and Legislature), substance deals with materials or forms of the legislation, while legal culture is a people's attitude to the law and the legal system which involves the beliefs in the value, thoughts or ideas and their hopes.

Lawrence M. Friedman highlights 4 (four) functioning legal systems. The first is as part of a system of social control that regulate human behaviour. The second is as a means to resolve disputes or dispute settlement. The third is the legal system which has function as social engineering function. The fourth is the legal system as a social maintenance that is a function that emphasizes the role of law as the maintenance of the status quo that does not want changes.

Sunaryati Hartono (1976), however, argues that the law is not only passively accept and experience the influence of socio-cultural values in society, but it should also actively influence the emergence of new social cultural values. One factor that can influence the functioning the good law is the society cultural law. This is closely related to the legal consciousness of society. Sunaryati (1976) further suggests that awareness of the law is a notion which became a creation of legal scholars that cannot be seen directly in the life of society, but it can only be inferred from the social life experiences through a way of thinking and certain interpretation. The success of the process of implementation of the rule of law in society is determined by the values espoused and prevailing in a society concern.

Mochtar Kusumaatmadja (1976) argued that the law as social norms cannot be separated from values prevailing in a society. It can even be said that the law is a reflection of the values prevailing in society. A good law is the law in accordance to the living law in the community that would be in compliance or is a reflection of the values prevailing in the society. These values cannot be separated from the attitudes and qualities that should be owned by the people who become members of the community. Without a change in attitudes and characteristics in the direction required by a modern life, then all the development in the sense of physical objects will have a little meaning. This has been proven by loses that occurs in many developing countries that ignore this aspect. So, the essence of the development problem lies in the problem of reform thinking and attitudes.

In modern society or pre modern society, there is a tendency to formulate legal rules in written form formally and generally called law containing a set of rules with a particular hierarchy. The main objective is to ensure legal certainty in the community. For the law enforcers this becomes a solid foundation to implement or carry out their duties as servants of the law. Thus it can be said that the law is a law in the sense of the rule of law that is structure and process of a set of laws that apply at a particular time and place in written forms.

A Law or regulation is considered good or bad, if it fulfils the following conditions:

1. Applicable juridical. This means that the law should be made and issued by official or government agency authorized using legitimate procedure, in which the law should be formalised and socialised according to rules or procedures that has been determined;
2. Applicable sociologically. This means that the law can be applied effectively, recognized, adhered to, or adhered to in the community as part of everyday life. The rule of law in society can be implemented from the top (by authorities) or accepted graciously by the society.
3. Applicable philosophically. It means that the applicable law in the society has been complied in accordance with the intention to issue the law. The application of the law philosophically is determined by the rule of sociological law. Thus, the sociological applicable law is an absolute requirement in order to be able to apply philosophically.

The law in anywhere cannot follow any developments that occur in the community. This means that the changes occurring in society are faster than changes of the law.

There are several reasons why the alternative dispute settlement started to get more attention in Indonesia, despite of factors mentioned above. There are also other factors such as:

1. Economic factors, which the alternative settlement has potential to become as a means for dispute resolution that is more economical, both from a cost standpoint and time.
2. Scope discussed factors. The alternative dispute resolution has the ability to discuss issues agenda more broadly, comprehensively and flexibly.
3. Building good relationship factor. The alternative dispute settlement that rely on the completion of case cooperatively. This way is perfect for those who emphasize the importance of good relations between people that have taken place or will take place.

Besides that, there are other things affected the development of the alternative of dispute resolution in Indonesia due to the demands of international business imposed by a free trade system and the increasing the number and weight of disputes in society. For these reasons, it is necessary to find ways and dispute resolution system that is fast, effective and efficient.

The globalization era requires the existence of a dispute settlement system and trade that are able to adjust with the speed of economic development and trade that led free market and free competition. For that reasons, there must be an institution that is able deal with those development changes.

The alternative dispute settlement began to receive attention in Indonesia because there is Indonesian culture that emphasised the important of consultation and consensus locally called *musyawarah* (discussion) and *mufakat* (compromising). Also, it is because of there some advantages or benefits. These advantages are as follows.

1. The process is Voluntarily. The parties believe that using the alternative dispute settlement, the results will be better as this settlement has no coercion element.
2. The procedure is fast, since the alternative dispute resolution is informal so the parties involved were able to negotiate the use of the terms conditions.
3. Non judicial decision. It is because no authority to make decisions on the dispute parties. This means that the parties involved were able to predict and control outcomes of dispute.
4. Control on the needs of the organization in which alternative dispute resolution procedures, putting the decision in the hands of people who have a certain position, in interpreting both short-term and long term goals of the organizations involved, as well as interpreting the positive and negative impacts of each option under disputes
5. The procedures is confidential. The alternative dispute resolution procedure provides a guarantee of confidentiality for the parties in equal portions. The parties can explore the options of disputes that are potential and are able to maintain their rights to present the data to counter.
6. Flexibility in determining the terms of problems settlement and comprehensive in which this procedure can avoid

the constraints of judicial procedures which has very limited in space and scope.

7. Save time, where the choice of settling disputes through alternative dispute resolution, offers the faster opportunity to resolve disputes. This is because of the principle in business that says "time is money and if there is a delay of dispute resolution there will be more expensive.

8. Cost-effective, it is because the longer the solution, there will be more expensive costs spending.

9. The high possibility to implement the agreement, because the decision taken is a decision which is based on the involvement of the disputes parties.

10. Maintain relationships. The alternative dispute resolution is capable to keep the on going working relationship or ongoing business as well as in the future.

11. Control and easier to predict results. Settlement through alternative dispute resolution is more easily estimate the advantages and disadvantages compared to ways in which the dispute is resolved through the litigation process.

12. The decision made is persisted over time. This is because there will a dispute again in the future, the parties will be able to use again the cooperative form of solving disputes than applying adversely.

Mediation institution is not a part of the litigation institute. This means that the mediation institute is outside the Court. But now the Mediation Institution had crossed into the territory of the Court. Developed countries including the US, Japan, Australia, Singapore has Mediation Institution in the court and outside the court.

Actually the mediation institute in Indonesia is more advanced than other countries. This can be found in the Civil Procedure Code, especially the Article 130 and Article 154 Rbg. These articles organised the reconciliation institute to judges shall first reconcile the dispute parties before the case is adjudicately examined. To empower the Article 130 HIR / 154 RBg, one of the results of the National Working Meeting (Rakernas) of the Supreme Court in Yogyakarta on 24 to 27 September 2001 is the important of the empowerment of the Court at First Instance in implementing the reconciliation (Dading Institute) as defined in Article 130 HIR / 154 RBg, and other articles in the Criminal Procedure applicable in Indonesia, in particular the article 132 HIR / article 156 RBg. These articles are the recommendation of the annual session of People Representative Assembly (MPR) in 2000 in that the Supreme Court should resolve pending law case. Therefore, the issuance of letter made by the Supreme Court (SEMA) No. 1/2002 is emphasis the importance of the reconciliation/mediation institute (Eks.Pasal 130 HIR / 154 RBg.).

However, the above SEMA No. 1 of 2002 is still considered incomplete, so it needs to be refined. The integration of mediation into the court proceedings can be one instrument to effectively address the possibility of accumulation of cases in courts. In addition, the institutional mediation in the justice system can strengthen and maximize the functions of the judiciary in resolving disputes apart from adjudicative litigation. Thus, on September 11, 2003 the Supreme Court issued the Regulation of the Republic of Indonesia (PERMA) No. 2 of 2003 on Mediation Procedure in the court, which then revised by the

Indonesian Supreme Court Regulation No. 1 Year 2008 on Mediation Procedure in court. Based on the vision of the establishment of judicial body in Indonesia, it was mentioned that one of the supporting elements is Mediation as an instrument to improve public access to justice and at the same time able to implement the principle of the administration of justice that is simple, fast, and efficient. However, this regulation is revised again by the Supreme Court Regulation Republic of Indonesia Number 1 Year 2016 About the Mediation Procedure in court.

Whilst Mediation or Alternative Dispute Resolution (APS) outside the court is already regulated in Article 6 of Law No. 30 of 1999 on Arbitration and Alternative Dispute Resolution, the institutions of Alternative Dispute Resolution ca also found scattered in the legislation. This, for example, can be found in the field of environment, labour and others. This study will reveal how judges attempts to reconcile disputes as stipulated in the article 130 HIR / 154 Rbg and how the Alternative Dispute Resolution outside the court.

On the other side, Sudikno Mertokusumo (1993) states: "that the judge is expected to be impartiality in deciding who is right and who is not in a case and end to the dispute or its case ". For judges in adjudicating a case, the emphasis is particularly in fact or event in question and not the law. The legal regulation is just a tool, whereas the event or facts is the critical factor. This is because there is the possibility of an event that cannot be solved by the regulation, and hence it needs other solution (Sudikno Mertokusumo,1993). The judges' verdict in the criminal case is limited by what the public prosecutor indicted, equal with the civil that is limited by what is sued. Judges should not make decision outside cases that the prosecutor charged. Ideally, the cases that should be indicted and it should also be proved (Andi Hamzah, 2003). Similarly, in the use of mediation institutions in an effort to settle cases between the parties, especially cases that do not use court.

The tasks of a judge appointed as a mediator in civil cases is to reconcile the conflicting parties in civil procedure law. Reconciliation can be interpreted formally and materially. Reconciliation in forma sense are:

1. Not continuing dispute (case) in court, or
2. Make an agreement to resolve the dispute before litigation in court.

This can be seen in the Law No. 4 of 2004 on Judicial Power, especially in Article 5 (2) that states as follows:

"The court assists to seek justice and strive to overcome all obstacles and barriers to achieve the justice that is simple, fast and inexpensive ".

If the parties do not continue the dispute (case) in court, then the case will be declined. If the parties make a reconciliation agreement for resolving the dispute before the process of further litigation, it is a must to make reconciliation certificate .

Reconciliation materially is defined as the achievement of an agreement on the settlement of disputes after through litigation in the courts. Litigation process is a process in the civil procedure that includes reading the lawsuit, answers, replicate, closing argument, evidence, conclusions and decisions. The process can be passed in whole or in part, which ended with the

verdict. If in the process of litigation, there has been reached agreement on the settlement of the dispute, the judge will make a decision in accordance with the agreement until it reached conclusion about the solution of dispute. The judge will further make a verdict which theoretically can be justified even though not in accordance with the opinion of one or both parties. In this case, the judge's decision serves to terminate or abolish the dispute that is formal, material and emotional. In a dispute that has formal character that is a dispute about the rule of law or the legal status of an object of the dispute, in this case the ultimate goal is the certainty of law.

In the dispute with material characteristicly, in order to achieve a common perception of the agreement towards the allocation of rights on objects, valuation or pricing, the fulfilment of obligations between the parties. This can happen in a dispute over the sale and purchase, leasing, accounts payable, inheritance, wills, *sodakoh* (*charity*), property in marriage, the wife living, a living child, in this case the target is a sense of justice. In a emotional dispute in the sense that will reach agreement (common perception) for each other to forgive, give mutual respect / appreciate and help each other, the ultimate goal is to create good relationship, peaceful, harmony.

Based on the article 130 paragraph (1), it was stated that the judge before examining a civil case should strive to reconcile the two sides. In conducting the reconciliation process, this can be done throughout the process as well as in the high court (Retno Wulan and Iskandar Oerip, 1995). To have clear example, it can be seen from the decision made by the High Court of Bandung, dated October 4, 1973 No. 143 / Pdt / PT Bandung, and March 27, Number 60 / pdt / PT Bandung, as well as the provision contained in Article 31 Rv. These dual decisions could be serve as jurisprudence in the legal establishment, especially regarding the reconciliation efforts that can be done by the judges. If the attempts made by the judge has reached an agreement and the parties accepted the case, the reconciliation certificate must be made and both parties should comply with the contents of the reconciliation certificate that that was signed.

With this reconciliation certificate, there will be a legitimate power as the judge's decision that has been *in kracht van gewijsde* for the party that was supposed to give something or omitted to pay a certain amount of money. If, for instance, there is no explanation of the obligation, it can immediately be executed against the goods in question to obtain a sum of money to be paid to the entitled party to receive a sum of money including other expenses. Therefore, it is appropriate that the reconciliation agreement solely become the responsibility of the dispute parties to make it.

IV. CONCLUDING NOTES

The settlement of dispute is one of the important legal aspects of the society in resolving a conflict or dispute. This is the duty of the Courts to resolve a case based on the Act and judges which were guided by the Law No. 48/2009 on judicial Power, which is the main and a general framework that lay the basis and principles of justice.

Along with the demands of globalization which led to free trade, the settlement of disputes can be resolved by the court or outside the court, or commonly known as the Alternative Dispute

Resolution (ADR) or also known as the Alternative Dispute Resolution (APS) with the issuance of the Law No. 30/1999 About the Arbitration and Alternative dispute Resolution. One method to this is through mediation.

The judge as mediator in resolving disputes has a very important role in handling disputes through alternative dispute settlements and /or through reconciliation / mediation. This method is considered much better and more wisely since nobody loses and nobody wins (win-win) than using the judge verdict with the decision one loses and one wins. Using mediation method, the cost is relatively low and it is efficient in term of time. This method is also in accordance with the principle of civil procedural law which states that "the court shall reconcile the litigants".

REFERENCES

- [1] Adi Sulistiyono, Mengembangkan Paradigma Penyelesaian sengketa Non Litigasi dalam Rangka Pendayagunaan Alternatif Penyelesaian Sengketa Bisnis/ Hak Kekayaan Intelektual: Disertasi: Semarang: PDIH, 2002.
- [2] Alan Redfern & Martin Hunter, Law and Practice of International Commercial Arbitration, London, Sweet & Maxwell, 1991
- [3] Andi Hamzah. Kemandirian dan Kemerdekaan Kekuasaan Kehakiman. Jakarta: BPHN Departemen Kehakiman dan HAM RI, 2003
- [4] Andrew L. Kaufman. Cardozo, Cambridge. Harvard University Press, 2000.
- [5] Badudu-Zein, Kamus Umum Bahasa Indonesia, Jakarta: Pustaka Sinar Harapan, 1996
- [6] Bagir Manan, Kekuasaan Kehakiman Indonesia Dalam Undang-Undang Nomor 4 Tahun 2004, Yogyakarta: FH UII Press, 2007
- [7] Bagir Manan, Keluarga Kehakiman Berdasarkan Undang-Undang No. 4 Tahun 2004, Yogyakarta: 411 FH UII Press, 2006
- [8] Butterworths "Concise Australian Legal Dictionary", Second Edition
- [9] Charles Himawan. The Foreign Investment Process in Indonesia. Jakarta: Gunung Agung, 1980
- [10] Christopher W. Moore, "legal process and history (alternative) dispute resolution" Paper University of Technology Sydney, centre for Dispute resolution, 20 October 1997
- [11] Christopher W. Moore, The Mediation Process Practical Strategies for Resolving Conflict, San Francisco, Jossey Bass, Second Edition
- [12] Departemen Pendidikan dan Kebudayaan, Kamus Besar Bahasa Indonesia, Jakarta: Balai Pustaka, 1997
- [13] Donal Black. "Black's Law Dictionary" New York: Paul, Minn, Edition (1891-1991) Sixth Edition, 1990
- [14] Emmy Yuhassarie, "Pointers Focus Group Mediasi", Pusat Pengkajian Hukum, Paper disampaikan di Hotel Mandarin Oriental Tanggal 12 Maret 2003
- [15] Erman Rajagukguk, Budaya Hukum dan Penyelesaian Sengketa Perdata di Luar Pengadilan, Dalam Jurnal Magister Hukum, vol. 2. No. 4, Okt 2000
- [16] Gary Goddaster, Panduan Negosiasi dan Mediasi, Ed 1 (Jakarta Proyek ELIPS, 1999
- [17] George Ritzer, Sosiologi Ilmu Pengetahuan Berparadigma Ganda, (Penyadur: Alimandan), Jakarta: Raja Grafindo Persada, 2002.
- [18] Henry Campbell Black; Black's Law Dictionary, Sixth Edition by The Publisher Editorial Staff, New York: St. Paul, Minn West Publishing, 1990
- [19] Indonesia Supreme Court Rule Number 1 of 2016
- [20] Indonesia Law Number 3 of 2009
- [21] Indonesia Law Number 48 of 2009
- [22] Indonesia Supreme Court Rule Number 1 of 2008
- [23] Indonesia Supreme Court Rule Number 2 of 2003
- [24] Kanter, e.y., Etika Profesi Hukum, Yogyakarta: Kanisius, 1998
- [25] Lokakarya Terbatas, "teknik Mediasi" (Tingkat Dasar) 18-20 Nopember 2002, Hotel Lido Lakes, Bogor, Jawa Barat
- [26] Normin S. Pakpahan, Pembaharuan Hukum di Bidang Kegiatan Ekonomi, Makalah pada Temu Karya Hukum Perseroan dan Arbitrase, Jakarta 22-23 Januari 1991. hlm. 29-37,
- [27] Muladi, Hak Asasi Manusia, Politik, dan Sistem Peradilan Pidana, Semarang: Badan Penerbit Universitas Diponegoro, 1997.
- [28] Reglemen Indonesia amandement (R.I.B) (Het Herziene Inlandsch Reglement (H.I.R) Stbl.1941:44
- [29] Satjipto Rahardjo, Peningkatan Wibawa Hukum Melalui Pembinaan Budaya Hukum, Makalah pada Lokakarya Pembangunan Bidang Hukum Repelita VII, Jakarta BPHN, Juli 1997
- [30] Sunaryati Hartono. Hukum Ekonomi Pembangunan Indonesia. Bandung: Binacipta, 1982
- [31] Sunaryati Hartono. Kapita Selekta Hukum Ekonomi. Jakarta: Bina Cipta, 1976
- [32] Syprianus A. Djaro. Beberapa Penyelesaian Sengketa Dalam Bisnis (Makalah). Jakarta: BPHN Departemen Kehakiman, 1994

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Regression Discriminant Analysis (RDA) Variants

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Abstract

This study is a follow-up to earlier publications on the relationship of least squares regression to FDA. In particular, we focus on the paper; On the Regression Discriminant Analysis (RDA), and its Identical Relationship to the Fisher's Discriminant Analysis, and argue that since $\hat{\beta}$ is a vector of coefficients for the least squares regression, given that $y \in (+1, -1)$, then a substitution of $\hat{\beta}$ with either $\hat{\beta}_{\text{ridge}}$ or $\hat{\beta}_{\text{lasso}}$ gives a regression discriminant analysis variant. We note that both $\hat{\beta}_{\text{ridge}}$ and $\hat{\beta}_{\text{lasso}}$ are respectively vectors of coefficients for ridge regression and lasso (least absolute shrinkage and selection operator), given that $y \in (+1, -1)$. We therefore identify Ridge Regression Discriminant Analysis (RRDA) and Lasso Discriminant Analysis (LaDA) as the two regression discriminant analysis variants. Further empirical investigation follows, mainly to show that RRDA and LaDA compete favourably against a known Fisher's Discriminant Analysis (FDA) variant namely, Regularized Fisher's Discriminant Analysis (RFDA). Since RRDA, LaDA or RFDA can be used in place of FDA in high dimensions, we further determine the most suitable replacement for FDA assuming we are in high dimensions.

Index Terms: Machine learning, Regression based binary classification, Linear discriminant analysis, Least squares discriminant analysis variants.

I. INTRODUCTION

The use of regression in classification has been in the form of logistic regression [4]. The logistic regression fits a non linear model to a linear combination of explanatory variables, and it is superior to FDA when normality assumptions are violated [13]. If normality is assumed, it is an alternative to FDA [9]. However, our interest is in a regression based classification procedure that fits a linear model for classification based on the multiple regression.

To this end, the work of [17, 5, 12] are of interest to us because they involve fitting a linear model for classification based on the multiple regression. In particular, we focus on the work of [12].

The authors proved that the least squares vec-

tor of coefficients $\hat{\beta}$ is proportional to γ , where γ is the weight vector of FDA's classification function given that $y \in (+1, -1)$. A detailed review of their work is as follows:

a. Data and some notations

Let X_1 ($n_1 \times p$) and X_2 ($n_2 \times p$) be datasets for two populations Π_1 and Π_2 , and let $n = n_1 + n_2$. Let

$$X = \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} (n \times p) \quad (1)$$

denote the whole dataset, and $H = I_n - (1/n) 1_n 1_n^T$ denote the $n \times n$ centring matrix. In a similar way, let H_1 and H_2 denote the $n_1 \times n_1$, and $n_2 \times n_2$ centring matrices respectively.

Let \bar{x}_1 , \bar{x}_2 and \bar{x} denote the sample means of X_1 , X_2 and X respectively. Note that

$$\bar{x} = (n_1 \bar{x}_1 + n_2 \bar{x}_2) / n$$

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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,

$$\delta = \bar{\mathbf{x}}_1 - \bar{\mathbf{x}}_2. \quad (2)$$

b. Fisher’s allocation rule

Several matrices are of interest in discriminant analysis:

$$\begin{aligned} T &= X^T H X, \\ B &= (n_1 n_2 / n) \delta \delta^T, \\ W &= X_1^T H_1 X_1 + X_2^T H_2 X_2. \end{aligned}$$

A classic result [8] states that

$$T = W + B.$$

The Fisher’s allocation rule is based on Fisher’s linear discriminant function given by:

$$f(\mathbf{x}) = \delta^T W^{-1} (\mathbf{x} - \mathbf{x}_{av}).$$

The allocation rule in respect of a new input \mathbf{x} says: allocate \mathbf{x} to Π_1 if $f(\mathbf{x}) \geq 0$, and to Π_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

$$\gamma = W^{-1} \delta; \quad (3)$$

then Fisher’s discriminant function simplifies to

$$f(\mathbf{x}) = \gamma^T (\mathbf{x} - \mathbf{x}_{av}).$$

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

$$g(\mathbf{x}) = \hat{\alpha} + \hat{\beta}^T \mathbf{x},$$

where $\hat{\alpha} = \bar{y} - \hat{\beta}^T \bar{\mathbf{x}}$, and

$$\hat{\beta} = (X^T H X)^{-1} X^T H \mathbf{y} = T^{-1} X^T (H \mathbf{y}).$$

Note that $\hat{\beta}$ is estimated using the centred data matrix $H X$, we then claim that

$$\hat{\beta} \propto \gamma, \quad (4)$$

where γ is as defined in (3).

d. Proof

First note that the centred 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,

$$\begin{aligned} X^T (H \mathbf{y}) &= (1/n_1) X_1^T \mathbf{1}_{n_1} - (1/n_2) X_2^T \mathbf{1}_{n_2} \\ &= \bar{\mathbf{x}}_1 - \bar{\mathbf{x}}_2 = \delta, \end{aligned} \quad (5)$$

where δ is as defined in (2).

Showing that $\hat{\beta} \propto \gamma$ is equivalent to showing that $T^{-1} \delta \propto \gamma$, which is true if and only if

$$\begin{aligned} \delta &\propto T \gamma \\ &\propto T W^{-1} \delta \\ &\propto (W + B) W^{-1} \delta \\ &\propto \left(I + (n_1 n_2 / n) \delta \delta^T W^{-1} \right) \delta \\ &\propto \delta + (n_1 n_2 / n) \delta \left(\delta^T W^{-1} \delta \right) \\ &= \left\{ 1 + (n_1 n_2 / n) \left(\delta^T W^{-1} \delta \right) \right\} \delta \\ &= u \delta, \end{aligned}$$

where $u = \{ 1 + (n_1 n_2 / n) (\delta^T W^{-1} \delta) \}$ is a constant. Hence, the result is proved.

e. Regression rule

Set,

$$\begin{aligned} g(\mathbf{x}) &= \hat{\alpha} + \hat{\beta}^T \mathbf{x} \\ &= \bar{y} - \hat{\beta}^T \bar{\mathbf{x}} + \hat{\beta}^T \mathbf{x} \\ &= \bar{y} + \hat{\beta}^T (\mathbf{x} - \bar{\mathbf{x}}), \end{aligned} \quad (6)$$

and allocate to Π_1 if $g(\mathbf{x}) \geq 0$, otherwise to Π_2 . If on the other hand we set $\mathbf{x} = \mathbf{x}_{av}$, then,

$$g(\mathbf{x}_{av}) = \bar{y} + \hat{\beta}^T (\mathbf{x}_{av} - \bar{\mathbf{x}}) \neq 0,$$

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 (6), 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

$$\begin{aligned} g^*(\mathbf{x}) &= g(\mathbf{x}) - (\hat{\alpha} + \hat{\beta}^T \mathbf{x}_{av}) \\ &= \hat{\alpha} + \hat{\beta}^T \mathbf{x} - \hat{\alpha} - \hat{\beta}^T \mathbf{x}_{av} \\ &= \hat{\beta}^T (\mathbf{x} - \mathbf{x}_{av}), \end{aligned} \quad (7)$$

and define another rule: allocate \mathbf{x} to Π_1 if $g^*(\mathbf{x}) \geq 0$ and to Π_2 otherwise.

The authors noted that the allocation rule given by f and g^* are identical, hence they called g^* a regression based discriminant function instead of g .

We now argue that since $\hat{\beta}$ in (7) is based on the least squares given that $y \in (+1, -1)$, a substitution thereof with either $\hat{\beta}_{ridge}$ or $\hat{\beta}_{lasso}$ under the same condition, gives rise to a classification function called RRDA or LaDA.

In the section that will follow, we shall carry out empirical investigation to show that both RRDA and LaDA competes favourably against RFDA.

II. EMPIRICAL INVESTIGATION

We shall analyse the error rates of RRDA, LaDA and RFDA on different datasets. Since all the classifiers can be used in place of FDA when $p \gg n$, we would like to know which of them, if any, significantly differs in its error rates given the different datasets. Here, p refers to the number of explanatory variables, and

n is the number of training instances. As p becomes larger than n , the investigation will also determine which classifier is a most suitable replacement for FDA. In other words, we shall determine a classifier that will be recommended in place of FDA in high dimensions.

A good number of the datasets used in the investigation will be sourced from the UCI Machine Learning Repository [10], and KEEL dataset repository [1]. We shall pre-process 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, the problem of rewriting the program we use each time a different dataset is involved is avoided. The datasets include:

Appendicitis

The data represents 7 medical measures taken over 106 patients on which the class label represents whether the patient has appendicitis (class label +1) or not (class label -1). We have a total of 21 samples in class +1 whereas class -1 consists of 85 samples. The dataset was sourced from KEEL dataset repository.

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 690×14 , with two classes representing approved and not approved. The data source is [1], and website; <http://sci2s.ugr.es/keel/dataset.php?cod=53>.

CoIL 2000

The dataset was used in CoIL 2000 challenge, and contains information on customers of an insurance company. It is a binary classification dataset, and consists of 85 variables including product usage data, and socio-demographic data. The number of samples involved is 9822, with a total of 9236 in class +1 and 586 in class -1. It was sourced from the UCI Machine Learning Repository.

Colon

Colon is a gene expression dataset from the microarray experiments of colon tissue samples

[2]. The dataset consists of 62 samples and 2000 genes (features). It has two classes, namely tumour tissue with 40 samples, and normal tissue with 22 samples. It is contained in the `plsgenomics` package in R. The names of the genes were not given and we represented them conveniently.

Gisette

The dataset is one of five datasets used in the NIPS 2003 feature selection challenge, and it was put together by [7]. The sample size is 7000, with 5000 features and each of the two classes has 3500 samples. The dataset is also contained in the UCI Machine Learning repository.

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 [16].

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.

Heberman

This dataset contains cases from a study that was conducted between 1958 and 1970, at the University of Chicago's Billings Hospital, on the survival of patients who had undergone surgery for breast cancer. The task is to determine if the patient survived 5 years or longer (positive) or if the patient died within 5 year (negative). The sample size is 306 with 3 features, and class +1 has 225 samples whereas class -1 contains 81 samples. The dataset was sourced from the KEEL dataset repository.

Hepatitis

Hepatitis is a real world dataset; it contains a mixture of integer and real valued attributes,

with information about patients affected by the hepatitis disease. It consists of 80 samples and 19 features. Class +1 has 67 samples whereas class -1 has 13 samples, and the task is to predict if these patients will die (-1) or survive (1). It was sourced from the UCI Machine Learning Repository.

Hill valley with noise (HVWN)

The hill valley with noise dataset consists of 606 instances, and 100 features for both training and test sets. Noise contamination of the dataset is retained, thereby differentiating it from the hill valley without noise dataset. 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.

Leukemia

The leukemia dataset is a gene expression data consisting of 3051 genes, with 38 tumour mRNA samples from the leukemia microarray study [6]. The tumour mRNA samples are of two cancerous classes, here denoted as -1 and +1. Since the number of training samples is small, we used the same dataset for training to also test the classifiers. Our interest here is merely in the performances of the classifiers given such scenarios. The dataset is contained in R package `plsgenomics`. Although the gene names were given, we have represented them conveniently because they are lengthy, and we have no intrinsic interest in the gene names.

Magic

This dataset was used to simulate registration of high energy gamma particles, in a ground-based atmospheric Cherenkov gamma telescope, using the imaging technique. The

dataset was generated by a Monte Carlo program [3], and the task is to discriminate statistically images generated by primary gammas, from the images of hadronic showers initiated by cosmic rays in the upper atmosphere. It contains 19020 samples and 10 features; the source is the UCI Machine Learning Repository.

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 830×5 , and the source is the KEEL dataset repository.

Parkinsons

The Parkinsons dataset is of dimension 195×23 , and involves a range of biomedical voice measurements of some people with and without Parkinson's disease (PD). It was sourced from the UCI Machine Learning Repository. Documentation on the dataset shows that each column is a particular voice measure, and each row corresponds to one of 195 voice recordings from these individuals.

Prostate

The prostate dataset is a gene expression dataset [15]. The dataset is contained in R package `spls` and consists of two classes, namely 52 prostate tumour and 50 normal classes. The number of genes involved is 6033. The names of the genes were not given and as a result, we represented them conveniently.

Ringnorm

Ringnorm is a 20 dimensional, 2 class classification dataset. Each class is drawn from a multivariate normal distribution, and class 1 has mean 0 and covariance 4 times the identity. Class 2 has mean (a, a, \dots, a) and unit covariance ($a = 2/\sqrt{20}$). The number of instances is 7400, and like most simulated datasets, the dataset is useful for testing performances of bi-

nary classifiers. The source is the KEEL dataset repository.

Saheart

The Saheart dataset pertains to a retrospective sample of males in a heart-disease high-risk region of the Western Cape, South Africa. There are roughly two controls per case of CHD. Many of the CHD positive men have undergone blood pressure reduction treatment and other programs to reduce their risk factors after their CHD event. In some cases the measurements were made after these treatments. The saheart data were taken from a larger dataset described in [14]. The class label indicates whether the person has a coronary heart disease: negative (-1) or positive (+1). The dataset has dimensions 462×9 , and is contained in the `ElemStatLearn` package in R.

Sonar

This dataset contains how many signals obtained from a variety of different aspect angles, spanning 90 degrees for mines and 180 degrees for rocks. Each pattern is a set of 60 numbers in the range 0.0 to 1.0, where each number represents the energy within a particular frequency band, integrated over a certain period of time. The output attribute contains the letter +1 if the object is a rock and -1 if it is a mine (metal cylinder). The source is the UCI Machine Learning Repository.

Spambase

The spambase dataset contains information about 4597 e-mail messages. The task is to determine whether a given email is spam (class +1) or not (class -1), depending on its contents (4 duplicated instances have been removed from the original data set). Most of the attributes indicate whether a particular word or character was frequently occurring in the e-mail. The dataset was sourced from the UCI Machine Learning Repository.

SPECTF Heart

The SPECTF Heart dataset is of dimension 267×44 , and consists of diagnosis of cardiac Single Proton Emission Computed Tomography (SPECT) images. Each patient involved

in the study is classified into one of two categories: normal and abnormal. Altogether, 44 continuous feature patterns were created for each patient. The source of the dataset is UCI Machine Learning 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 $(-a, -a, \dots, -a)$. $a = 2/\sqrt{20}$. The dataset has dimensions 7400×20 , 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 tumour found is benign or malignant (-1 = malignant, and 1 = benign). It was sourced from the UCI Machine Learning Repository.

i. Discussion

Table 1 consists of the error rates of the three classifiers and the system time it took each classifier to finish execution. The LaDA variables refers to the number of variables used by LaDA to compute the error rate given each dataset. On examination of the Table, it appears that differences in the error rates of the classifiers on most datasets are not significant. Exceptions may include six datasets, namely the Colon, Hepatitis, HVWN, HVWON, SPECT Heart and Sona. The error rates on these datasets are comparatively higher. It seems that the RRDA error rates are marginally smaller on Hepatitis, HVWN, SPECT Heart and Sona datasets. LaDA seems to have marginally smaller error rates on Colon dataset, whereas RFDA recorded a marginally smaller error rates on HVWON dataset. Altogether, it appears that

RRDA performed relatively better on the six datasets, but it can still be argued that the different error rates between RRDA and others are not significant.

The box plots of Figure 1(a) show that LaDA has a marginally smaller median error rate, in comparison with RRDA and RFDA. The median error rates of RRDA and RFDA appear to be similar. However, based on the size of the LaDA box, it seems that we have more variations in error rates of LaDA than in the error rates of RRDA and RFDA.

On the other hand, differences in the time it took each classifier to finish execution may be seen as insignificant with some datasets, and very significant with other datasets. For instance, with datasets Australia, Handheight, Heart, Mammographic, Parkinsons, Saheart, Sonar, Twonorm and WDBC, differences in system time appear insignificant. The same may not be true with datasets like Gisette, Prostate, and possibly, Colon and Leukaemia. It seems that in the instances where $n > p$, the system time is relatively smaller vis-a-vis when $p > n$. An exception here is the dataset Gisette, because despite the fact that $n > p$ the system time for the classifier is still very high. The RFDA particularly recorded the highest system time on datasets Gisette and Prostate. They constitute the two most prominent outliers in Figure 1(b). Comparatively, it seems we have more outliers with the system time for RFDA. The implication is that RFDA may not be a preferred classifier in high dimensions.

Test for Normality, Homogeneity of Variances, and the Repeated Measures ANOVA

A Shapiro Wilks normality test on the error rates of LaDA, RRDA and RFDA failed to reject compliance with the normality assumption at p-values of 0.4059, 0.383 and 0.9509 respectively. Similarly, a Bartlett's test also failed to reject compliance with the homogeneity of variances at a p-value of 0.9590. Hence, we confirm that we have complied with both normality and homogeneity of variances assumptions.

Name Dataset	Dimensions	LaDA	LaDA Variables	Sys. Time in Sec.	RRDA	Sys. Time in Sec.	RFDA	Sys. Time in Sec.
Appendicitis	106 × 7	0.125	5	1.96	0.125	1.89	0.1563	5.71
Australia	689 × 14	0.1353	8	1.98	0.1353	2.19	0.1159	1.9
Coil2000	9822 × 85	0.2677	50	18.82	0.2691	21.6	0.2959	15.65
Colon	62 × 2000	0.1579	18	3.96	0.2105	9.01	0.2105	49.66
Gisette	7000 × 5000	0.028	1407	1495.2	0.023	2248.8	0.091	8958.24
Handheight	167 × 2	0.18	2	1.84	0.18	1.85	0.18	1.47
Heart	270 × 13	0.1489	11	3.37	0.1489	3.01	0.1596	1.67
Heberman	306 × 3	0.2637	2	1.82	0.2418	1.95	0.2418	1.56
Hepatitis	80 × 20	0.1944	3	8.09	0.1389	2.07	0.2222	1.65
HVWON	1212 × 100	0.3069	36	16.54	0.33	6.62	0.2822	6.19
HVWN	1212 × 100	0.3465	30	16.96	0.3152	7.18	0.396	7.09
Ionosphere	350 × 32	0.1619	20	2.28	0.1714	2.28	0.1905	11.75
Leukemia	76 × 3051	0	37	3.85	0	14.03	0	180.6
Magic	19020 × 10	0.2059	9	9.31	0.2075	10.72	0.205	8.91
Mammographic	830 × 5	0.2289	2	1.79	0.2088	1.98	0.1968	1.46
Parkinsons	195 × 23	0.1207	20	3.36	0.1897	2.93	0.1897	1.76
Prostate	102 × 6033	0.0968	68	10.92	0.0968	32.42	0.0968	6496.2
Ringnorm	7400 × 20	0.2477	20	6.36	0.2482	5.2	0.2477	4.1
Saheart	462 × 9	0.3525	7	1.74	0.3381	2.04	0.3597	1.87
Simulated dataset	2000 × 40	0.0425	38	7.76	0.0363	4.13	0.04	3.39
Sonar	208 × 60	0.2742	17	2.78	0.1935	2.58	0.2258	1.96
Spambase	4597 × 57	0.1159	52	7.85	0.1145	7.8	0.1319	5.59
SPECTF Heart	267 × 44	0.3209	22	2.44	0.2834	4.04	0.3369	2
Twonorm	7400 × 20	0.0216	20	5.64	0.0216	5.59	0.0216	4.22
WDBC	569 × 30	0.0175	25	2.14	0.0175	2.09	0.0702	1.96

Table 1: Error rates of RFDA, LaDA and RRDA, and the system time it took each classifier to finish execution given different datasets.

We therefore carried out repeated measures ANOVA test, which rejected the hypothesis that differences in the error rates of the classifiers are non significant at a p-value of 0.0233. We further considered a post hoc test based on paired t-test, and obtained the following output in R:

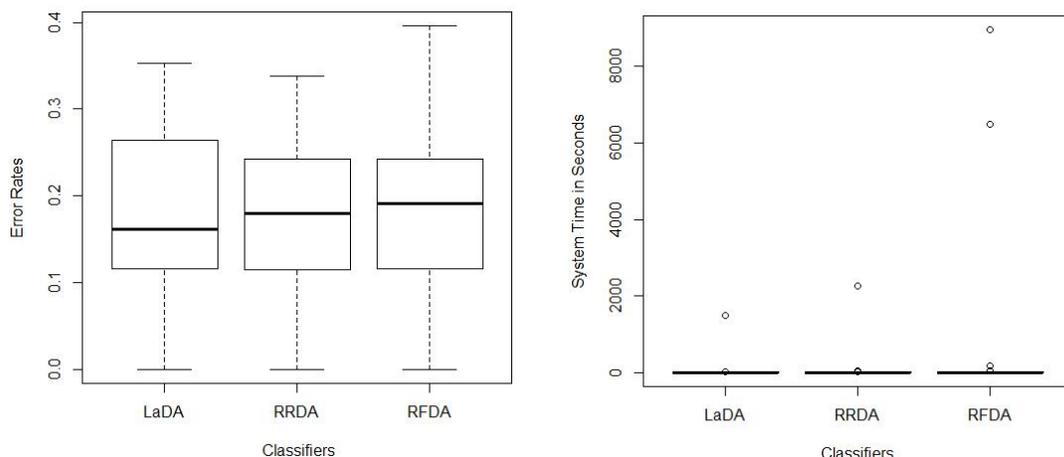
Pairwise comparisons using paired t tests
 data: Values and Classifiers

```

LaDA RFDA
RFDA 0.057 -
RRDA 0.437 0.013
    
```

P value adjustment method: none

The result shows that differences in the error rates between LaDA and RRDA are non significant at a p-value of 0.437. We narrowly rejected the hypothesis that differences in error rates between RFDA and LaDA are significant at a p-value of 0.057. Lastly, we failed to reject the hypothesis that differences in error rates between RFDA and RRDA are significant at a p-value of 0.013. By considering the p-value at which we rejected the existence of significant differences between the error rates of RFDA



(a) Box plots of the error rates of LaDA, RRDA and RFDA (b) Box plots of the system time for LaDA, RRDA and RFDA

Figure 1: Box plots in respect of the error rates and system time for LaDA, RRDA and RFDA.

and LaDA, one may be cautious to assume that both classifiers are as good as the other. If we further consider the number of variables LaDA used, we are of the view that LaDA performed better than RFDA. In all, based on the error rates, we argue that RRDA relatively performed better, followed by LaDA and lastly, RFDA.

Assuming we considered a paired t-test with a Bonferroni adjustment, we would have obtained the following result:

```
Pairwise comparisons using paired t tests
data: Values and Classifiers
```

```
      LaDA RFDA
RFDA 0.17  -
RRDA 1.00 0.04
```

```
P value adjustment method: bonferroni
```

The Bonferoni adjustment gives a result similar to the paired t-test without adjustment. For this reason, our interpretation of the performances of the classifiers remains unaltered.

Regarding the system time, the histograms of Figure 2 strongly suggest that the system time in respect of each classifier does not follow a normal distribution. It is clearly caused by the

heavy presence of outliers. Confirming our position, the Shapiro Wilks normality test rejected compliance with the normality assumption in respect of system time of LaDA, RRDA and RFDA at p-values of $1.48e-10$, $1.429e-10$ and $1.012e-09$ respectively. Also, the Bartlett’s test on homogeneity of variances rejected compliance with the homogeneity of variance assumption at a p-value of $2.2e-16$. For these reasons, we shall use a non parametric Friedman’s test for comparison of the system time of the three classifiers.

Consequently, the output of the Friedman’s test in R gives:

```
Friedman rank sum test
data: datx
Friedman chi-squared = 8.7475, df = 2,
p-value = 0.0126
```

With a p-value of 0.0126, at 5% level of significance, we reject the null hypothesis of no difference in the system time of the three classifiers. This means that the observed differences are significant, hence, a post hoc analysis for the Friedman’s test will follow. In this regard, we used the Nemenyi post hoc test [11] and obtained the following output in R, at a 5% level of significance:

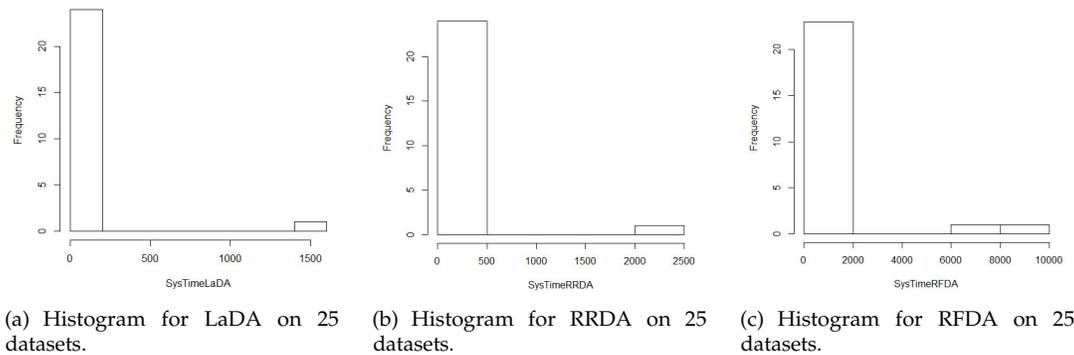


Figure 2: Histograms in respect of system time for RFDA, LaDA and RRDA on 25 datasets.

```

Pairwise comparisons using Nemenyi
multiple comparison test
data: datx
          LaDA.SysTime  RRDA.SysTime
RRDA.SysTime      0.989          -
RFDA.SysTime      0.036      0.024
    
```

The Nemenyi test shows that we have significant differences in system time between LaDA and RFDA, and between RRDA and RFDA. Differences in the system time between LaDA and RRDA are non significant at a p-value of 0.989.

Because we suspected that datasets like Colon, Gisette, Leukaemia and Prostate may be responsible for significant differences in the system time between RFDA and others, we removed them and carried out the Friedman test again. At a p-value of $8.598e-05$, at the same level of significance, we equally rejected the null hypothesis of no difference in the system time between RFDA and other two classifiers.

A post-hoc Nemenyi test similarly rejected the null hypothesis of no difference in system time between RFDA and LaDA, and between RFDA and RRDA at p-values of 0.00025 and 0.00150 respectively. Also at a p-value of 0.88862, we failed to reject differences in the system time between LaDA and RRDA.

We equally observed that the dimensions of the datasets, where RFDA recorded increased number of system time are relatively higher. It suggests that increase in the dimensions of

a dataset, would mean more system time for RFDA.

On account of the foregoing, we state that based on the system time, either of LaDA or RRDA can be preferred to the use of RFDA. In high dimensions, we recommend the use of LaDA as a preferred classifier in place of FDA, primarily for its additional feature as a variable selector.

III. CONCLUSIONS

RRDA and LaDA are valid binary classifiers based on the outcome of the tests carried out in section II. Both classifiers can be used in place of FDA when $p > n$. If $p \gg n$, they are still preferred alternative to FDA in comparison with RFDA. On the other hand, RFDA has a weakness of using more computational time vis-a-vis RRDA and LaDA, hence in high dimensions, the use of RRDA or LaDA may be preferred to RFDA.

On the strength of the number of variables used by LaDA to compute its error rates, we infer that if the objective of a binary classification problem is to use a few important variables, LaDA may be a choiced classifier.

REFERENCES

- [1] J Alcalá et al. "Keel data-mining software tool: Data set repository, integration of algorithms and experimental analysis framework". *Journal of Multiple-Valued Logic and Soft Computing* 17.2-3 (2010), pp. 255–287.
- [2] Uri Alon et al. "Broad Patterns of Gene Expression Revealed by Clustering Analysis of Tumor and Normal Colon Tissues Probed by Oligonucleotide Arrays". *Proceedings of the National Academy of Sciences* 96.12 (1999), pp. 6745–6750.
- [3] Thomas Bretz et al. "The drive system of the major atmospheric gamma-ray imaging Cherenkov telescope". *Astroparticle Physics* 31.2 (2009), pp. 92–101.
- [4] David R Cox. "The Regression Analysis of Binary Sequences". *Journal of the Royal Statistical Society. Series B (Methodological)* (1958), pp. 215–242.
- [5] Richard O Duda, Peter E Hart, and David G Stork. *Pattern Classification*. John Wiley & Sons, 2012.
- [6] Todd Golub et al. "Molecular Classification of Cancer: Class Discovery and Class Prediction by Gene Expression Monitoring". *Science* 286.5439 (1999), pp. 531–537.
- [7] Isabelle Guyon. "Design of Experiments of the Nips 2003 Variable Selection Benchmark". *NIPS 2003 workshop on feature extraction and feature selection*. 2003.
- [8] Paul J Hewson. "Multivariate Statistics with R" (2009).
- [9] Gareth James et al. *An Introduction to Statistical Learning*. Vol. 6. Springer, 2013.
- [10] M. Lichman. *UCI Machine Learning Repository*. 2013. URL: <http://archive.ics.uci.edu/ml>.
- [11] Peter Nemenyi. "Distribution-free Multiple Comparisons". *Biometrics*. Vol. 18. 2. INTERNATIONAL BIOMETRIC SOC 1441 I ST, NW, SUITE 700, WASHINGTON, DC 20005-2210. 1962, p. 263.
- [12] Jude C Obi, Peter Thwaites, and John Kent. "On the Regression Discriminant Analysis (RDA), and its Identical Relationship to the Fisher's Discriminant Analysis". *International Journal of Scientific and Research Publications (IJSRP)* Volume 7 (Issue 7 2017).
- [13] Maja Pohar, Mateja Blas, and Sandra Turk. "Comparison of Logistic Regression and Linear Discriminant Analysis: A Simulation Study". *Metodoloski zvezki* 1.1 (2004), p. 143.
- [14] J Rousseauw et al. "Coronary Risk Factor Screening in three Rural Communities". *South African Medical Journal* 64.430-436 (1983), p. 216.
- [15] Dinesh Singh et al. "Gene Expression Correlates of Clinical Prostate Cancer Behaviour". *Cancer cell* 1.2 (2002), pp. 203–209.
- [16] Jessica Utts and Robert F Heckard. *Mind on Statistics*. Cengage Learning, 2011.
- [17] Jieping Ye. "Least Squares Linear Discriminant Analysis". *Proceedings of the 24th International Conference on Machine Learning*. ACM. 2007, pp. 1087–1093.

Food Hygiene Conditions and Microbial Contamination of Minimally Processed Fruits in Central Ward, Nairobi County

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Abstract- Background: Minimally processed fruits (MPF) vended as street foods, despite numerous benefits, can cause food-borne illnesses due to poor hygiene practices and unsanitary conditions. This study sought to assess food hygiene condition in minimally processed fruit vending businesses in Nairobi Central Ward.

Methods: Cross sectional with analytical component through convenient sampling of 76 street food vending environment (FVs). Observational checklist prepared using codex food hygiene and safety principles captured data. Inferential statistics established variable relationships at 95% confidence interval. Food Hygiene Condition (FHC) was ranked according to Bloom cut off points on calculated percentage scores.

Results: The vending places were washable and cleanable but the environmental surrounding was not very clean as 68% of the stalls had garbage and waste nearby. Most (75%) of the FVs had no houseflies, 89% had adequate water, and 30% had drainage system. Therefore, FHC was generally poor in 57.9% of the cases. Fruit salad samples had the highest bacterial load (\log_{10} 4.65cfu/g) and coliforms (\log_{10} 0.78cfu/g) while pineapples (mean \log_{10} 3.50cfu/g) had the highest mould and yeast count. Hence fruit salad samples were highly contaminated while pineapple and pawpaw samples were least contaminated. However there was no significant association between FHC and microbial contamination of MPF.

Conclusion: FHC were poor and MPF were not microbiologically safe. Periodic hygiene training and policy on ready-to-eat food vending should be implemented.

Index Terms- minimally processed fruits, food hygiene condition, street food vendors, microbial contamination

I. BACKGROUND

Fruits are an extraordinary dietary source of nutrients, micronutrients, vitamins (especially C) and fiber for humans [1]. They are vital for health and wellbeing; and reduce the risk of several diseases whose consumption has become a global priority. Minimally processed refrigerated (MPR) fruits and vegetables are slightly modified fruits and vegetables that retain characteristics of freshness during expanded shelf-life2] . Increasing demand for ready-to-eat fresh-cut fruits due to the paucity of time cost efficiency and increasing demand for low-caloric food products with fresh-like characteristics has caused an expansion of the market for minimally processed products [

HYPERLINK \l "Sim11" 1]. However, because of the specific forms of preparation, they are highly perishable and associated with new food epidemiological and microbiological safety problems3] . Food safety is a major concern with street foods. People working industries and other institution are more likely to get food safety training as compared to street food vendors and are also more likely to be well educated [HYPERLINK \l "Mon11" 4]. The main aim of the training is to minimize food poisoning and improve the food safety among all food handlers5] . Food safety courses and training can be used to curb the food-borne diseases among food and fruit vendors by learning various sustainable and proper methods they can employ in order to maintain a hygienic environment [HYPERLINK \l "Wal03" 6 , HYPERLINK \l "Git12" 7]. Most fruit and food vendors have undergone training but less than half made use of the knowledge learnt [8] . However, improper food handling has in the past increased with increase in the number of fruit vendors trained [" 5] . In Northern Nigeria, physical factors such as equipment used, furniture used in the vending area and the environment itself, coupled with poor hygiene practices during production and washing of fruits with contaminated water are all sources of contamination. Personal grooming, washing of hands and medical check-up are important preventive measures of contamination [4] . Food preparation premises should be purposely built in areas that are free from dust or smoke, away from heaps of garbage, and the surfaces should be made of material that is easy to clean and free from cracks or crevices so that microorganisms cannot easily grow and multiply [4 , 9] . Street food vending is common in the Central ward of Nairobi Count in the form of mobile vendors who hawk, or by stationary vendors set up in stalls, market places and public bus stations [10] . Poor hygiene practices therefore, coupled with low standards of environmental and personal hygiene, improper handling of food, improper storage occur with street foods raising health concerns such as food-borne illnesses [11] . Due to increased demand; and unlimited and unregulated growth, there has been a severe strain on city resources such as water, sewage systems, and interference with city plans through congestion and littering, and the street food vendors are usually unlicensed blocking vehicle and pedestrian traffic [4, 10] . This raises concern with respect to their potential for serious food poisoning outbreaks and exposure of the sliced fruits to flies, dust and other disease causing agents [12] . Intentional or inadvertent contamination of fruits puts the consumer at the risk of suffering food-borne illnesses 1033 [4] .

II. METHODS

The study was analytical in design conducted in the Central ward, Nairobi Metropolis. The study randomly observed 76 fruit vending environment. Data was collected using observation checklist. Quality control measures were employed including pre-test, validity and reliability checks. The research permit was obtained from the National Commission for Science, Technology and Innovation and Kenyatta University. Collected data was cross-checked for completeness and any missing entries updated. Data from observation checklists was analysed into descriptive statistics and non-parametric tests for possible associations using Statistical Package for the Social Sciences (SPSS) version 21. Findings were presented in the form of text, charts, graphs and tables.

III. RESULTS AND DISCUSSION

Food Hygiene Condition

The main means of vending were stalls (52.6%) and carts (38.2%) mostly on average condition (78.9%). The vending places were made of iron sheets (55.3%) hence they were washable and cleanable but the environmental surrounding was not very clean as 68% of the stalls had garbage and waste nearby. Most (75%) of the street fruit vending places had no houseflies, 89% had adequate water supply for washing fruits, while

drainage system was only observed in 30% of the vending places visited. This raises concern with respect to their potential for serious food poisoning outbreaks and exposure of the sliced fruits to flies, dust and other disease causing agents. Similar findings were made in Kibera which showed that 72% of informal outlets had garbage heaps near their vending places [4]

Inadequate refuse disposal facilities lead to the accumulation of refuse at food vending sites which leads to an increased pest population and resulted in an increased risk of food contamination [13]. Street foods are sometimes stored at improper temperatures and sold from vending sites which include kiosks, make-shift accommodation, and push carts as well as other temporary structures [14]. They are prepared at very dirty surroundings with waste water and garbage disposed nearby, providing nutrient and breeding ground for rodents and vermin [15]. Similarly in a study in Sudan, in most cases running water was not available at vending sites, washing of hands and crockery were done in bowls or buckets and sometimes without soap and the vending sites had flies [16]. Similar findings were also made in Benin city CITATION PWO14 \l 2057 [HYPERLINK \l "PWO14" 17] and Owerri, Nigeria [18] where there were sufficient water but few waste bins and the vending environment had flies and rats/cockroaches (17).

Table 1 : Hygiene profile of the vending environment

Hygiene profile	Category	Frequency	Percent (% N = 76)
Means of Vending	Cart	29	38.2
	Wheelbarrow	7	9.2
	Stall	40	52.6
Status of vending place	Good condition	5	6.6
	Average condition	60	78.9
	Bad condition	11	14.5
Nature of construction material	Wood	31	40.8
	Iron Sheets	42	55.3
	Sacs	3	3.9
Building structure washable and surfaces cleanable	Yes	72	94.7
	No	4	5.3
Stalls distance from garbage	Garbage and waste near	52	68.4
	Garbage and waste far	24	31.6
Houseflies and other pests present in stalls	Yes	19	25
	No	57	75
Availability of water for washing fruits	Yes	71	93.4
	No	5	6.6
Adequacy of water for washing fruits	Yes	68	89.5
	No	8	10.5
Presence of drainage	Yes	23	30.3
	No	53	69.7

A score of “1” was assigned for the presence of relevant item while a score of “0” was assigned for its absence. The total score was converted to 100 percent. Using Bloom cut off points, more than half (57.9%) of the vending environments were in a poor state, 34.2% had fair hygiene vending environment while 7.9% were categorized as having good environmental conditions. The observation of poor sanitary condition in the majority of the food vending sites was contrary to findings of studies conducted in Owerri, Nigeria [18], Accra, Ghana [19], and Benin [17] where the majority of the food premises were observed to be tidy, with the use of waste bin and the presence of on-site water source for sanitary purposes. This finding was similar to a study in Ethiopia which found that 21.3% of the establishments had good sanitary conditions [20]. This finding is, however, similar with what was reported in an earlier study in Nairobi where it was observed that about 85.0% of the vendors prepared their food in unhygienic condition 2057 [10]

Figure 1 : Hygiene condition score

Fruit salad samples yielded the highest bacterial load levels (mean log₁₀ 4.65cfu/g) and coliforms count (mean log₁₀ 0.78cfu/g) while pineapples (mean log₁₀ 3.50cfu/g) had the highest mould and yeast count. This showed that fruit salad samples were highly contaminated while pineapple and pawpaw samples were least contaminated. This high contamination might be emanating from food handling during handling, processing or vending [21]. This was similar to studies in Bangladesh [22 , 23] and Ghana [24 , 19] which found presence of unacceptable levels of Salmonella spp., Escherichia coli and other coliforms in street fruits which constituted a potential microbial hazard to human health. Similar findings were also found in Kibera [4] and Industrial Area [7] where E. coli and coliform present in street foods were of a level of concern.

Table SEQ Table * ARABIC 2 : Microbial contamination of the minimally processed fruits

	Bacteria count	Coliforms count	Mould and Yeast count
Fruit salad	4.56	0.78	2.27
Water melon	3.63	0.72	2.00
Pawpaw	1.99	0.72	1.05
Pineapple	1.44	0.72	3.50

In all the fruits, level of contamination was not significantly associated with the hygiene condition of the vending environment. Lack of basic infrastructure, absence of potable water, lack of proper storage facility and unsuitable environments for food operations can contribute to poor microbial quality of foods [20]. Unhygienic environment are breeding place for houseflies and other disease causing microbes

thus plays an integral role in preventing food from being contaminated hence the need for food vendors to operate within a clean environment. Contrary findings were made in Ghana which found that poor environmental condition continues to be a constant factor contributing to food contamination [25].

Table 3 : Food Hygiene Conditions and Microbial Contamination

Fruit		Bacteria	Coliform	Moulds and Yeast
Fruit salad	r	-0.214	-0.072	0.162
	p	0.645	0.878	0.728
Water melon	r	-0.286	-0.414	-0.162
	p	0.535	0.355	0.728
Pawpaw	r	-0.291	-0.036	-0.709
	p	0.527	0.939	0.074
Pineapple	r	-0.371	-0.408	-0.429
	p	0.413	0.364	0.337

* r - Spearman correlation; p – p - value

IV. CONCLUSIONS

Hygiene condition of the vending environment poor and although fruit vendors tried to maintain proper standards of hygiene, some environmental factors such as poor structures, poor waste disposal systems, pollution by vehicles passing by and garbage dumps and litter near them could not be controlled.

Minimally processed fruits were not microbiologically safe as levels of up to 105 cfu/g were seen in the fruit samples. Coliform counts in the fruits suggest contamination of the fruit samples by fecal material possibly from poor personal hygiene by vendors, water used for washing, the poor vending environment, or a combination of all these factors. However the hygiene condition of the vending environment did not determine the microbial status of the fruits.

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Competing interests

All authors declare that: there are no significant competing financial, professional or personal interests that might have influenced the performance or presentation of the work described in this manuscript.

Authors’ contributions

Authors made substantial contributions to conception and design, and/or acquisition of data, and/or analysis and interpretation of data.

REFERENCES

- [1] P. J. Simitu, "Consumption and conservation of drylands' indigenous fruit trees for rural livelihood improvement in Mwingi District, Kenya," Masters Thesis 2011.
- [2] M. A. McCarthy and R. H. Matthews, "Nutritional Quality of Fruits and Vegetables Subject to Minimal Processes.," Springer US, vol. 313-326, 1994.
- [3] F. Artés, P. A. Gómez, and F. Artés-Hernández, "Physical, Physiological and Microbial Deterioration of Minimally Fresh Processed Fruits and Vegetables," *Food Science and Technology International*, vol. 13, no. 3, pp. 177-188, 2007.
- [4] A. W. Monica, "Food safety and hygiene practices in the informal outlets (a case study of food kiosks in Kibera slums, Nairobi)," Kenyatta University, Nairobi, Thesis 2011.
- [5] H. Kassa, G. Silverman, and K. Baroudi, "Effect of a manager training and certification program on Food Safety and Hygiene in Food service operation," *Environmental health insight*, pp. 13-20, 2010.
- [6] E. Walker, C. Prichard, and S. Forsythe, "Food handling knowledge in small business," *Food control*, pp. 339-343, 2003.
- [7] M.G. Gitahi, J. Wangoh, and P.M.K. Njage, "Microbial Safety of Street Foods in Industrial Area, Nairobi," *Research Journal of Microbiology*, vol. 7, pp. 297-308, 2012.
- [8] A. Nurudeen, A. Lawal, and S. AJayi, "A survey of hygienic and sanitary practices of street vendors in the central state of Northern Nigeria," *Journal of public health and epidemiology*, pp. 174-181, 2014.
- [9] Food and Agriculture Organization; World Health Organization, *Food Hygiene Basic Texts*. Rome: Codex Alimentarius Commission, 2009.
- [10] K. Muinde and E. Kuria, "Hygienic and Sanitary Practices of Vendors of Street Foods in Nairobi, Kenya," *African Journal of Food Agriculture and Nutritional Development*, vol. 5, no. 1, 2005.
- [11] J. G. Kariuki, "Food handling practices and the prevalence of food borne pathogens among food handlers in Embu municipality, Kenya," Kenyatta University, Nairobi, Masters Thesis 2012.
- [12] S. W. Kamunyor, "A Growing Space for Dialogue: the Case of Street Vending in Nairobi's Central Business District," *Massachusetts Institute of Technology*, 2007.
- [13] M. D. Khairuzzaman, Fatema Moni Chowdhury, Sharmin Zaman, Arafat Al Mamun, and Latiful Bari, "Food Safety Challenges towards Safe, Healthy, and Nutritious Street Foods in Bangladesh," *International Journal of Food Science*, vol. 2014, pp. 1-9, 2014.

- [14] Food and Agricultural Organization, "FAO Food and Nutrition Paper," Food and Agricultural Organization, Jakarta, Indonesia, Report of an FAO expert consultation 1990.
- [15] Nicolas Barro et al., "Hygienic status assessment of dish washing waters, utensils, hands and pieces of money from street food processing sites in Ouagadougou (Burkina Faso)," *African Journal of Biotechnology*, vol. 5, no. 11, pp. 1107-1112, 2006.
- [16] M. A. Abdalla, S. E. Suliman, and A. O. Bakhiet, "Food safety knowledge and practices of street food vendors in Atbara City (Naher Elneel State Sudan)," *African Journal of Biotechnology*, vol. 8, no. 24, pp. 6967-6971, 2009.
- [17] P. W. Okojie and E. C. Isah, "Sanitary Conditions of Food Vending Sites and Food Handling Practices of Street Food Vendors in Benin City, Nigeria: Implication for Food Hygiene and Safety," *Journal of Environmental and Public Health*, vol. 2014, no. 2014, pp. 1-6, 2014.
- [18] Comfort O. Chukuezi, "Food safety knowledge and practices of street food vendors in Owerri, Nigeria," *Studies in Sociology of Science*, vol. 1, no. 1, pp. 50-57, 2010.
- [19] Patience Mensah, Dorothy Yeboah-Manu, Kwaku Owusu-Darko, and Anthony Ablordey, "Street foods in Accra, Ghana: how safe are they?," *Bulletin of the World Health Organization*, vol. 80, no. 7, pp. 546-554, 2002.
- [20] Mulugeta Kibret and Bayeh Abera, "The Sanitary Conditions of Food Service Establishments and Food Safety Knowledge and Practices of Food Handlers in Bahir Dar Town," *Ethiopian Journal of Health Sciences*, vol. 22, no. 1, pp. 27-35, 2012.
- [21] M Abadias, J Usall, Anguera M, C Solsona, and I Viñas, "Microbiological quality of fresh, minimally-processed fruit and vegetables, and sprouts from retail establishments," *International Journal of Food Microbiology*, vol. 123, no. 1-2, pp. 121-129, 2008.
- [22] Z. Tabashsum et al., "Prevalence of Foodborne Pathogens and Spoilage Microorganisms and Their Drug Resistant Status in Different Street Foods of Dhaka city," *Agriculture Food and Analytical Bacteriology*, vol. 3, no. 4, pp. 281-292, 2013.
- [23] Mohammad Ali, M. R. Khan, and Mihir Lal Saha, "Antibiotic resistant patterns of bacterial isolates from ready-to-eat (RTE) street vended fresh vegetables and fruits in Dhaka City," *Bangladesh Journal of Scientific Research*, vol. 24, no. 2, pp. 127-134, 2011.
- [24] F. Amponsah-Doku et al., "Bacterial contamination of lettuce and associated risk factors at production sites, markets and street food restaurants in urban and peri-urban Kumasi, Ghana," *Scientific Research and Essays*, vol. 5, no. 2, pp. 217-223, 2010.
- [25] Boateng Acheampong Emmanuel, "Assessment of food hygiene practices by street food vendors and microbial quality of selected foods sold: A study at Dunkwa-On-Offin, Upper Denkyira East municipality of the Central Region," Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, Master's Thesis 2014.

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Study of Drug Resistance in Relapsed and New Cases of Leprosy in select rural and urban areas of Maharashtra using PCR and Mouse Footpad Assays

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Abstract- Background: At a stage where concerted effort is being made to control leprosy through multidrug therapy (MDT), reports of bacterial resistance to constituents of MDT demand vigilance.

Aim: To investigate bacterial resistance to Dapsone (DDS), Rifampicin (RIF) and Ofloxacin (OFX) in relapsed and new cases of leprosy in select areas in Maharashtra, India.

Subjects and Methods: Clinical samples from 76 relapsed, and 69 new cases were tested for drug resistance using PCR and nucleotide sequencing for mutations. Among these, 46/76 relapses and 24/69 new cases were also tested using the Mouse footpad (MFP) method. Results of two methods were further compared for their detection sensitivity.

Results: PCR products identified *M.leprae* specific fragments in 60/76 (79%) relapsed and 48/69 (70%) new cases. Mutation in the *rpoB* gene associated with resistance to RIF was not observed in any of the 94 amplicon positive clinical samples. Mutation in *folP1* (Pro55Arg) and *gyrA* (Gly89Cys) genes associated with resistance to DDS and OFX respectively, were observed in 2/53 (4.7%) and 1/48 (2%) of relapsed cases. A further 17.5% of all strains demonstrated several single nucleotide polymorphisms (SNPs) that so far have not been identified with drug resistance. In the MFP assay, 13/46 (28%) relapsed and 13/24 (54%) new cases gave positive yield. Resistance to DDS (0.01 gm%) was observed in 1/11 (9%) relapsed cases, this isolate also had *folP1* mutation and others were sensitive. No resistant phenotype was observed in any of the 13 new cases.

Conclusions: No secondary or primary resistance to RIF was observed, while resistance to DDS and OFX were observed in 4.7% and 2% respectively of relapsed cases. For quick screening PCR direct sequencing method of drug resistance testing is a robust and sensitive assay as compared to MFP. Further studies are required to establish the significance of SNPs observed outside the Drug Resistant Determining Region (DRDR) of the 3 genes in 17.5% of the strains tested.

Index Terms- Leprosy; Relapse; New cases; Drug Resistance; PCR; Mouse Foot-pad; Active screening

I. INTRODUCTION

Multidrug therapy (MDT) for leprosy was introduced by the WHO in 1982, in response to the threat to leprosy control posed by Dapsone resistance.¹ Since then MDT remains the cornerstone of National Leprosy Elimination Programs (NLEP).

Following sporadic reports of bacterial resistance to Rifampicin, being the most important component of current MDT regime, surveillance for drug resistance was deemed important and initiated in seventeen endemic countries, including India.^{2,3,4} Detection of resistance to Rifampicin (RIF), Dapsone (DDS) and Ofloxacin (OFX), using PCR and nucleotide sequencing to identify mutations was developed and commonly used.^{5,6} As a result, number of countries reporting relapsed cases, increased from 49 in 2008 to 122 in 2012. Of the 3427 globally reported relapsed cases in the year 2012, 1709 (50%) were from Brazil and 697 (20%) were from India.⁷ These were considered to underestimate the true situation.^{8,9}

Disease relapse in leprosy could result from re-infection, 'persisters', or poor efficacy of drugs in use. Relapse due to development of bacterial resistance to components of MDT would be detrimental to the control programme.

A multi-centric study was initiated in India under the aegis of and funding from the Indian Council of Medical Research (ICMR) with two main objectives:

(a) To determine the *extent* of relapse and other deleterious events such as reactions and nerve function impairments (NFI) in patients registered, treated and released from WHO-MDT at select primary health centres (PHCs) in Maharashtra; (b) To determine the *level* of drug resistance in the relapsed and new cases in the areas under study.

As a part of the three year study, 577 available and consenting patients, released from treatment (RFT) between April 2005 and March 2010 in 5 PHCs in Panvel block/ Raigad district (rural) viz. Gavan, Apta, Nere, Wavanje and Ajivali and 3 health posts in Mumbai (urban) viz. G-North, G-South and H Municipal Wards in Mumbai, were clinically examined in three annual visits. Those detected with deleterious events including relapse were further investigated.

The clinical profile of the entire cohort and data on deleterious events are part of a separate report.¹⁰ The present article reports the findings on bacterial resistance, using PCR nucleotide sequencing and Mouse Foot pad (MFP) methods, in relapsed and new cases detected in the study area. Also studied was the detection sensitivity of the two assay systems.

Study Subjects:

a) Sixty relapsed cases were detected during active screening of patients, over a period of 3 years (i.e. July 2011 to June 2014), in a cohort of 577 leprosy patients (350 Multibacillary [MB] and 277 Paucibacillary [PB], WHO operational classification), RFT between April 2005 and March 2010 were included in the study.

b) An additional, sixteen relapsed MB cases of Boderline lepromatous (BL) and Lepromatous leprosy (LL) type (Ridley-Jopling classification) detected in the same study area during active survey, although not a part of the above cohort, were also subjected to drug sensitivity testing.

Total number of clinical samples (biopsy or slit-skin smear) tested from relapsed cases were 76, of which 46 were tested using both MFP assay and PCR nucleotide sequencing method, and in 30 cases only PCR nucleotide sequencing was done.

Note: Relapse is defined as recurrence of active disease any time after the release from multidrug treatment.¹¹

2) New cases:

Sixty nine newly detected cases during June 2011 to July 2014, from the same study area were included, of which 24 were tested using both MFP assay and PCR nucleotide sequencing, and in 45 cases only PCR nucleotide sequencing was done.

Parameters studied were; a) Bacteriological index (BI) of clinical samples b) Detection sensitivity of PCR direct sequencing and MFP method in BI positive vs BI negative clinical samples c) Primary and secondary resistance in PCR and MFP methods and 4) Tally between genotypic and phenotypic resistance in the clinical samples.

II. METHODS

Bacteriological index (BI):

The clinical samples were checked for the presence of acid fast bacilli (AFB). Spot slides prepared from tissue homogenate or Slit Skin Smear (SSS) slides, stained by Ziehl- Neelsen (ZN) method, were examined under 100x oil immersion lens. The acid fast bacilli (AFB) were counted in 100 fields or more and BI determined.¹²

PCR and nucleotide sequencing:

PCR amplification of drug resistance determining region (DRDR) of *M. leprae* using *rpoB*, *folP1* and *gyrA* specific primers was performed. The PCR products were subjected to Sanger sequencing for DNA analysis using the same forward and reverse primers as in PCR.

DNA was extracted from the tissue homogenate using standard DNeasy Blood and Tissue kit as per manufacturer's protocol (Qiagen GmbH, Hilden, Germany). Briefly, the skin

biopsy was homogenised, subjected to proteinase K treatment and DNA isolated using a spin column. Polymerase Chain Reaction (PCR) was used to amplify *folP1*, *rpoB* and *gyrA* gene.^{5, 6} The PCR products were electrophoresed on 2% agarose gel and the amplicons were sequenced on automated Genetic Analyser ABI3100 (Life Technologies, Amsterdam). The PCR amplification and nucleotide sequencing primers were as follows:

folP1-Forward primer -5'-CTTGATCCTGACGATGCTGT-3'

folP1-Reverse primer -5'-CCACCAGACACATCGTTGAC-3'

rpoB-Forward primer -5'- GACGCTGATCAATATCCGT -3'

rpoB-Reverse primer -5'- ACGGTGTTTCGATGAACCCG -3'

gyrA -Forward primer -5'-GA TGGTCTCAAACCGGTACATC-3'

gyrA -Reverse primer -5'- TACCCGGCGAACCGAAATTG -3'

Sequencing and analysis: The sequencing of samples were done at SciGenome, Kochin. The sequences obtained were compared with corresponding sequences of the reference *M. leprae* TN strain using NCBI-BLAST tool. Based on the hot-spot codons and their concerned aminoacid changing pattern, mutations were identified. Any nucleotide variations in the samples observed were compared with the known hotspot sequence and subsequently mutation analysis was carried out.

Mouse Foot pad (MFP) assay:

Clinical samples from 46 relapsed cases and 24 new cases were tested by the MFP assay for growth and only BI positive clinical samples were tested for sensitivity to DDS and RIF (phenotypic) in the primary passage, using the standard technique. Briefly, the biopsy was homogenized with a glass homogenizer within 24 hours of collection of the samples. Spot slides were prepared, stained using ZN stain and bacillary count estimated. The bacilli were, adjusted to 1×10^4 AFB / 30 μ l of homogenate and injected into both hind foot-pads of twenty-four adult Swiss white (S/W) mice. They were further grouped into three groups of 8 mice each, to test for sensitivity to DDS (0.01 gm %), RIF (0.03 gm %) and the third group comprised of untreated controls. The drugs were given to the test mice from day zero (continuous method), through feed prepared on a day-to-day basis by wet mixing and blending at room temperature. They were maintained in 12 hr day/night cycle in an air conditioned room. Foot pads were harvested on 6th, 7th and 8th month post inoculation. At 12th month the remaining mice were harvested and bacterial yield/foot pad were calculated using the standard method. One or more per foot pad counts showing $\geq 1 \times 10^5$ *M. leprae* in the harvests carried out at 6 month or later was considered as positive yield.^{13, 14}

Ethical clearance:

The study followed International Ethical Guidelines for Biomedical Research involving human subjects (CIOMS/WHO, 1993). The study was approved and received ethical clearance from the Ethics Committee of Foundation for Medical Research (IEC No. FMR/IEC/LEP/02/2011). Written informed consent was obtained from individual subjects prior to inclusion in the study. Approval from Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) for the use of animals in the study was obtained. The Foundation for

Medical Research is registered with CPCSEA (valid registration number is 424/PO/Re/S/01/CPCSEA).

III. STATISTICAL METHODS

Data entry was done in MS Excel. Quantitative analysis was performed using SPSS version 19.

IV. RESULTS

Determination of bacteriological index (BI) followed by PCR direct sequencing was used to test 145 clinical samples comprising 76 relapsed cases and 69 newly detected cases.

Bacteriological index (BI):

Of the 76 cases with histopathology and/or clinical evidence of relapse, 27(35.5%) were BI positive (2+ to 6+), BL to LL cases and 49 (64.5%) were BI negative, Boderline Tuberculoid (BT) to Boderline Boderline (BB) leprosy cases.

Of the 69 new (untreated) cases, 23 (33.3%) were BI positive and 46 (66.7%) were BI negative (Table 1).

PCR analysis:

PCR amplification and nucleotide sequencing of the PCR products identified *M. leprae* specific fragments in 27/27 (100%) BI positive and 33/49 (67%) BI negative clinical samples from relapsed cases. Among the new cases, 21/23 (91%) BI positive and 27/46 (59%) BI negative clinical samples showed *M. leprae* specific fragments (Table 1) (Figs 1, 2, 3). Overall, both relapse and new cases combined, detected *M. leprae* specific amplimers using PCR in 96% of BI positive (48/50) and 63% (60/95) of BI negative clinical samples.

Mutations in *folP1*, *gyrA* and *rpoB* genes:

***folP1* gene mutation associated with DDS resistance, detected at Codon 55 (CCC to CGC) with Pro substituted to Arg (Fig 4)** was observed in 2 relapsed cases (2/42= 4.7%); one of these was a MB case (WHO operational classification), BI negative i.e. no acid fast bacilli seen in the SSS as well as in the biopsy sample and the histopathology confirmed to BT leprosy. The MFP test was not done in this case (as it was a BI negative case). The second was an LL case with BI of 5+. This isolate showed a high degree resistance to DDS (i.e. at conc. of 0.01 gm%) in the MFP assay.

***gyrA* gene mutation at Codon 89 (GGC to TGC) with Gly substituted to Cys (Fig 5)** was observed in one BL relapse case with a BI of 2+ (1/52=2%). This mutation has been shown to be associated with OFX resistance.

***rpoB* gene mutation associated with RIF resistance was not observed** in the 94 amplimer-positive clinical samples, including 53 relapsed and 41 newly detected cases (Table 2).

Further, single nucleotide polymorphism/s (SNPs) at different codon positions were observed in 19/108 (17.5%) clinical samples including 13 relapsed cases and 8 new cases in either *rpoB*, or *gyrA* or *folP1* gene. All except one, were

observed *outside* the DRDR region. Nine of the SNPs were non-synonymous; all were outside the DRDR region. Ten were synonymous of which one was detected within the *rpoB* DRDR region (Table 3).

Mouse Footpad assay:

Of the 46 relapsed cases and 24 new cases tested in the MFP assay, positive yields in the absence of drug (control) were obtained in 13 (28%) relapsed cases and 13 (54%) new cases (Table 4).

Resistance to DDS at the conc. of 0.01 gm% was observed in 1/11 (9%) relapse case in the MFP test. This strain also demonstrated *folP1* mutation at Codon 55. Resistance to RIF was not observed in any of the samples. Resistance to OFX was not tested in the MFP assay. Thirteen new cases tested for DDS and RIF susceptibility proved sensitive in MFP assay as well as in genotypic assay.

Clinical details of patients detected with drug resistance:

Of the two patients detected with DDS mono-resistance, one was a 64 year old male, with nodular lesions and smear BI of 5+ at the time of relapse examination. The medical history revealed that he had received DDS monotherapy for more than 20 years prior to receiving 12 months of MB-MDT, and was not on any treatment for the past 25 years. No SSS test reports of the past were available.

The second case was a 44 year old male, with multiple new lesions and reactivation of old lesions, 42 months after RFT. Histopathology of lesion biopsy on relapse confirmed BT leprosy was BI negative. The third patient detected with *gyrA* gene mutation was a female aged 65 years, who had received 2 courses of WHO-MB-MDT in the year 1990 and 2010. She was a case of BL relapse, with average BI of 4+.

V. DISCUSSION

We studied bacterial resistance to DDS, RIF and OFX using genotypic and phenotypic assays in relapsed and new cases. Study subjects, 76 relapsed cases and 69 new cases are from select parts of western Maharashtra which remain leprosy endemic.¹⁵ Mutation in *folP1* gene at Codon 55 (CCC to CGC) with Pro substituted to Arg was observed in 2 relapsed cases; *gyrA* gene mutation at Codon 89 (GGC to TGC) with Gly substituted to Cys was observed in one BL relapsed case. These mutations are known to be associated with DDS and OFX resistance respectively.^{16,17} Overall, in the PCR assay secondary drug resistance to DDS was observed in (4.7%) and probable primary resistance to OFX in one case (2%). Mutation in the *rpoB* gene associated with RIF resistance was not observed in any, showing that bacterial resistance is not a major concern and is not the underlying cause of high number of relapse cases detected in the study area.

Different studies report varying levels of drug resistance, reflecting differences in local practice of drug usage or the type of clinical samples studied. A retrospective study carried in 941 Colombian patients with and without previous leprosy treatment, demonstrated 5.77% (22/381) of new cases and 3.04% (17/560) of previously treated cases with resistant genotypes. Proportion

showing resistance to RIF was highest 30/941 (3.17%) followed by OFX 11/941 (1.17%) and DDS 4/941 (0.43%).¹⁷

In a study carried out in Vietnam, 423 clinical samples were studied which included 83 new cases, 321 patients 'receiving treatment' and 19 relapsed cases. Mutation in *folP1* gene was detected in 10.2% (19/187) cases, while mutations in *rpoB* and *gyrA* genes were not observed in any. It was further noted that cases of *folP1* mutation was highest in relapsed cases (8/14=57%) as compared to new cases (2/33 = 6.1%), whereas in patients 'receiving treatment' it was 6.4% (9/140). Patients who had received DDS mono-therapy had high mutation rates (78%) as compared to MDT (33%).¹⁸ In a study conducted at The Leprosy Mission (TLM) Hospital in North India, primary resistance to RIF was observed in 7/16 (43%) clinical samples, highest reported so far.¹⁹ In contrast, neither secondary nor primary RIF resistance was observed by us in any of the clinical samples tested from parts of Western Maharashtra in the current study. Likewise the study conducted by a partner institution of the current ICMR study, namely Blue Peter Public Health and Research Centre, Hyderabad, did not observe any primary RIF resistance in clinical samples from two districts, Adilabad and Hyderabad in Andhra Pradesh.²⁰

SNPs outside the DRDR region:

Single nucleotide polymorphisms (SNP's), were observed in 19/108 (17.5%) clinical isolates and all, except one, were seen outside the DRDR region. In terms of frequency, SNPs outside the DRDR region of *rpoB* gene were more common (n=10), followed by *gyrA* (n=5) and *folP1* (n=4). Presence of such SNPs have been reported by several other groups but significance of the same is yet to be established^{17,18,19,21} The SNPs may indicate association with drug resistance or may represent single nucleotide polymorphism of no consequence to drug resistance.

Comparison of detection sensitivity of PCR vs MFP method:

Notably, *M.leprae* specific DNA was obtained from 48/50 (96%) of BI positive and 60/95 (63%) of BI negative relapsed and new cases combined. In contrast, 22/34 (65%) of BI positive and 4/36 (11%) of BI negative cases scored positive in the MFP test. Thus for quick screening, PCR direct sequencing method of drug resistance testing is a robust and sensitive assay as compared to MFP. One limitation of our study is the small number of clinical samples tested in the MFP assay, barring this there was good concordance between genotypic and phenotypic results.

A noteworthy finding in our study is that two of the lepromatous relapsed cases detected with resistant genotypes including one each *folp1* and *gyrA* had received prolonged and irregular anti-leprosy treatment indicating a relationship between high bacterial load and drug misuse. Another important finding is that systematic and active screening of the 577 strong study cohort resulted in the detection of **60 relapsed cases (10.3%) over a period of three years**. Apart from this, 16 lepromatous relapse cases that were not part of the cohort, were detected by chance during the active survey in the same area. In this group, all except four had nodular lesions and the duration between RFT and time of detection of relapse ranged from 9 years to 30 years. Two (2/16=12.5%) demonstrated mono-drug resistant mutant genotypes viz. *folp1* and *gyrA*. Point of concern is that, these

having been undetected for a long time, undoubtedly forming a source of infection in the community. The patients and the health visitors' failure to recognize the symptoms highlight lack of awareness. In Maharashtra, Raigad district, is one of the high endemic areas with several blocks recording high incidence of child cases.^{15,22} Periodic examination of all RFT cases along with contact examination may go a long way in bringing the transmission level down.

VI. CONCLUSIONS

In the areas covered, no secondary or primary resistance to RIF was observed, while resistance to DDS and OFX were observed in 4.7% and 2% respectively of relapsed cases. Thus drug resistance was not a major problem but undetected lepromatous relapse cases are of concern, could well be a major sources of infection in the community. For quick screening PCR direct sequencing method of drug resistance testing is a robust and sensitive assay as compared to MFP. Further studies are required to establish the significance of SNPs observed outside the DRDR region of the 3 genes in 17% of the strains tested.

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REFERENCES

- [1] Pearson, J. M., Cap, J. A., Haile, G. S., & Rees, R. J. (1977). Dapsone-resistant leprosy and its implications for leprosy control programmes. *Leprosy review*, 48(2), 83-94.
- [2] Matsuoka, M., Kashiwabara, Y., & Namisato, M. (2000). A Mycobacterium leprae isolate resistant to dapsone, rifampin, ofloxacin and sparflaxacin. *International journal of leprosy and other mycobacterial diseases*, 68(4), 452.
- [3] World Health Organization. Report on sixth meeting of the WHO Technical Advisory Group on Elimination of Leprosy. World Health Organization, 2004, Geneva.
- [4] WHO (2009). Guidelines for Global Surveillance of Drug Resistance in Leprosy, Geneva.

- [5] Maeda, S., Matsuoka, M., Nakata, N., Kai, M., Maeda, Y., Hashimoto, K., & Kashiwabara, Y. (2001). Multidrug resistant Mycobacterium leprae from patients with leprosy. *Antimicrobial agents and chemotherapy*, 45(12), 3635-3639.
- [6] Sekar, B., Arunagiri, K., Kumar, B. N., Narayanan, S., Menaka, K., & Oommen, P. K. (2011). Detection of Mutations in folp1, rpoB and gyrA genes of M. leprae by PCR-direct sequencing—A rapid tool for screening drug resistance in leprosy. *Leprosy review*, 82(1), 36.
- [7] Report of WHO-ILEP joint meeting (2014). Drug resistance surveillance in leprosy, Philippines.
- [8] Shetty, V. P., Wakade, A., & Antia, N. H. (2001). A high incidence of viable Mycobacterium leprae in post-MDT recurrent lesions in tuberculoid leprosy patients. *Leprosy review*, 72(3), 337-344.
- [9] Shetty, V. P., Wakade, A. V., Ghate, S., & Pai, V. V. (2003). Viability and drug susceptibility testing of M. leprae using mouse footpad in 37 relapse cases of leprosy. *International journal of leprosy and other mycobacterial diseases*, 71(3), 210.
- [10] Shetty, V.P., Pandya, S.S., Kamble, S.M., Shah S., Dighe A.R., Pai V.V., et al. Estimation of deleterious events in 577 leprosy patients Released from treatment between 2005 -2010 in Urban and Rural areas of Maharashtra. Submitted to Ind Jour of Lepr.
- [11] WHO SEA-GLP-2009.4. (2011-2015).Enhanced global strategy for further reducing the disease burden due to leprosy operational guidelines.
- [12] Ridley, D. S. (1955). The bacteriological interpretation of skin smears and biopsies in leprosy. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, 49(5), 449-452.
- [13] Shepard, C. C. (1960). The experimental disease that follows the injection of human leprosy bacilli into foot-pads of mice. *Journal of Experimental Medicine*, 112(3), 445-454.
- [14] WHO document, Mouse foot pad techniques (1987). In *Laboratory techniques of leprosy*; WHO/CDS/Lep 86.4.
- [15] Shetty, V. P., Ghate, S. D., Wakade, A. V., Thakar, U. H., Thakur, D. V., & D'souza, E. (2013). Clinical, bacteriological, and histopathological characteristics of newly detected children with leprosy: A population based study in a defined rural and urban area of Maharashtra, Western India. *Indian Journal of Dermatology, Venereology, and Leprology*, 79(4), 512-517.
- [16] Maeda, S., Matsuoka, M., Nakata, N., Kai, M., Maeda, Y., Hashimoto, K., & Kashiwabara, Y. (2001). Multidrug resistant Mycobacterium leprae from patients with leprosy. *Antimicrobial agents and chemotherapy*, 45(12), 3635-3639.
- [17] Guerrero, M. I., Colorado, C. L., Torres, J. F., & León, C. I. (2014). Is drug-resistant Mycobacterium leprae a real cause for concern?: First approach to molecular monitoring of multibacillary Colombian patients with and without previous leprosy treatment. *Biomédica*, 34, 137-147.
- [18] Kai, M., Nguyen Phuc, N. H., Nguyen, H. A., Pham, T. H. B. D., Nguyen, K. H., Miyamoto, Y., & Makino, M. (2011). Analysis of drug-resistant strains of Mycobacterium leprae in an endemic area of Vietnam. *Clinical Infectious Diseases*, 52(5), 127-132.
- [19] Lavania, M., Nigam, A., Turankar, R. P., Singh, I., Gupta, P., Kumar, S., & John, A. S. (2015). Emergence of primary drug resistance to rifampicin in Mycobacterium leprae strains from leprosy patients in India. *Clinical Microbiology and Infection*, 21(12), e85-e86. doi: 10.1016/j.cmi.2015.08.004.
- [20] Male, M. M., Rao, G. B., Chokkakula, S., Kasetty, S., Rao, P. R., Jonnalagada, S., & Srikantam, A. (2016). Molecular screening for primary drug resistance in M. leprae from newly diagnosed leprosy cases from India. *Lepr Rev*, 87, 322-331.
- [21] Beltrán-Alzate, C., Díaz, F. L., Romero-Montoya, M., Sakamuri, R., Li, W., Kimura, M., & Cardona-Castro, N. (2016). Leprosy drug resistance surveillance in Colombia: the experience of a sentinel country. *PLoS neglected tropical diseases*, 10(10), e0005041.
- [22] NLEP – Progress report for the year 2014–2015 ending on 31st March 2015. Central Leprosy Division. Directorate of Health Services, Govt. of India, New Delhi, 2009. Available from: <http://nlep.nic.in/pdf/Progress%20report%2031st%20March%202014-15%20.pdf>

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Table 1:

Bacteriological Index (BI) +ve and BI –ve clinical samples from relapsed and new cases in PCR and Mouse Foot Pad (MFP) assay

BI group	PCR	MFP
	Amplified / tested (%)	Growth / tested (%)
Relapsed cases		
BI +ve (n=27) (35.5%)	27/27 (100)	11/20 (55)

BI –ve (n=49) (64.5%)	33/49 (67)	2/26 (8)
Total (n= 76)	60/76 (79)	13/46 (28)
New cases		
BI +ve (n=23) (33.3%)	21/23 (91)	11/14 (79)
BI –ve (n=46) (66.7%)	27/46 (59)	2/10 (20)
Total (n= 69)	48/69 (70)	13/24 (54)

Table 2: PCR results of *rpoB*, *gyrA* and *folP1* genes in Relapsed and New cases

Category	<i>rpoB</i> (%)	<i>gyrA</i> (%)	<i>folP1</i> (%)
Relapsed Cases			
Amplified/Tested	53/76 (70)	52/76 (68)	42/76 (55)
Mutation detected /Amplified	0/53	1/52 (2)	2/42 (4.7)
New cases			
Amplified/Tested	41/69 (60)	42/69 (60)	35/69 (49)
Mutation detected /Amplified	0/41	0/42	0/35

Table 3: Single nucleotide Polymorphisms (SNPs) in relapsed and new cases

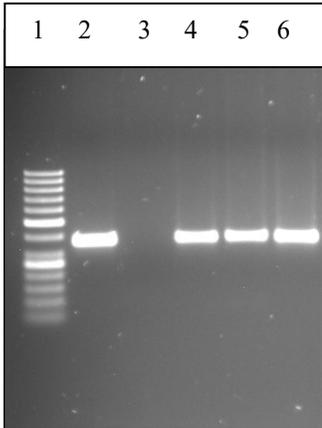
Gene	Codon	SNPs-synonymous (Syn) or Non-synonymous (Non-syn)	Change in Nucleotide	Amino Acid	No. of Relapsed cases (SNP %) n=60	No. of New cases (SNP %) n=48
<i>rpoB</i>						
	511	Non-syn	CTG →CCG	Leu →Pro	4 (6.6)	5 (10.4)
	514	Non-syn	TTC →CTC	Phe → Leu	1 (1.6)	0
	548	Non-syn	CGT →TGT	Arg → Cys	1 (1.6)	0
	507	Non-syn	GGC →AGC	Gly → Ser	0	1 (2)
	509	Syn	AGC →AGT	Ser → Ser	4 (6.6)	5 (10.4)
	516	Syn	GAT →GAC	Asp → Asp	1 (1.6)	0

	531	Syn	TCG→TCC	Ser → Ser	1 (1.6)	0
	533	Syn	CTG→CTC	Leu → Leu	1 (1.6)	0
	534	Syn	GGC→GGT	Gly → Gly	0	1 (2)
	503	Syn	AAG→TAG	Lys → Lys	0	1 (2)
<i>gyrA</i>						
	90	Non-syn	GAC →TAC	Asp → Tyr	1 (1.6)	0
	106	Non-syn	CTG →CGC	Leu → Pro	1 (1.6)	0
	77	Syn	TCA →TCG	Ser → Ser	2 (3.3)	0
	84	Syn	AAT →GAT	Ile → Ile	0	1 (2)
	111	Syn	GTT →GTC	Val →Val	1 (1.6)	0
<i>folP1</i>						
	66	Non-syn	CTC →CCC	Leu → Pro	0	1 (2)
	67	Non-syn	TCT →ACT	Ser → Thr	0	1 (2)
	86	Non-syn	GAT →ATA	Asp →Ile	1 (1.6)	0
	25	Syn	TAC →TAT	Tyr →Tyr	1 (1.6)	0

Table 4: Drug Susceptibility using MFP assay for relapsed and new cases expressed as number showing positive yield/ number tested

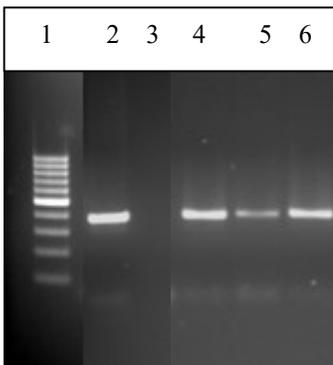
Type	Control group	DDS (0.01gm%)	RFP (0.03gm%)
	Growth /No. tested		
Relapse	13/46 (28%)	1/11 (9%)	0/11
New	13/24 (54%)	0/8	0/8

Fig. 1: PCR amplimers of *rpoB* gene (348bp)



Lane 1: 50bp Ladder, Lane 2: Positive Armadillo control, Lane 3: Negative control, Lane 4-6: Patient samples

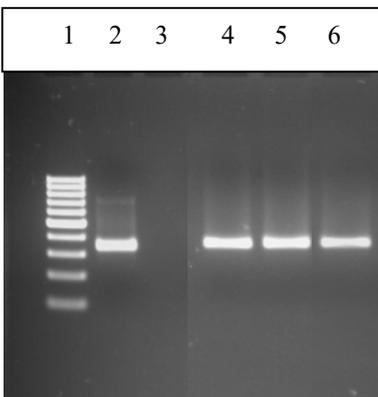
Fig. 2: PCR amplimers of *folP1* gene (388 bp)



Lane 1: 100bp Ladder, Lane 2: Positive Armadillo control, Lane 3: Negative control

Lane 4-6: Patient samples

Fig. 3: PCR amplimers of *gyrA* gene (342 bp)



Lane 1: 100bp Ladder, Lane 2: Positive Armadillo control, Lane 3: Negative control,

Lane 4-6: Patient samples

Fig. 4: Mutation detected in codon 55 with substitution (CCC to CGC) in *folP1* gene

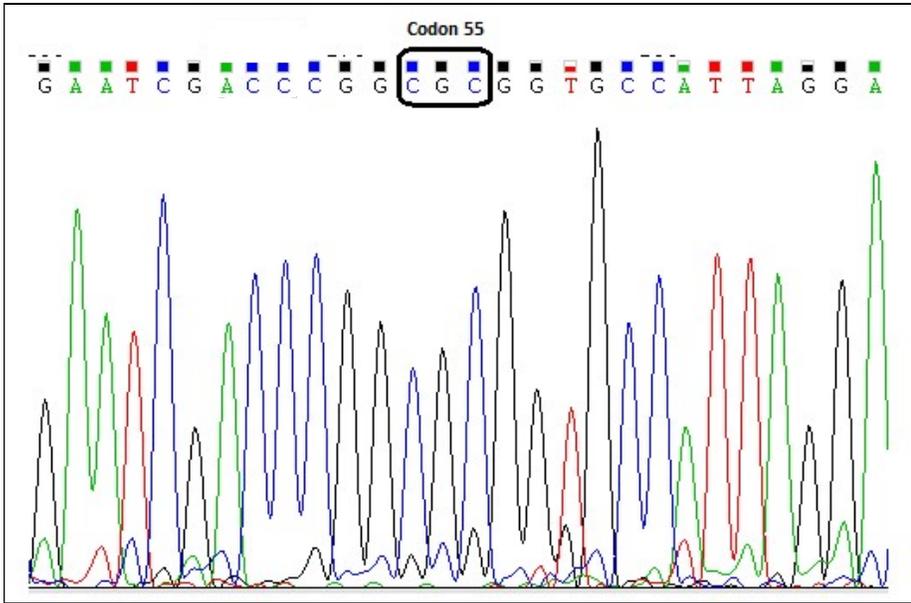
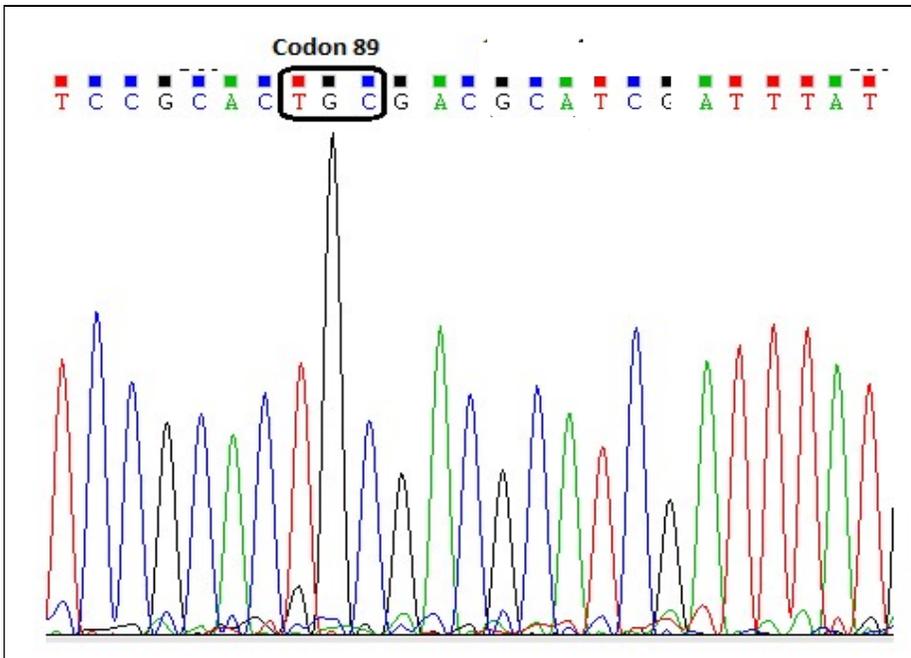


Fig. 5: Mutation detected in codon 89 with substitution (GGC to TGC) in *gyrA* gene.



Authentication of antibacterial activity of wound healing Siddha medicinal plants

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Abstract- Several medicinal plants have been used in traditional health care systems to heal wounds. Wound infecting bacteria are one of the major factors that delays or prevent wound healing. In the present study, three medicinal plants those have been widely used in Siddha medicine to treat wounds namely, *Erythrina variegata*, *Tamarindus indica* and *Datura metel* were tested for their antibacterial activity against standard bacterial isolates which isolated from different sources including wounds, viz. *Staphylococcus aureus* subsp. *aureus* (ATCC® 29213™), *Pseudomonas aeruginosa* (ATCC® 25668™), *Escherichia coli* (ATCC® 25922™) and *Enterococcus faecalis* (ATCC® 29212™). Leaf of *E. variegata*, seed coat of *T. indica* and fruit of *D. metel* were extracted with hexane, ethyl acetate and ethanol. Antibacterial activity was tested using two different methods; well diffusion and growth curve analysis in broth culture. Both methods revealed that all the extracts of *T. indica* and fruit of *D. metel* had inhibitory effect on *S. aureus*, a bacterial isolate from wound. Similarly extracts of *E. variegata* had antibacterial activity on *E. faecalis* and *P. aeruginosa*, urine and clinical isolates respectively. The results confirm the antibacterial property of the plant extracts and their possible role in wound healing. Further studies are being carried out to find out the active compounds that responsible for antibacterial activity.

Index Terms- Antibacterial activity, Medicinal plants, Siddha medicine, Wound infection.

I. INTRODUCTION

A huge percentage of human population still depends on traditional health care systems to cure several infectious and non-infectious diseases, especially in developing countries [1]. This is because of less side-effects and low cost of the medicines in traditional health care systems. The conventional health care systems developed through the accumulation of knowledge of ancient people from several hundreds of years. Before the development of modern medical practices human population completely relied on traditional health care systems. Even nowadays, several new drugs are being extracted from various medicinal plants or chemically synthesised based on the structure of natural compounds [2].

The traditional health care systems completely or partly depend on plant sources to formulate various medicines. Naturally, plants produce diverse secondary metabolites through various biosynthetic pathways and these chemicals are important for

various bioactivities of plants. Tannins, alkaloids, saponins and terpenoids are some major groups of bioactive compounds present in plants [3]. These secondary metabolites and their derivatives are the key active ingredients in conventional medicine. The type and amount of active ingredients also vary with the diversity and surrounding environmental conditions of the plants. Extraction and identification of active compounds from plants, which have been used in traditional health care systems, make a bridge to modern medicine. Therefore, researchers are very much keen on screening of medicinal plants which have been reported as an ingredient in drug preparations in traditional health care systems.

One of the vital activities possessed by these secondary metabolites is antimicrobial activity. Originally, these active compounds prevent the plants to get infected from various pathogenic microorganisms through various modes of actions. These substances can either inhibit the growth of bacteria or kill them, with no toxicity or minimum toxicity to host cells are considered candidates for developing new antimicrobial drugs [4]. In recent years, antimicrobial properties of medicinal plants are being increasingly reported from different parts of the world. Wound healing is a complex process with many potential factors that can delay healing. Wound infection is detrimental to the wound healing process. In open wounds, the absence of an intact epithelium provides a favorable environment for bacteria. Both acute and chronic wounds are susceptible to contamination and colonization by a wide variety of aerobic and anaerobic microorganisms. Aerobic or facultative pathogens such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and beta-hemolytic *streptococci* are the primary causes of delayed healing and infection in both acute and chronic wounds [5]. Optimal management of wound infection is essential to promote a good healing response. Topical antimicrobials such as silver, iodine and chlorhexidine may reduce bio-burden and improve the wound healing response. Newer topical creams, ointments, gels, and dressings appear to provide adequate, sustained, and apparently nontoxic levels of antiseptics. Unfortunately, there is little information on systemic absorption of the agents and evidence of clinical efficacy is meagre. Nowadays, a broad range of antibiotics are also being used for management of wound infections. But, these have been proved to have undesirable effect on the human body. The pathogens also have been successful in developing resistance against various antibiotics [6]. Investigators and the industry are seeking other ways to deal with chronic wound infections, including various innovative

nonantimicrobial approaches such as Bee honey and *Aloe vera* [7].

Siddha medical practice has flourished in Sri Lanka for thousands of years before the western medical practice became widespread. Even at present, at primary care level a large segment of the population seek siddha treatment [8]. Siddha system of medicine has several treatment methods for wound healing and these methods are widely used in siddha medicine practices. In a text book for siddha medicine, *Pararasaseharam* (part – V), 14 different medicines are listed for wound healing activity [9]. In general, these medicines consists several ingredients; mainly medicinal plants based materials and trace amount of heavy metals. However, there is lack of modern experimental evidences to prove wound healing activity of these medicines. There is gab in knowledge between the wound healing activity of siddha medicine and the exact bioactive compound or compounds present in the medicine. The work reported here was carried out to validate the antibacterial activity of three medicinal plants listed in Siddha medical practice for wound healing activity.

II. MATERIALS AND METHODS

A. Collection of plant samples and extraction

Leaves of *Erythrina variegata*, seed coat of *Tamarindus indica* and fruits of *Datura metel* was collected from healthy plants growing in herbal garden, agriculture farm school, Thirunelveli, Jaffna, Sri Lanka. Shade dried plant parts were ground into fine powder using electric blender. The powder was successively extracted using solvents of increasing polarity. 20 g powder was initially soaked in 100 ml of hexane in air tight conical flask for two days and then it was first filtered through double layered muslin cloth and then filtered through Whatman no 1 filter paper and the filtrate was collected into a sterile air tight bottle. Similar process was repeated twice with fresh hexane and the filtrates were collected together. Later, hexane was removed from the filtrate at 40 °C using oven and the extract was stored at the refrigerator for further studies. The dried residue of each powder was used for sequential extraction with ethyl acetate and ethanol [10].

B. Test bacteria

The standard bacterial isolates, *Staphylococcus aureus* subsp. *aureus* (ATCC[®] 29213[™]), *Pseudomonas aeruginosa* (ATCC[®] 25668[™]), *Escherichia coli* (ATCC[®] 25922[™]) and *Enterococcus faecalis* (ATCC[®] 29212[™]) were obtained from Department of Microbiology, Faculty of Medicine, University of Peradeniya, Sri Lanka and they were stored on nutrient agar slants at 4 °C until used for the assay.

C. Determination of antibacterial activity by agar well diffusion method

20 ml molten nutrient agar media were mixed with 1 ml of (10⁶ cfu/ml) each test bacteria and poured in sterile Petri dishes

separately. After complete solidification, 8mm diameter well were made using sterile cork-borer and filled with 100 µl of (30 mg) hexane extract; (30 mg) ethyl acetate extract, and (30 mg) ethanol extract of *E. variegata*. (3 mg) streptomycin and different solvents (100 µl of hexane, ethyl acetate or ethanol) were used as standard and control respectively. Then the plates were incubated at 37 °C for 24 hours and antibacterial activity was determined by measuring the diameter of clear zone around the well [10]. Similarly, activities of extracts of *T. indica* and *D. metel* were measured.

D. Determination of antibacterial activity in broth culture

20 ml nutrient broth was taken in 250 ml Nephelo culture flasks and sterilized by autoclaving. 500 µl of each of the test bacteria (10⁶ cfu/ml) was added into the above flasks separately. 10 mg of hexane extract of *E. variegata* was dissolved in 500 µl of hexane and added into the above nutrient medium. The optical density (OD) readings were measured at different time points using spectrophotometer. The flask which has nutrient broth and plant extract was used as blank. In similar manner activity of rest of the extracts were tested against all test bacterial isolates. It was assumed that the amount of bacteria in the flask at particular time point was proportional to the absorbance.

Absorbance = OD of test sample – OD of respective blank

III. RESULTS AND DISCUSSION

Plants such as *E. variegata*, *T. indica* and *D. metel* are commonly used in traditional health care systems and in home remedies to treat wounds. In the present study, hexane, ethyl acetate and ethanol extracts of above plants were tested for their antimicrobial activity. Leaf extract of *E. variegata* inhibited the growth of *E. faecalis*, *P. aeruginosa* and *E. coli* in agar well diffusion method (Table 1). Among the three different solvents used for the extraction, ethanol extract of *E. variegata* showed inhibition on all the above three bacterial isolates. However, none of the tested extracts of *E. variegata* had inhibition on the growth of *S. aureus*. All the extracts of *T. indica* and *D. metel* showed significant inhibition on *S. aureus*, but both of them failed to inhibit *E. faecalis* and *E. coli*. Whereas *P. aeruginosa* was inhibited by all the extracts of *E. variegata* and hexane extract of *T. indica* and ethyl acetate extract of *D. metel*.

The antibacterial activity of the extracts was also confirmed by growing the test bacteria in liquid medium with test extracts. The growth pattern of the bacteria in control growth medium (no any test extracts) was compared with the growth pattern of the bacteria in medium having test extracts. *S. aureus* showed differential growth pattern when it grow in hexane, ethyl acetate and ethanol extracts of *D. metel* and *T. indica* (Figure 1 and 3). Ethyl acetate and ethanol extracts of *D. metel* had significant inhibition on *S. aureus* compared to hexane extract of same plant (Figure 1). In ethyl acetate extract, the bacteria grow similar to control up to 4 hours from inoculation, but later *S. aureus* grow

slowly and reach stationary phase at about 12 hours, that is 4 hours delay than control.

Table 1: Inhibitory effects of hexane, ethyl acetate and ethanol extracts of *E. variegata*, *T. indica* and *D. metel* against some test bacteria.

Sample		Diameter of inhibition zone (mm)			
Plant	Solvent	<i>E. faecalis</i>	<i>P. aeruginosa</i>	<i>E. coli</i>	<i>S. aureus</i>
<i>Erythrina variegata</i>	Hexane	9*	11	-	-
	Ethyl acetate	-	10	-	-
	Ethanol	10	15	11	-
<i>Tamarindus indica</i>	Hexane	-	10	-	12
	Ethyl acetate	-	-	-	12
	Ethanol	-	-	-	10
<i>Datura metel</i>	Hexane	-	-	-	12
	Ethyl acetate	-	9	-	13
	Ethanol	-	-	-	12

* Values includes the diameter of well (8mm)

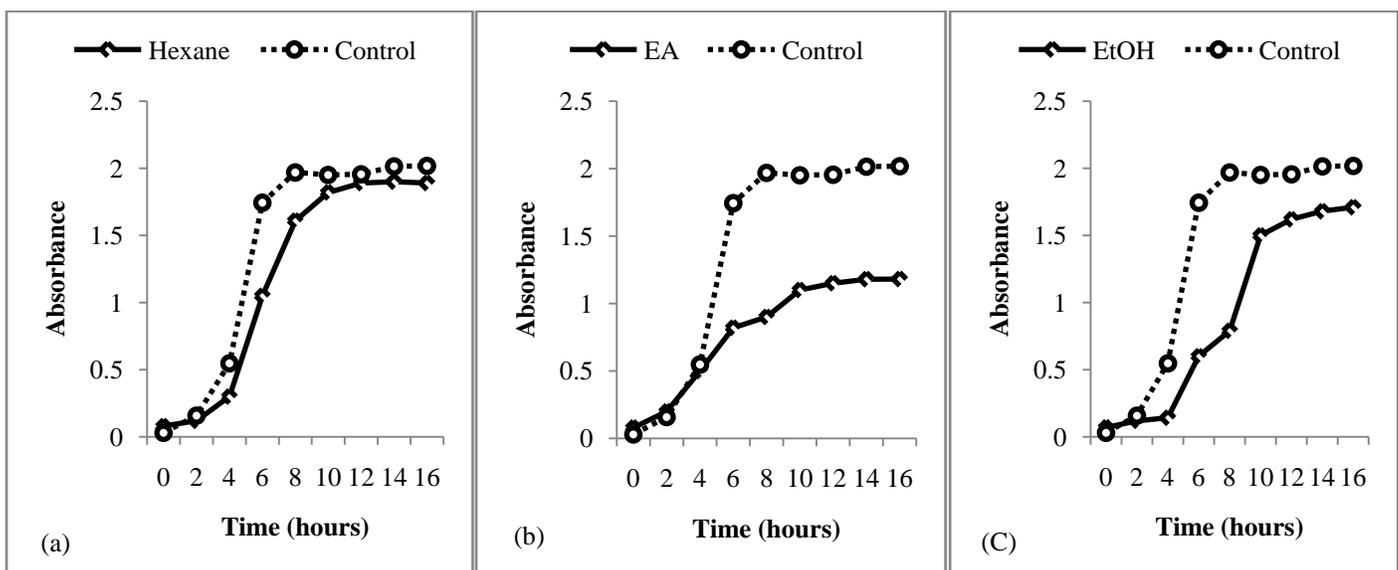


Figure 1: Growth pattern of *S. aureus* in liquid growth medium. In each graph, dot lines represent the reading for control, straight lines shows growth pattern with different extracts of *D. metel*; (a) hexane extract, (b) ethyl acetate extract and (c) ethanol extract.

The amount of absorbance in ethyl acetate extract was reduced to half than control. In ethyl acetate extract of *T. indica*, first 6 hours *S. aureus* grow in lag phase that is about 2 hours longer than control. Later, the amount of bacteria increased to about half of the amount of bacteria in control, reached stationary phase by 12 hours.

P. aeruginosa showed significant grow retardation when grow with the extracts of *E. variegata* (Figure 2). All the three extracts of *E. variegata* extended the lag phase of bacterial growth further one or two hours compared to control. Hexane and ethanol extracts of the plant reduced the amount of bacteria by 1/3 portion at stationary phase compared to control. *Staphylococcus aureus* subsp. *aureus* (ATCC®

29213™) is a wound isolate. In present study, this isolate was inhibited by the extracts of *T. indica* and *D. metel*. This finding confirms their role in wound healing and their importance in traditional health care system.

IV. CONCLUSION

In conclusion, extracts of *T. indica* and *D. metel* have significant amount of inhibition on *S. aureus*. Similarly, *E. variegata* extracts have inhibition on *P. aeruginosa*. These findings confirm the value of these extracts using in the wound. However, further studies are needed to find out the exact compounds that responsible for this activity.

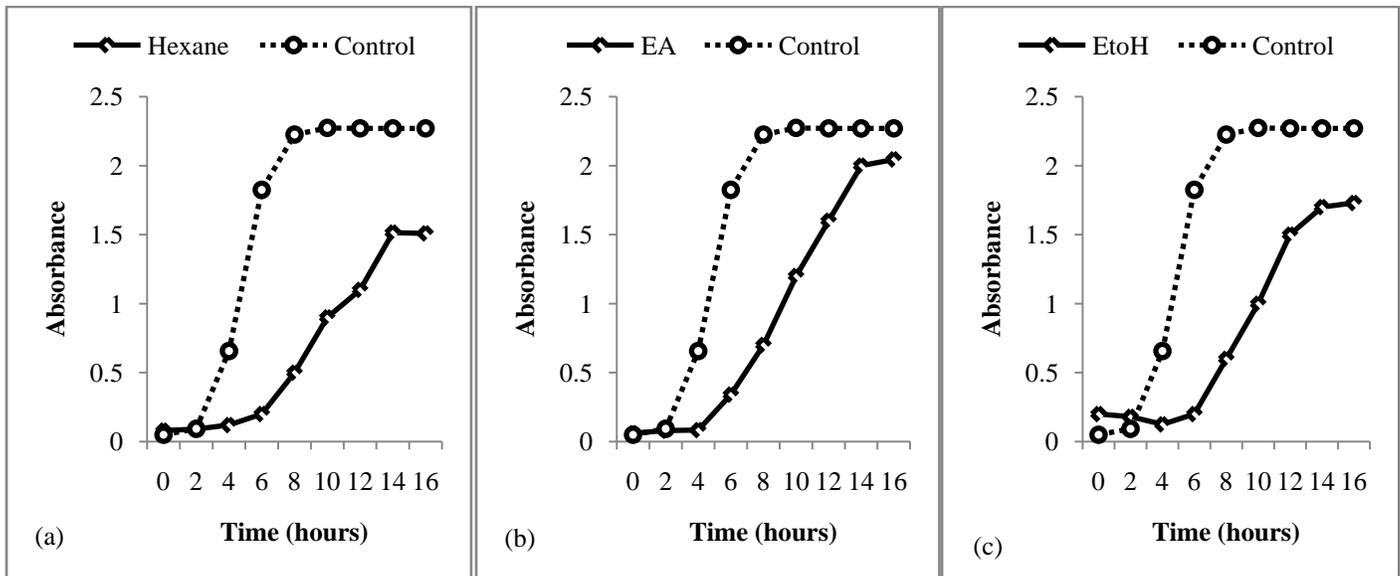


Figure 2: Growth pattern of *P. aeruginosa* in liquid growth medium. In each graph, dot lines represent the reading for control, straight lines shows growth pattern with different extracts of *E. variegata*; (a) hexane extract, (b) ethyl acetate extract and (c) ethanol extract.

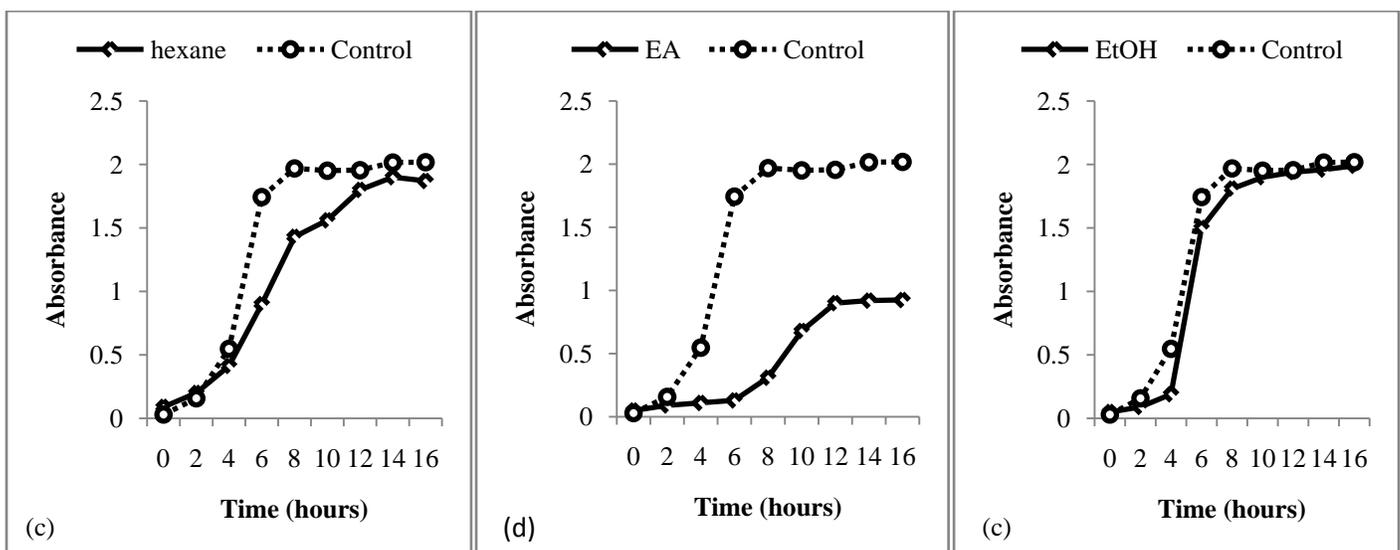


Figure 3: Growth pattern of *S. aureus* in liquid growth medium. In each graph, dot lines represent the reading for control, straight lines shows growth pattern with different extracts of *T. indica*; (a) hexane extract, (b) ethyl acetate extract and (c) ethanol extract.

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REFERENCES

- [1] Al-snafi, A. E. (2017). A review on *Fagopyrum esculentum*: A potential medicinal plant. *IOSR J Pharm.*, vol. 7, pp. 43–58.
- [2] Valle, D. L., Andrade, J. I., Puzon, J. J. M., Cabrera, E. C., Rivera, W. L. (2015). Antibacterial activities of ethanol extracts of Philippine medicinal plants against multidrug-resistant bacteria. *Asian Pac. J. Trop. Biomed.*, vol. 5, pp. 532–540.
- [3] Cowan, M. M. (1999). Plant products as antimicrobial agents. *Clin. Microbiol. Rev.*, vol. 12, pp. 564–82.
- [4] Lee, C. K., Kim, H., Moon, K. H., Shin, K. H. (1998). Screening and isolation of antibiotic resistance inhibitors from herb materials-resistance inhibition of volatile components of Korean aromatic herbs. *Arch. Pharm. Res.*, vol. 21, pp. 62–66.

- [5] Bowler, P. G., Duerden, B. I., Armstrong, D. G. (2001). Wound microbiology and associated approaches to wound management. Clin. Microbiol. Rev., vol. 14, pp. 244–269.
- [6] Thangamani, S., Mohammad, H., Abushahba, M. F. N., Sobreira, T. J. P., Hedrick, V. E., Paul, L. N., Seleem, M. N. (2016). Antibacterial activity and mechanism of action of auranofin against multi-drug resistant bacterial pathogens. Scientific Reports, vol. 6, 22571.
- [7] Sabale, P., Bhimani, B., Prajapati, C., Sabale, V. (2012). An overview of medicinal plants as wound healers. Journal of Applied Pharmaceutical Science, vol 2 (11), pp. 143-150.
- [8] Kumarasinghe, S. P. W. (2000). Medicinal plants in skin diseases: a survey among ayurvedic practitioners in Kalutara, Sri Lanka. Sri Lankan J. Dermatology, vol. 4, pp. 15–20.
- [9] Anonymous, (2003). Pararasaseharam (volume 5). Niyanthree Publication, Nallur, Jaffna, Sri Lanka.
- [10] Niranjana, K., Sathiyaseelan, V., Jeyaseelan E. C. (2013). Screening for anti-microbial and phyto chemical properties of different solvents extracts of leaf of *Pongamia Pinnata*. International Journal of Scientific and Research Publications, vol. 3(1), pp. 1-3.

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Analysis of Distance Education Programmes in Kenya

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Abstract

Distance education is an important mode of education delivery. In the 21st century the importance of education cannot be underscored. Therefore, any methodology that can provide access to education for all (EFA) should be embraced. The current surge of interest in distance education has been brought about by contemporary technology that facilitates communication between the instructor and learner. Objectives of distance education have a high output especially improving skills, cost effectiveness, efficiency and improved content delivery by use of technology. In Kenya some students have relied on this mode of study to access education. Institutions of higher learning have embraced this mode though faced with several challenges. Despite this, distance education should be made accessible and designed to meet the needs of different types of students. With support from the government, the national goals of education can be met, hence a recommendation by this research that distance education be embraced alongside the conventional teaching mode.

Key words: Distance education, technology.

I. Introduction

Distance education dates back to the end of the 18th century, but it was towards the end of 19th century that it became firmly established. At that time several large correspondence schools were founded and distance education was then first applied to university education. In its early stages in the 20th century the only media available for it was print and so the programme was called correspondence education. Since early 1980s when other types of media began to be used the term was changed to distance education. From its inception, distance education has been characterized by mediated subject matter presentation and mediated interaction between students and tutors (Juma, 2001). But what is distance learning?

In today's information age, learning is no longer within the four walls of a classroom. The instructor armed with a text book is no longer the sole source of educational experience. Information resources are everywhere, often separated from the learner by time and space. Verner(1994) therefore defines distance learning as the process of connecting students with these remote resources. It uses communication technology to harness the vast resources available and stimulate the development of lifelong learning skills.

Distance education is defined by Cassel(2008) as a systematically organized form of self-study in which presentation of learning materials, securing and supervising of students' success is carried out by a team of teachers. This is made possible at a distance by media which can cover long distances. Panlsen(2001) agrees with this definition but adds that technical media is used to produce high quality teaching material that makes it possible to instruct a high number of students at the same time even when they are at different locations.

Moore(1987) says distance education is a student centred instructional format which allows a student to study without having to commit to regular campus attendance. Interactive telecommunication systems are used to connect students, resources and instructors. Burton et al (2002) in their definition include the needs for special techniques, technologies and even special organizational and administrative arrangements.

According to Edmunds(2001) distance education is a mode of learning where students can learn but are separated from their tutor. This is done via print, multi-media and on-line materials. The tutor is available to answer telephone and e-mail questions from the student about course content and comment on their written assignments. Mboroki et al(2011) say that distance education can be defined as a form of education which students in universities and institutions of higher learning do not attend regular classes but instead study teaching materials specially prepared for this purpose by lecturers and experts. The medium of interaction is technical media like, letters, printed materials, telephone, video, audio-tapes, satellites etc.

From the definitions given above, distance education is characterized by features like separation between the student and tutor, use of communication technologies, organized learning materials, and self study on the part of the student. These features distinguish it from the convenience face to face learning common in formal school and college settings. Other terms used to refer to distance education are correspondence education, home study, independent study, external studies, continuing education, self instruction, adult education, technology based education, open learning, open access, flexible or distributed learning.

II. Rationale for Distance Education Programmes

Distance education has developed into a much applied and frequently praised mode of education with millions of students taking their studies in various parts of the world. It has been applied in secondary and tertiary education as well as to occupational and professional training. Since there has been an upsurge in distance education all over the world, government departments and private organizations have established distance education systems to deal with increasing educational needs that are unable to met by traditional school systems. Simonson et al (2003) These distance education systems have basically been influenced by local needs and local environments.

This mode of study is an out of class study that allows a student to learn when they have the desire and time. They can study in a place they like or while doing some other activities. All they need are the necessary materials which include content and mode of delivery (internet). In Kenya many students have registered for Module II programmes where they pay for themselves to study for higher education certificates. Such students have self motivation and learn purely at their own will. The programmes are offered over the school holidays or in the evening after work. The programmes are flexible allowing students to be involved in other activities as they learn. Many other have successfully gone through these programmes.

Distance education has been introduced to respond to growing educational needs which are not easily met in traditional forms of education. For example there can be courses for students in scattered communities that are sparsely populated or large geographical areas like those found in Australia, Canada, North America, Africa and in even Kenya. Students from North Eastern parts of Kenya characterized by conditions like insecurity, nomadic life and hostile weather would benefit from such programmes. This is because most tutors are unwilling to work under such hostile conditions yet there are students willing to take up education.

Training of personnel like teachers who are already working and cannot be away from their places of work for long periods would call for distance education programmes. In the Kenyan context teachers, bankers and other civil servants register for distance education because they are engaged most of the working hours. Teachers opt to go for holiday based sessions in colleges and universities to further their training and update their skills. Civil servants go for evening and weekend classes in nearby colleges especially those who stay in urban areas where most of the colleges are located. Their efforts have not been in vain since with certificate workers have been given promotions, pay increase, motivation and better working conditions. This is a credit to distance learning programmes.

Distance education is learner centered giving the student integrity and freedom to negotiate sequence of study, learning methods, assessments, support mechanisms and learning objectives and content. This is important to adult learners who may have other engagements or have specific needs to achieve. They sieve out content relevant to them as opposed to the contemporary systems where one learns what has been stipulated in the syllabus in a given context and within a specified period. One of the national goals of education in Kenya is to promote social, economic, technological and industrial needs for national development. By giving learner centred education this goals would be met (Mbwesa,2007).

This mode of study is a good opportunity to provide access to educational opportunities in a cost effective manner to those who would otherwise have been denied access. One can take courses from where they are at their convenience. Those who are far from schools, colleges and universities are targets by distance learning programmes. The financial obligation are slightly lower compared to traditional mode of learning which requires boarding and tuition facilities, books, face to face instruction by tutor. Hawkridge(2002) says distance learning can deliver training at a faster and cheaper rate as compared to the traditional system.

Universal Primary Education(UPE) objectives especially in developing countries can be achieved through distance learning. Due to poverty, civil strife, insecurity, lack of learning facilities some students within the range for UPE do not achieve this objective. With distance learning an opportunity is availed for them to learn even just the basic numeracy and literacy skills. Even those who may have left school for one reason or another now have a second chance. This is because students can learn as they work, they are allowed

to gain access to education at whatever level they qualify to. The system is flexible and convenient such that students can enroll for a course anytime regardless of their previous education. This mode is therefore recommended for nomadic tribes in North Eastern and Rift Valley regions in Kenya.

Distance education is a platform for those whom for reasons of geographical proximity, financial constraints and the desire for flexibility in their learning may not be able to attend traditional face to face classes. The British Open University and Unisa(University of South Africa) were started with this objective and they dedicated their programmes to distance learning. This also served to bridge the socio-political distance as was witnessed in 'a part-heid' policy in South Africa .Distance learning aims at linking learners across cultural, social and economic divides. It provides a broad out reach that can foster continental and global collaboration through interaction and dissemination of ideas. Even in the Kenyan context distance education will promote respect for Kenya's rich and varied cultures and foster positive attitude towards other nations.

Distance learning is a break through in the use of new technologies in education. Through this program, students learn by use of synchronous technology which requires all participants to be present on-line at the same time. This is done through video conferencing, direct broadcast, telephone, satellite, radio or internet. Participants can access course materials by audio-cassettes, e-mail, voice-mail, video cassettes or print mode. These new inventions improve education delivery because they can reach out to a larger population within a short time making the programme cost effective. Students in this programme will get the necessary skills and attitudes for industrial and technological development in line with national goals of education.

More and more governments and individuals are beginning to look at distance learning as the only alternative to meet the massive demand for education. Daniel(1996) say the commonwealth secretariat in 1990 confirmed that 48 million students participated in higher education. This number had more than doubled in 2010. This increase, coupled with constraints on facilities, then distance learning becomes a better option.

In Kenya, one of the objectives of higher education is to provide opportunities for those aspiring citizens who cannot secure places in the existing internal faculties of public universities. This mode of learning will enable them acquire the much needed high level skills, they will learn at their own pace and in a friendly and motivating environment (using technologies). This programme is an avenue to maximize the limited education resources both human and material making education available beyond the lecture halls. This has been done in Kenyan universities through introduction of Module II(parallel) programmes.

III. Distance Education delivery methods in Kenya

Learning in the 21st century is no longer confined to the classroom or lecture hall. A host of communication technologies are applied to distance education as expounded below:

Print Based Distance Education.

Print materials in the form of study lecture units, course notes, practical guides and assignments is the primary delivery strategy. Students review printed materials from tutors, read, do assignments and send this back to the tutors. The tutors in turn correct and then guide the students further. Such is practiced in England, Germany, USA and Japan. Despite this, there are other support components used together with print materials. Many of the larger scale distance education programmes in the Faculty of External Studies in the University of Nairobi use print (paper) based mode of study together with other media to deliver content to students.

Institution-Based mode of study.

This mode of study includes the full-time residential mode where students in this program study with the rest of the regular students or in their own groups. The full-time institution based mode has students who are in employment during their entire period of study. Such students are required to attend residential sessions at the university during the vacation period i.e. April, August and December. This mode was started at Kenyatta University but has now been adopted by other Kenyan universities. Many teachers at both primary and secondary school level have opted for this mode of study. Examinations consist of course work assessment, assessment of practicals contributing 50 percent of the total marks and one final university exam which contributes another 50 marks to enable a student get the final grade.

Mixed mode provision.

Here, there is use of a combination of face to face and distance learning strategies. Most universities in Kenya have adopted this method with students who are taking module II, also called 'parallel' degree courses, diploma and postgraduate diploma in different fields. Learning is via technology but again at specific periods like evening, weekends or holidays, seminars and short on-campus classes are held.

Satellite and web based distance education.

Such is an example of African Virtual University (AVU) model currently being used at Kenyatta and Egerton universities. The main aim of this mode is to bridge the digital divide and knowledge gap between Africa and the rest of the world by increasing access to global educational resources throughout Africa. This is achieved through integration of satellite technology and the internet to allow cost-effective and efficient delivery of education programmes throughout the continent and increased access to global educational resources in Africa. Benefits of AVU include increased enrolment at affordable cost, access to digital library, and provision of improved quality teaching and learning materials.

There is another mode where learning is supplemented by tutors and demonstration on radio, television, computer and internet. Here the computer is programmed to perform important teaching functions as is done in the USA air force. In Kenya, the Kenya Broadcasting Cooperation (KBC) has a programme named Radio Broadcasting to schools where content in various subjects and classes is broadcast live on radio during school hours.

Group distance mode

In the Group-distance education mode, a number of students enroll for the same course, meet regularly to recapitulate, check and discuss what they have learned after reading the teaching materials provided.

IV. Challenges facing implementation of distance education programmes in Kenya.

i. Scarcity of funds.

Since the government does not have a distance education policy in place, there is no specific allocation of funds to support this programme in the overall national budget. Faculties of distance education in the universities have to generate funds to plan, run, coordinate, supervise and evaluate such programmes. Some rely on donor funding which is hardly enough. In the end some of the much needed infrastructure and equipment is not available and this hinders the smooth running of the programs. High poverty levels and the rural geographical location of some students may deny them access to internet services.

ii. Lack of clear understanding of distance education.

Some key players in distance education like Ministry of Education staff and Senior University management do not understand principles and application of open and distance education. This creates a gap in policy planning and implementation. Many scholars from Kenyan universities do not believe that quality education can be delivered through information technology. This negative attitude towards digital literacy hinders implementation of distance education. The common belief is that education is only valid if there is face to face interaction between students and tutors.

iii. Inadequate resources

Most distance education programmes in Kenya use print as the medium of instruction. Supplementary media like audio, video cassettes, slides and experimental kits which would reinforce learning are not in use due to poor design of course programmes.

Many of the institution lack study guides that would give a broad view with the context of the courses to be studied as well as information about examination schedules, contact programmes or students assignment. Students rely on asking for information from one another. Apart from the college of Adults Distance Education in the University of Nairobi, other universities lack study or

resource centres which can provide facilities for learning for different groups of students. This is an important mode of transmitting content.

Production of high quality distance learning materials for Kenyan programmes appears very expensive. The cost includes design of the curriculum, authorship of content, review and evaluation of the programmes require skilled personnel who should be remunerated well. Such personnel are unable to access current journals and publications, e-libraries because of limited funds available to universities.

iv. Slow and high cost of internet connectivity.

Technology enhanced distance education like Africa Virtual University relies heavily on the internet for delivery of academic courses and digital library. Slow internet connection and low bandwidth in Kenya impedes the effectiveness of AVU courses. Internet services provider (ISP) subscription charges are high. Transmission signals are not available in some areas which hinders some students from accessing learning materials. Fuel prices are high so the use of generators to supplement electricity is equally expensive. Computing technology resources that can enhance distance education are scarce. Both hardware and software resources are expensive for any university to afford in reasonable quantities and quality. Since technology is dynamic, some universities cannot cope with these changes in terms of cost and relevancy.

v. Lack of skills in Information Communication Technology (ICT) use.

Most faculty members and students lack skills and competencies in ICT use hence AVU's digital library, e-learning platform and other digital products are not fully utilized in distance education. Some have even adopted behavior patterns in traditional education delivery which is not appropriate for distance education. Teacher training is theoretical and does not give practical teaching on use of ICTs. Most people use ICTs for personal communication and entertainment without viewing it as an important tool in education delivery. The lecture method is preferred in content delivery by most tutors hence shunning use of ICTs.

vi. Communication policy.

Due to high international tariffs and lack of circuit capacity, obtaining sufficient international bandwidth for delivery web pages over the internet is still a major problem in Kenya. This problem is further enhanced by the National Communication sector that has monopoly hence ISPs depend on it. This kind of scenario poses a major challenge to proper functioning and delivery of AVU products. Communication regulations in Kenya which do not allow Two-way satellite based internet services may deny AVU capability to deliver content from Africa to other AVU sites globally.

V. Ways of improving distance education in Kenya.

Advances in internet use to make distance education efficient and effective are a fundamental innovation in higher education in Kenya. For technology enhanced distance education to succeed, the Kenyan government, universities, industries, and non-governmental organizations all have a role to play as stakeholders.

There is need to prepare a web-based database and a back-up base in print format. Have adequate information on institution offering distance education, available opportunities and different modes of delivery. Provide information of course material and format. The knowledge base can then be linked to other existing relevant databases in the world.

Lower of cost of distance learning technologies for all students to afford. For example, the cost of internet should be subsidized by well-wishers, donors and service providers in learning institutions. Low cost computers, easily accessible to students would also help in smooth running of distance education.

Improved training in ICT use is very necessary for tutors. It should be mandatory, and with regular refresher courses to improve their skills as newer technologies come. The importance of ICTs should be stressed to create a positive attitude using these technologies in teaching. Graduates of distance learning programmes should also be good role models while working just like those students who went through the conventional system of education.

VI. Conclusion

This paper has discussed at length the concept of distance education with reference to the Kenyan context. Since modern technologies through advanced internet-based courses can also be used to meet learning objectives this study recommends its adoption, Reasons advanced for use of distance education in this discussion are worthy being adopted. Despite the challenges faced, distance education is the way to go in order to meet global educational needs.

REFERENCES

Burton, J., Lockee, B., moore, M., (2002). *Measuring Success: Evaluating Strategies for Distance Education*.

Cassel, D 2008. *Definition of Distance Education*. Retrieved 19/12/2015, from <http://ezinearticles.com/?definition-of-distance-education&id=1715195>.

Daniel, J. (1996). *Mego-Universities and the knowledge media. Technology strategies for higher education*. London: Kogan page.

Edmunds, M. (2001). *Equal access to open learning*. *Adults learning* 12(6): PP 1-5.

Hawkrige, D(2002). *Distance learning instruction design in international settings*. In R.A and J.V Dempsey (Eds). *Trends and issues in instructional design and technology*. PP 269-278 Upper Saddle River: Merrill/Prentice Hall.

Juma, M.N 2001. *From Traditional Distance Learning to Virtual Distance Learning in Higher Education in Africa, Trends and Challenges in F.T Tschag and T.D Senta, (eds.) Access to Knowledge: New Technologies and the Emergencies of Virtual University*, UNESCO/Pergamon Press.

Mbwesa, K.J (2007) *Adults in Higher education. The role of distance education in Kenya with special reference to the faculty of external studies, university of Nairobi*. www.fillc.org//aup/Rsap/publications/nairobi/adult_education.pdf.

Mboroki D.G, Mulwa D.A, Kyalo D.D, Bobwa D.O (2011) *"Distance Education; Product or Process."* JCODE. 2011; 1(2):71-84.

Moore, CTM. (1987). *American journal of distance educ*. vol 1 no 3 edition.

Panlsen, M. F. 2001. *Teaching Methods and Techniques for Computer- Mediated Communication*. *Journal of Distance learning administration*, Vol. IV. No IV 2001. Retrieved on 20/12/2010, from www.studymmentor.com.

Republic of Kenya, 1999. *Totally Integrated Quality Education and Training (TIQET): Report of the Commission of Inquiry into, the Education System of Kenya, (Koech Report)*: Nairobi, Government Printer.

Simonson, M Smaldino, S. Albright, M and Zuazek. S. (2003) *Teaching and learning at adistance. Foundation of distance education*. (2nded) Upper Sddle River, N.J Merrill/prentice Hall.

Verner, C. 1994 *Definition of Terms in Adult Education. Outline of an emerging field of University study*. Chicago: Adult education association of USA. P 32. Retrieved on 20/12/2015, from: www.eric.ed.gov.

The Evolution of Community-Oriented Policing (COP): Community Perception and Expectation on Community Oriented Policing (COP) Development & Implementation in Malaysia

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Abstract- Community Oriented Policing (COP) is a bridge that enables community and law enforcement agencies to communicate, collaborate and work together to build safer, more caring community. COP comes with its unique set of challenges. It should not be presented to the community as a simple solution, and residents should understand from the outset that it will not put an end to crime. COP has a more preventive orientation. It reduces crime by engaging the public as a partner in the fight against crime rather than relying on aggressive law enforcement as the only solution to community problems. It is a philosophy; a belief that by working together with the police, the community can accomplish what neither can be accomplished alone. It involves a rethinking of the role of the police and the restructuring of the police force. The purpose of this paper is: (a) to investigate community perception on COP development & implementation; (b) to investigate community expectation on COP development & implementation.

Index Terms- Community, perception, involvement, community oriented, policing.

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I. INTRODUCTION

The concept has been widely discussed and applied in various countries and a range of contexts, thus raising questions about what exactly it involves and what in particular is so attractive about it? Despite the widespread interest in the concept, it seems that there is no clear agreement on its meaning and, as various scholars have indicated, it appears to be understood by different people in different ways, besides invoking both acclaim and criticism in roughly equal measures (Trojanowicz et al, 2002; Eck and Rosenbaum, 1994; Skolnick and Bayley, 1988; Manning 1988; Klockars, 1988). Formerly, the community understood that ultimately, the community was responsible for reaffirming the social norms that promoted public safety.

According to Brookes (2006), there are various definitions, interpretations, and applications that have made the difficult to define community-oriented policing. Corder (1999) argues that community-oriented policing usually misinterpreted as a concept and recognizes that community-oriented policing is. Palmiotto (2000) has agreed with Trojanowicz and Bucqueroux (1990) that community-oriented policing involves partnership and problem solving. In addition, the researcher believes that community-oriented policing emphasis on community and police engagement to resolve the underlying issues of crime, fear of crime, physical and social disorders which according to Virta (2006) it is similar to the Sage Dictionary of Criminology defines community-oriented policing. Virta also believes that community-oriented policing is a process that is police and community together control crime and develops interaction between them as to enhance the quality of life level and building police legitimacy. For these reasons, the investigation of the concept and the practice of community-oriented policing has been a strong driver in this research.

II. THE EVOLUTION OF COMMUNITY-ORIENTED POLICING (COP)

Traditional conceptions of policing envision police officer as responding to crime reports after crimes have occurred. This approach has caused some citizens to view police work as mostly passive. However, the philosophy of community-oriented policing is being advanced as the new policing system for the twenty-first century. In the early 1980s, the concept of community-oriented policing appeared as the principal direction and thinking towards policing. It was designed to unite the police with the community. Community-oriented policing has applied in various forms by the police agencies, for example, community-oriented policing is differs based on the community needs, politics, and recourses available in the United States.

Furthermore, many past and present practitioners have become staunch proponents of the community policing concept. As for former New York City Police Commissioner, Lee P. Brown (1992), who earlier implemented community policing in Houston, Brown believes community policing is the future of American law enforcement, which builds a problem-solving partnership between police and those they serve. In addition, according to Brown, in the essence of bringing back a modern

version of "cop on the beat". Brown suggests that community-oriented policing should solve community problems rather than just react to them. It is time to adopt new strategies to address the dramatic increases in crime and fear of crime. As for Brown, he views community policing as a better, smarter, and more cost-effective way of using police sources.

However, community-oriented policing is a long-term process that involves fundamental institutional change. Scholar Vaughn (1991) has warned the police managers that "if you approach the community-oriented policing as a program, you will likely fail". Beware of the trap that seeks assured, perfect, and immediate result. Community-oriented policing goes beyond simply implementing foot and bicycle patrols or neighbourhood stations. It redefines the role of the police officer on the street, from crime fighter to problems solver and neighbourhood ombudsman. It forces a useful transformation of the entire department, including a decentralized organizational structure and changes in recruiting, training, rewards system, evolutions, promotions, and so forth. Furthermore, this philosophy asks officers to break away from the bonds of incident-driven policing, but to seek a proactive and productive resolution to crime and disorder. Table 1.0 represents the major points where community-oriented policing is intended to depart from traditional policing.

Table 1.0 Traditional vs. Community Policing, Source: Malcolm K. Sparrow, Implementing Community Policing. U.S Department of Justice, National Institute of Justice. November 1988. Pp.8-9.

Questions	Traditional Policing	Community Policing
Who are the Police?	A government agency principally responsible for law enforcement	Police are the public, and the public is the police; the police officer is those who are paid to give full-time attention to the duties of every citizen.
What is the relationship between the police force and another public service department?	Priorities often conflict.	The police are one department among many responsible for improving the quality of life.
What is the role of the police?	Focusing on solving crimes.	A broader problem-solving approach.
How is police efficiency measured?	By detection and arrest rates.	By the absence of crime and disorder.
What are the highest priorities?	Crimes that are high value (e.g., bank robberies) and those involving violence.	Whatever problems disturb the community most?
What, specifically, do police deal with?	Incidents.	Citizen is problems and concerns.
What determine the effectiveness of police?	Response times.	Public cooperation.
What view do police take off service calls?	Deal with them only if there is no real police work to do.	Vital function and an excellent opportunity.
What is police professionalism?	Swift and effective response to serious crime.	Keeping close to the community.
What kind of intelligence is the most important?	Crime intelligence (the study of particular crimes or series of crimes).	Criminal intelligence (information about the activities of individuals or groups)
What is the essential nature of police accountability?	Highly centralized; governed by rules regulations and policy directives; accountable to the law.	Emphasis on local accountability to community needs.
What is the role of headquarters?	To provide the necessary rules and police directives.	To preach organizational values.
What is the role of the liaison press department?	To keep the 'heat' on operational officers so they can get on with the job.	To coordinate a primary channel of interaction with the community.
How do the police regard prosecutions?	As an important goal.	As one tool among many.

Essentially, community-oriented policing is a new concept of policing. It is a movement of a new policing strategy, which is from the independent (traditional) policing into community-based or oriented policing. Usually, Police is known as a government agency principally responsible for law enforcement, and it focuses on several cases of crime, especially those with high values, such as bank robbery and those involving violence. However, the new concept of community-oriented policing is a concept whereby the police are the public and the public is the police, and besides, police officers are those who are paid to provide full attention to the duties of every resident.

Community policing, in contrast to the traditional systems, is focused on solving the problems rather than on generating arrest statistics; quality, and not quantity. It shifts creative problem-solving, which the police have always done from being an informal part of the service to the essence of formal police service. Therefore, the challenge is to find ways to capture and to present the community police successes, along with the traditional kinds of data that the police have always kept and will continue to need to keep.

Adopting a comprehensive approach concerning community-oriented policing requires the changing of performance evaluations of virtually everyone in the field to reflect how well they express this new concept in their service. Nevertheless, it is a community out on beat who most completely and directly expresses the performance evaluation for the community-oriented policing officer's job hence the changes that should effect in all the other performance evaluations.

Clearly, performance evaluations should be based on behaviour, as much as possible eliminates bias and prejudice. Approaching support from officers for performance evaluation is effected by how they used does not take long for employees in any organization to figure out when the performance evaluations are disciplinary rather than constructive purposes. The purpose of performance evaluations is needed to provide documentation to justify disciplinary actions, but it's only applies to a handful of cases.

III. THE MAJOR OBJECTIVES OF COMMUNITY-ORIENTED POLICING

Community policing is not just a program with a single consolidated form to implement. Rather, it varies according to the community and its needs along with the police department that attempts to apply it (Peak & Glensor, 2004). In the United States, many programs have been established under the banner of community policing. Each program has had slightly different objectives to achieve; however, certain common strategies used in these programs distinguish a community policing strategy from traditional policing (Wycoff, 1988). For example, in the year 2000, COPS developed four major objectives to implement community policing:-

- (a) **Community Partnership:** The expression "community partnership" has dominated both private and public sector management ideologies for at least the last three decades (Roth et al., 2004). The participation of citizens in solving community problems is essential in almost every community-based program. Without the participation of the community, any community policing

program is subject to fail. Not surprisingly, the collaborative partnership between community and police is one of the major premises of community policing to improve police performance (MacDonald, 2002). Through two-way communication, police departments obtain more information regarding community needs, and they can generate appropriate responses by working closely with the community (CPC, 1994). Although police agencies use a variety of partnership tactics, Bayley (1996) and Roth et al., (2004) classified the tactics under two major categories with slight differences.

According to Bayley (1996), the first partnership category is a consultation that refers to defining and prioritizing neighbourhood problems by reaching community residents. Police receive information about community problems, including complaints about police, and they also have an opportunity to educate, as well as to inform community members about crime and disorder, along with the department's success and failure. In this process, the two-way information flow makes the police and the resident's co-produce public safety (Greene, 2000). In addition to its contribution to public safety, receiving feedback from the community can be used in the performance appraisal of police officers, assessing the quality of police service, and in the police department's program evaluation (McGarrel, Benitez, & Gutierrez, 2003).

The second partnership category is mobilization, which refers to the active participation of community members and organizations in crime prevention strategies. When community members actively engage in crime prevention strategies, a sense of community and community cohesion is increased (Bayley, 1996). Police, in addition to community members, work closely with community organizations, businesses, and other agencies to improve the quality of life issues, such as working with the municipality to remove graffiti, working with landlords to properly maintain properties, as well as working with parks and recreation agencies to provide recreational programs for youths (Bayley, 1996).

On the other hand, Roth et al., (2004) categorized the types of partnership activities as community partnership and problem-solving partnership. "The former varied from simple information sharing to coordination (i.e., planning and executing joint activities involving all partners) to special collaboration, such as adaptation by all partners of a joint agenda" (Roth et al., 2004).

(b) Problem-solving: Goldstein (1977) argued that "the failure of team policing was due to a focus on secondary considerations," such as generating an organizational change without a clear focus on underlying problems creating calls for service (Goldstein, 1977). Currently, community policing is viewed as the impetus for drastic changes in both organization and philosophy; therefore, team policing, at best, can be perceived as a partial

reflection of current community policing (Greene, 2000).

In his later work, Goldstein (1990) emphasized the importance of community collaboration while solving the underlying causes that were responsible for the calls for service. Some scholars prefer to distinguish community policing and problem-oriented policing (Sherman & Eck, 2006; Walker & Katz, 2005; Eck & Spelman, 1987a). These scholars suggest that the roots of community policing and problem-solving are distinct. One of the main reasons for the emergence of community policing was that the police alienated from the community they served (Miller & Huss, 2002; Champion & Rush, 1997; Rosenbaum, 1988). On the other hand, a major impetus for problem-solving was that police had failed to address chronic problems (Goldstein, 1990).

Second, what differentiate those two are the ends over means syndrome. Problem-oriented policing stresses the importance of the final product rather than stressing the means by which policing is done (Eck & Spellman, 1987a). In community-oriented policing, the ultimate goal is to establish a positive relationship between the police and the community. In problem-oriented policing, solving chronic problems that create calls for service is the primary goal. Unlike community policing, in problem solving, community involvement is not necessarily a prerequisite (Sherman & Eck, 2006; Walker & Katz, 2005; Eck & Maguire, 2000; Eck & Spellman, 1987b). Based on this perspective, it seems accurate that community involvement is secondary in the course of solving problems.

However, the relationship between community policing and problem solving is a relative one. There has to be a geographic boundary and a community with particular problems to be solved to implement problem-oriented policing that will effectively address local issues; and this can be best achieved with community involvement (Kelling & Moore, 1988). Moreover, community policing today does not only offer genuine relationships between the community and the organization, but it also offers tangible benefits, such as crime prevention, as well as a reduction in disorder and fear of crime (Tilley, 2004).

(c) Crime prevention: Community policing refers to a significant change in the role of police (Walker & Katz, 2005). Instead of emphasizing crime control, the role of police within community policing philosophy emphasizes partnership with the community in solving problems about which the community is most concerned (Palmiotto, 2000). This shift in the role of police attempts to accomplish a "crime prevention" goal rather than crime control (Riechers & Roberg, 1990).

(d) Organizational change: Community policing cannot succeed without fundamental alterations inside the organization of police agencies (Redlinger, 1994). It not only requires a philosophical shift regarding police mission, but it also requires a commitment to alter the organization and the structure (Kappeler & Gaines, 2005). Moreover, Eck and Maguire (2000) discuss the need for organizational changes in three areas: i) organizational structure, ii) organizational culture, and iii) management styles (Eck and Maguire, 2000).

- i. **Organizational Structure:** Traditional police organizations have a military type hierarchical system and management style, in which community policing cannot be achieved (Miller & Huss, 2002). "Community policing requires the shifting of the initiative, decision-making, and responsibility downward within the police organization" (CPC, 1994, p. 22). Community policing demands a flat hierarchy by giving beat officers more authority and flexibility to respond to community-specific problems. Parallel with changes in the private and the public sectors, police agencies within the frame of community policing should be more decentralized, and should empower beat officers to make decisions and participate in management (Mastrofski, 1999). Another issue regarding the change in the organizational structure is assigning officers to certain geographic areas so that they can become familiar with their areas, their residents, and the area's specific problems. The hypothesis is that if an officer is assigned to a particular beat, he/she will respond more effectively to residents' concerns. Moreover, officers can be held accountable for the incidents that take place in their beats, which in turn, creates a sense of ownership in the assigned area among the officers.
- ii. **Organizational Culture:** The core elements of traditional policing, such as crime fighting, quick response time, and making a large number of arrests are assumed by police cadets when they enter the police force. The tenets of traditional police culture resist change in the view of police officers (Walker & Katz, 2005). A study conducted by Zhao, Thurman, and Lovrich (1995) revealed that the implementation of community policing in agencies was frustrated more by internal organizational barriers than obstacles in the community. Agencies that scored higher on internal resistance were less likely to implement community policing.
- iii. The management style of community policing should also be different than in traditional policing. In traditional management, the primary concern is maintaining discipline by stressing departmental rules and regulations (Walker & Katz, 2005).

However, police managers in community policing should assist line officers in developing community contacts and in finding resources to solve community problems. This task might be achieved by vertical staff meetings, where line officers can discuss issues that emerge in the communities they serve with their supervisors (Kappeler & Gaines, 2005).

Besides, community policing might enable supervisors to alter their management role. In some agencies, community policing is implemented by the chiefs who would like to be seen as progressive and willing to enhance public relations despite the fact that they do not believe in community policing principles. In fact, not many changes typically occur in these types of agencies. Community policing that is all about cosmetics, and basic service delivery is still based on the traditional policing mentality (Hunter & Barker, 1993).

IV. THE EVOLUTION OF COMMUNITY-ORIENTED POLICING (COP) IN MALAYSIA

Community-oriented policing was endorsed by the government throughout Polis Di Raja Malaysia (PDRM) five (5) years strategic plan (2007-2011) as to encourage the community to participate and to cooperate with the police force in order to fight crimes at all levels in the country. In addition, the government also hopes that with the implementation of the concept, it can build and improve the human relationship between the police force and the community residents.

Generally, the government has endorsed several new concepts of community-oriented policing as additional concepts to be implemented in Rukun Tetangga. Basically, the concept of Rukun Tetangga is to improve and to unite the community with different ethnics, cultures and religions as to become one big community who is living in harmony. However, with the new concept of community-oriented policing in Rukun Tetangga, the focus and scope of Rukun Tetangga will become wider and expanding into more directions.

The concept of community-oriented policing is slightly different with the concept of Rukun Tetangga. It is not just a concept to encourage various activities in the community which enable local people to meet or to interact and to bridge the relationship between the grassroots leaders or to encourage activities with charity organisations. COP is actually a concept to improve the human relationship and to encourage the community to participate and to work together with the police force. Community works as the "eyes" for the police and provides valuable information about crime in their area to the police.

People may get confused between the concept of community-oriented policing and the concept of Rakan COP (August, 2005). Basically, community-oriented policing is a part of Rakan COP. The concept is similar which is to improve human relationship, to encourage the public to become the "eyes" and to share any information about crime with the police. However, the concept of community-oriented policing is to encourage the public as a community to get involved with and volunteering to work with the police by doing the patrol beats and fighting the crime in their residential area.

Community-oriented policing also borrowed the basic concept of Ikatan Relawan Rakyat Malaysia (RELA) (January, 1972). Basically, the scheme is to deploy and to mobilize the volunteer force in order to reduce illegal immigrants and to assist other law enforcement agencies in order to maintain peace and security throughout Malaysia. As a result, community-oriented policing becomes a new concept to be implemented with a bigger scope and objectives into neighbourhood association revolution in Malaysia. The main objectives of community-oriented policing are to increase the participation of the community and to improve the human relationship between the police force and the community residents in a specific residential area.

In addition, police and community strive to work towards a safer community through close cooperation and understanding with the police by sharing a responsibility in the development and the implementation of proactive problem solving strategies as in identified issues and problems occurs.

It is basically the same whether it is Rakan Cop, Rukun Tetangga, RELA or community-oriented policing concept. It actually shows the evolution of Malaysia policing program. As we can see, these four (4) programs are almost similar in terms of concept and direction in which they improve the human relationship, working voluntarily and sharing of information between the community and police force.

For example, the concept of Rukun Tetangga was endorsed to build and to improve human relationship within the community with different ethnics, cultures and religions. The same concept has also been used in community-oriented policing which is to build and to improve human relationship but with different target of individuals which is between the community residents and the police force. The same concept was also developed and used in Rakan Cop and RELA.

Malaysia has developed Ikatan Relawan Rakyat Malaysia (RELA) (1972) and Kawasan Rukun Tetangga (1975). Malaysia developed these two different concepts and schemes. RELA is a concept of deploying and mobilizing the volunteer force and to maintain peace and security in Malaysia. However, as for Rukun Tetangga concept, the concept is to build trust and to unite the community from different ethnics, cultures and religions in Malaysia.

In 2005, Malaysia has developed a new concept of policing related to community based. Rakan Cop was introduced by PDRM in Kuala Lumpur on 9th August 2005, the main concept of Rakan Cop was to encourage the public to become the “eyes” of the police and to provide information on crime to the Police Command Centre through the hotline or SMS.

In 2007, the community-oriented policing was fully endorsed by the government throughout PDRM five years strategic plan as to build trust, partnership and to improve human relationship between the community residents and the police force in Malaysia.

In addition, the concept is considering the community as a partner with the police force to fight and to prevent crime at all levels in Malaysia. In this stage, Malaysia has developed community-oriented policing throughout several phases in Malaysia. This concept will be implemented slowly throughout Malaysia according to the strategic plan.

V. METHODOLOGY

In this research study, the researcher employed “Stratified Sampling” as a method of survey. Stratified sampling is a probability sampling technique wherein the researcher divides the entire population into different subgroups or strata, then randomly selects the final subjects proportionally from the different strata.

Stratified random sampling is used to highlight a specific subgroup within the population. This technique is to ensure the presence of the key subgroup within the sample. In this research study, the subgroup is a housing scheme that is implementing community-oriented policing and the sample is the community that lives in the housing scheme. This method was used to observe the existing relationships between two or more subgroups. With this method, the researcher can representatively sample even the smallest and most inaccessible subgroups in the population which allow the researcher to sample the rare extremes of the given population. With this method, the researcher will have a higher statistical precision because the variability within the subgroups is lower compared to the variations when dealing with the entire population. This method also allows the researcher to have a small sample size which can save a lot of time, money and effort of the researchers.

Based on data from Ibu Pejabat Polis Daerah (IPD), Daerah Timur Laut, there are six (6) housing schemes that implemented community-oriented policing in their housing schemes which are: i) Bandar Sri Pinang; ii) Pulau Tikus; iii) Bayan Baru; iv) Pantai Jerjak; v) Relau; and vi) Green Lane.

In the year 2009, Bahaman conducted a study on the effectiveness of community participation in Volunteer Patrol Scheme in residential areas in selected states in Peninsular Malaysia. The population samples were drawn from members of Rakan COP who registered voluntarily. It was found that a total of 73,786 members were enrolled in Rakan COP Kuala Lumpur, while there were 240,323 members across the country. Bahaman had set the criteria of the sample with the assistance Kuala Lumpur Police Headquarters. The criteria were that respondents in this study must be (a) a Malaysian citizen; (b) staying, studying or working in selected focus areas and (c) registered as members of Rakan COP. As a result, Bahaman selected 384 respondents based on Krejcie and Morgan’s (1970) formula which is if the population size (n) is in the range of 75,000 – 100,000, the total sample required is 384 respondents which is equivalent to 0.5% only. Bahaman selected his location based on verbal discussion with Kuala Lumpur Police Headquarters. The selected location areas were identified as namely (i) Sentul; (ii) Dang Wangi; (iii) Brickfields; (iv) Bangsar and (v) Cheras. Data were distributed and collected in May 2009 using self-administered survey.

As for this research study, the calculation of sample (N) was adopted from scholar and researcher Yamanae, T. (1973). As a result, 2,032 respondents from 23,517 populations were selected as a sample for the research study which is equivalent to 8.63%. It was considered higher compared with a previous research conducted by Bahaman in his research study “The Effectiveness of Community Participation in Volunteer Patrol Scheme on Residential areas in selected States in Peninsular Malaysia”.

As for questionnaire distribution design, a total of 28 questions were developed for the survey directed to Community residents. The questionnaire survey included both quantitative and qualitative questions, which means it is a semi-structured questionnaire. In addition to that, a semi-structured interview was preferred as this method still allowed for a general framework to be present in the interview, but also allowed the interviewer to flexibly change the way the questions were asked or the order they were asked in. This allowed probing from the researcher and the interviewees responded in their own terms or ways that had been significant and relevant (Jupp et al., 2007). The advantage of the semi-structured interview is that the researcher is able to explore in depth some aspects of the respondent's feelings, motives, meanings, and attitudes (ibid). This had been particularly important for the aim of this dissertation. On the contrary, an unstructured interview was not considered, as Bryman (2004: 321) described it as 'very similar in character to a conversation'. Moreover, one way to address some of these issues would have been to use a different research method, such as self-completion questionnaires. This would have eradicated any interviewer bias and would have ensured anonymity. This method, however, may have been too structured for the research aim. Questionnaires are not the best way to gather meanings and feelings, as they are impersonal and do not allow the researcher any flexibility. This is why for this research, despite the limitations with interviews, it was decided that they were the most appropriate method of gathering the data to answer the research questions.

However, for a professional interview with the Police Officers, the researcher developed 18 questions together with the checklist. The questions were directly asked to the Police Officers in charge about the strategies that were used to implement Community-Oriented Policing in Pulau Pinang. The researcher also indirectly asked the human relationship between the Police Officers and the Community residents in the questions of the survey interview. In this research study, the researcher tried to manipulate the respondents by indirectly asking the Community residents and the Police Officers about their human relationship. It was to prevent the tendency of bias answers from the respondents.

In order to strengthen the questionnaire, the researcher also conducted a desk research to obtain secondary data. Desk research was done through newspaper archives, internet, and books to retrieve the view of the research design. As secondary data have a tendency to provide biased data (Forgaty and Dirsmith, 2005) and cannot provide meaningful answers to the research questions (Premaratne, 2002), based on the study and the nature of the research problem, primary data were collected from the field to obtain empirical findings.

The data collected were analysed by using IBM Statistical Packages for the Social Sciences (SPSS) Version 22 software. Most of the data were analysed using descriptive statistical analysis, correlation analysis and mean in SPSS.

VI. RESULT & DISCUSSION

Community perception towards community-oriented policing development & implementation

Table 2.0: Frequency-Respondents' thoughts of community-oriented policing

	Frequency	Percent	Percent without 'not applicable' consideration
Not applicable	806	39.7	0
Community assisting PDRM to ensure safety within the neighborhoods due to shortage of PDRM manpower	446	21.9	36.3
Community and PDRM together doing patrol within the neighborhoods	316	15.6	25.8
It is a new policing strategy by PDRM to encourage community to take part and to assist PDRM in crime prevention	354	17.4	28.9
Community and PDRM work together in solving crime problem within the neighborhoods	110	5.4	9.0
Total	2032	100.0	100.0

Based on the data collected, four (4) various thoughts have been identified from the respondents on their understanding towards community-oriented policing in which the community assumed that community-oriented policing are: (i) Community assisting PDRM doing patrols and to ensure safety within the neighbourhood due to shortage of PDRM men power, (ii) It is a new policing strategy by PDRM to encourage the community to take part and assist PDRM in preventing crime, (iii) Community and PDRM together doing patrols within the neighbourhood, and (iv) Community and PDRM together solving crime problems within the neighbourhood.

The majority 36.3%, N=446 of the respondents believe that community-oriented policing program is the community assisting PDRM to ensure safety within their neighbourhood due to shortage of PDRM manpower. 28.9%, N=354 of the respondents believe that community-oriented policing is a new policing strategy by PDRM to encourage the community to take part and to assist PDRM in crime prevention. 25.8%, N=316 of the respondents believe that community-oriented policing is a program in which the community and PDRM are working together doing patrol within the neighbourhood. 9.0%, N=110 of the respondents believe that community-oriented policing is the community and PDRM are working together solving the crime problem within the neighbourhood.

Generally, the main idea of community-oriented policing implementation in Malaysia is to create a safer living lifestyle. Community-oriented policing is based on the partnership between the police and the community in which both parties share the responsibility to identify, to reduce, to eliminate and to prevent problems that impact community safety and order. The main vision of the community-oriented policing implementation in Malaysia is to foster mutual belief, trust, respect, understanding, responsibilities and embracing smart strategies and solutions between the public and the police department in crime prevention.

There are seven (7) missions have been set up in the program by PDRM which are i) to create crime awareness/shared responsibilities among community and reducing/denying crime, ii) to address and moderate police grouses and complaints made against police officers, iii) to provide free legal advice and necessary services to the public and police to ensure the justice and fairness of law, iv) to encourage community in embracing the “Broken Window” Theory, v) to promote a trustful and truthful working relationship between the public and the police, vi) to establish and to enhance participation of local authorities efforts and cooperation in crime prevention and vii) to advocate and to educate the public in creating safer concept through proactive community based programs.

It is vital that community and PDRM to have the same interpretation towards these three (3) main keys which are i) objective, ii) vision and iii) mission towards community-oriented policing. Misinterpretation of these three (3) main keys may lead the program to failure.

Community expectation towards community-oriented policing development & implementation

Table 3.0: Frequency-Community expectation

	Frequency	Percent	Percent without 'not applicable' consideration
Not applicable	846	41.6	0
To enhance safety and security within the neighborhoods	302	14.9	25.5
To have info sharing session with COP committee and PDRM	192	9.4	16.1
To prevent crime and social problem within the neighborhoods	224	11.0	18.8
To conduct active patrols within the neighborhoods	262	12.9	22.1
To have better relationship with the PDRM towards crime prevention	124	6.1	10.5
To react quickly after receiving complaints from the residents	42	2.1	3.6
To be reliable to the residents	40	2.0	3.4
Total	2032	100.0	100.0

Seven (7) expectations were highlighted by the respondents during the data collection; respondents are expecting that Community-oriented policing can enhance safety and security within the neighbourhood area. Most of the respondents see community-oriented policing as an additional safety and security effort by PDRM with the assistance of the community residents themselves within certain radius area in the neighbourhood. According to the respondents, even knowing that most of the neighbourhoods are gated and guarded strata housing scheme, this scheme covers residents within the housing scheme strata boundary only. The residents still have a risk of become a victim of crime especially for those residents who park their cars outside the scheme and for those without guarded scheme.

The respondents expect Community-oriented policing committee to have consistent and regular patrol beat system within the neighbourhood area. PDRM together with the committee should schedule the patrol beat accordingly at least once every night. This regular basis patrol beat is the best effort to prevent crime and social problems within the neighbourhood.

Besides that, the respondents are also assuming that with Community-oriented policing implementation in the neighbourhood, community residents, committee and PDRM will have a session for info sharing regarding the current crime and social problems within the neighbourhood. The respondents expect that PDRM, with the existing committee, will have more time for one on one sessions with the community residents at least once a month to share their concerns about the surrounding safety environment.

According to the respondents, this session shall assist in building a strong relationship between PDRM, the committee and the community itself. In addition to that, it is an opportunity for PDRM and the committee to introduce, educate and explain community-oriented policing strategy to the community. Nevertheless, it is also a bridge that can connect PDRM and the committee to personally communicate, interact and build trust with the community. This session might be a medium for PDRM to achieve their objectives towards community-oriented policing implementation and crime prevention.

Nevertheless, the respondents are also expecting PDRM to respond much faster after receiving any complaint or report from the residents in the housing scheme with the assistance of Community-oriented policing committee in charge. This is to achieve the efficiency of PDRM and Community-oriented policing implementation service.

VII. CONCLUSION & RECOMMENDATION

Each community member have a different understanding and interpretation of community-oriented policing. Some community may give a positive review on the community-oriented policing program and understand the main objectives, mission, and vision of the program. This group of the community will encourage other community members within their group to appreciate and to support PDRM efforts towards community-oriented policing implementation. However, there will be a small group of community with a lack of understanding of the community-oriented policing program. This group may spread wrong information about the program to the other community members within the group. This situation will lead to the failure to the program.

There are several processes to generate and to develop ideas and solutions. The first process is to understand the findings and issues from the data collection. There is no doubt that plentiful information regarding community-oriented policing strategies and development has been published in the PDRM website, social media, newspapers and other mass media. However, this information did not explain enough or in the right way to the public. It may need more efforts from related parties to explain about the community-oriented policing. The best way to explain to the public is to educate the public by showing and demonstrating it to them so that the public will be able to understand it.

It is important to develop and implement a comprehensive education and training program to canvass the shift in policing focus from a predominantly reactive to more proactive style. This education and training program should accommodate both police department as well as community members.

The concept of community-oriented policing entailed a partnership arrangement, and the utilization of this partnership is to identify and come up with the solutions for community problems. The partnership arrangement involves both police department and community members and such arrangement requires both parties to have a commonality of understanding concerning the policing concept for it to be successfully implemented. As the terms "partnership" implies, both parties must contribute and participate equally unless the pertaining issue requires specific police involvement. Therefore, as one of the foundation blocks to successfully implementing the policing concept, both police department and community need to be exposed to appropriate education and training packages that promote the understanding of the concept of "community-oriented policing".

However, this education and training arrangement should not be considered as a "one-off" exercise but should be developed to provide regular updates about the residential area. In addition, the successful implementation of police-community strategies in addressing local community problems should be utilized as experiential learning across the whole police department.

In Texas, the Texas Police Department has introduced a program called the Huston citizen patrol program in which members of the community will assist the police department in crime prevention matters. This program is specially designed to allow members of the community group to carry out patrols to reduce crime in local areas. The police department will assist the community by providing training and equipment such as radio and trademarks. This program is considered successful with the assistance and close cooperation between the police department and community members. Huston Police Department as stated in Priest and Carter (1999) showed that 80 civil patrol groups in Huston with more than 3, 100 volunteers had undergone more than 82, 000 of patrol per person in 1991.

There is another campaign, which is also commenced in the United States, the "McGruff" Crime Prevention Campaign. The objective of this campaign is to spark a sense of responsibility in each individual in an effort to prevent crime, to educate the community to take joint preventive measures, change the mind-set of the people to work with the non-governmental body (NGOs) on the prevention of crime. In the study conducted for this campaign in 1991 by Matera and Artique (2000), found that 88% of crime prevention enforcement personnel were involved in this campaign while the awareness among community members was 80%. In addition, 86% embraced the campaign activities and responded positively with things that they had learned from it.

REFERENCES

- [1] Bahaman, A. S., O. Jamilah, K. Nurani, H.H. Hanina & M.H. Rezal (2009) Consultation Report: Study on the Effectiveness of Voluntary Patrolling Scheme and Community Participation. Institute for Social Science Studies, Unversiti Putra Malaysia Press, Malaysia.
- [2] Bayley, D. H. (1996) What Do Police Do?. In: Saulsbury, W., Mott, J. & Newburn, T., (eds). Themes in Contemporary Policing, London: Independent Enquiry into the Roles and Responsibilities of the Police.
- [3] Brown, Lee P. (1992) 'Community Policing: Partnership with Promise'. The Police Chief.
- [4] Bryman, A. (2004) Social Research Methods (3rd Edition). Oxford: Oxford University Press.
- [5] Champion, D. J. & Rush, G. E. (1997) Policing in the Community. Upple Saddle River, NJ: Prentice Hall.
- [6] Cordner, G. (1999) Elements of Community Policing. In: L. Gaines & G. Cordner, (eds). Policing Perspectives: An Anthology. Los Angeles: Roxbury Publishing Company. P. 137-149.
- [7] Community Policing Consortium. (1994) Understanding community policing: A framework for Action. Washington, DC: Bureau of Justice Assistance.
- [8] Eck, J. E. & D. P. Rosenbaum (1994) The New Police Order: Effectiveness, Equity and Efficiency in Community Policing. In Dennis P. Rosenbaum (eds) The Challenge of Community Policing: Testing the Promises. Sage: Thousand Oaks. P. 3-23.
- [9] Eck, J. E., & Maguire, E. R. (2000) Have Changes in Policing Reduced Violent Crime? An Assessment of the Evidence. In: A. Blumstein & J. Wallman (eds). The Crime Drop in America. New York: Cambridge University Press. P. 207-265.
- [10] Eck, J. E. & Spelman, W. (1987) Problem Solving: Problem-Oriented Policing in Newport New. Washington, D.C.: Police Executive Research Forum.
- [11] Forgaty, G. J. & Drismith (2005) Response Bias in Computerised Test.
- [12] Foskett, J. M. (1955) Social Structure and
- [13] Goldstein, H. (1977) Improving Policing: A Problem-Oriented Approach. Crime and Delinquency.
- [14] Goldstein, H. (1990) Problem-Oriented Policing. Temple University Press.
- [15] Greene, J. R. (2000) Community policing in America: Changing the Nature, Structure, and Function of the Police. Washington, D. C.: Criminal Justice, National Institute of Justice, Vol. 3, P. 299-370.
- [16] Hunter, R. D. & Barker, T. (1993) The New Police Organizational Style. American Journal of Police, Vol. 12, P. 157-168.
- [17] Jupp J., Langdon P. & Godsill S. (2007) Mobile Computing in Maintenance Activities: A 'Situational Induced Impairments and Disabilities' Perspective. Lecture Notes in Computer Science, Vol. 4554, p. 696-705.
- [18] Kappeler, V. E. & Gaines, L. K. (2005) Community Policing: A Contemporary Perspective. Cincinnati, OH: Anderson Publishing.
- [19] Klockars, C. B. (1988) The Rhetoric of Community Policing. In: J. R. Greene & S. D. Mastrofski (eds). Community Policing: Rhetoric or Reality. New York: Praeger. P. 239-258.
- [20] MacDonald, John M., (2002) "The Effectiveness of Community Policing in Reducing Urban Violence", Crime and Delinquency, Vol. 48(4), P. 592-618.
- [21] Manning, P. K. (1988) Community Policing as a Drama of Control. In: J. R. Greene & S. D. Mastrofski (eds). Community Policing: Rhetoric or Reality. New York: Praeger. P. 27-46
- [22] Mastrofski, S. D. (1999) Ideas in American Policing: Policing for people. Washington, DC: Police Foundation.
- [23] McGarrel, E. F., Benitez, S. & Gutierrez, R. S. (2003) Getting to Know Your Community through Citizen Surveys and Focus Group Interviews. In: Q. C. Thurman & E. F. McGarrel (eds). Community Policing in a Rural Setting. Cincinnati, OH: Anderson Publishing. P. 113-121.
- [24] Miller, L. S. & Huss, K. M. (2002) The police in the community: Strategies for the 21st century (3rd ed). Belmont, CA: Wadsworth.
- [25] Palmiotto, M. (2000) Community Policing: A Policing Strategy. Boston: 21st Century, Jones and Bartlett Publishers.

- [26] Peak, K. J. & Glensor, R. W. (2004) *Community policing and problem solving: Strategies and practices*. (4th ed). Upper Saddle River, NJ: Prentice Hall.
- [27] Premaratne, S. P. (2002) *Entrepreneurial Networks and Small Business Development: The Case of Small Enterprises in Sri Lanka*. PhD diss., Eindhoven University of Technology.
- [28] Priest, T.B. and D.B. Carter (1999) *Evaluation of Police Performance in an African-American Sample*, *J. Criminal Justice*, Vol. 27, P. 57-65.
- [29] Redlinger, L. J. (1994) *Community Policing and Changes in the Organizational Structure*. *Journal of Contemporary Criminal Justice*, Vol. 10(1), P. 36-57.
- [30] Riechers, L. M., & R.R. Roiberg (1990) "Community Policing: A Critical Review of Underlying Assumptions." *Journal of Police Science and Administration*, Vol. 17(2), P. 105-114.
- [31] Rosenbaum, D. P. (1988) *The Changing Role of the Police: Assessment of the Current Transition to Community Policing*. In: J. P. Bodeur (eds). *How to Recognize Good Policing: Problems and Issues*. Thousands Oak: CA, Sage Publications. P. 27-53.
- [32] Roth, J. A., Roehl, J., & Johnson, C. C. (2004) *Trends in Adaptation of Community Policing*. In: W. G. Skogan (eds). *Community Policing: Can it Work*.
- [33] Sherman, L. W., Denise Gottfredson, Doris Layton MacKenzie, Ecl J.E, Peter Reuter, & Shawn Bushway (1997) *Preventing Crime: What Works, What Doesn't, What's Promising—A report to the AttorneyGeneral of the United States*. Washington, DC: United States Department of Justice, Office of Justice Programs.
- [34] Sherman, L.W., & Eck, J. E (2002) *Policing for Crime Prevention*. In: Sherman, L. W., Farrington, D. P., Welsh, B. C., & MacKenzie, D. L.,(eds). *Evidence-Based Crime Prevention*, Routledge: New York. P. 295-329.
- [35] Sherman, L. W. & Eck, J. E. (2006) *Policing for Crime Prevention*. In: L. W. Sherman, D. P. Farrington, B. C. Welsh & D. L. Mac Kenzie (eds). *Evidence-Based Crime Prevention* New York: Routledge. P. 331-403.
- [36] Skolnick, J. H. & Bayley, D. H. (1988) *Theme and Variation in Community Policing*. *Crime and Justice*, Vol. 10, P. 1-37.
- [37] Sparrow, Malcolm K., Mark H. Moore, & David M. Kennedy (1990) *Beyond 911: A New Era in Policing*. New York Basic Books.
- [38] Tilley, N., (2004) 'Community Policing and Problem Solving', in *Community Policing (Can it Work)*, Wadsworth: Toronto. P. 165-184.
- [39] Trojanowicz, R. C. & Bucqueroux, B. (1990) *Community Policing: A Contemporary Perspective*. Cincinnati, OH.
- [40] Trojanowicz, R. C., Kappeler, V.E., & Gaines, L.K., (2002) *Community Policing: Contemporary Perspective, Third Edition*. Cincinnati, Ohio: Anderson Publishing.
- [41] Vaughn, J. R. (1991). "Community-Oriented Policing . . . You Can Make It Happen." *Law and Order* 39(6), P. 35-39.
- [42] Virta, S. (2006) *Community Policing*. In: McLaughlin, E., & Muncie, J., (eds). *The Sage Dictionary of Criminology*. London: Sage.
- [43] Walker, S., & Katz, C. (2005) *The Police in America: An Introduction* (5th ed.). New York: McGraw-Hill.
- [44] Wycoff, M.A. (1988) *The Benefits of Community Policing: Evidence and Conjecture*. In: J reen & S Mastrofski (eds). *Community Policing: Rhetoric or Reality*. New York: Praeger Publishers. P. 103-134.
- [45] Yamane, T. (1973) *Statistic: An Introductory Analysis*. Happer & Row, New York.
- [46] Zhao, J., Thurman, Q. C., & Lovrich, N. P. (1995) *Community-Oriented Policing Across The U.S.: Facilitators and Impediments to Implementation*. *American Journal of Police*, Vol. 14, P. 11-28.

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AN EXAMINATION OF ARTICLE 38 (1) OF THE STATUTE OF THE INTERNATIONAL COURT OF JUSTICE 1945 AS A SOURCE OF INTERNATIONAL LAW

Zakiyyu Muhammad¹, U. S. Jahun²

ABSTRACT

This article examined Article 38 (1) of the Statute of the International Court of Justice 1945 as a source of international law, the article found out that it is obvious from the establishment of the Statute of the International Law Commission in 1947 (shortly after the establishment of the International Court of Justice) to the various opinions of international law experts, it is without any doubt that there is need for the review and redrafting of the provisions of Article 38 (1).

Keywords: Article 38, International Court of Justice, International Law, Civilized Nations

INTRODUCTION

States exist side by side and interact with one another in terms of trade, cooperation and conflict; hence the need for international law³. The need for peaceful coexistence, cooperation and understanding leads to the creation of multiple international organizations and further entrench the need for the international law⁴.

International law means different thing to different people, it can be vaguely understood as a body of rules and regulations governing the activities and relationships between states. It may also mean rules governing international organizations and international relations. Its scope and boundaries have over the years saw a significant shift in its limits and parameters. These rules are derived from treaties and conventions, agreements, international customs, general principles of law recognized by civilized nations, judicial decisions as well as teachings of renowned publicists⁵.

International law is broadly divided into two major categories; public and private. Public international law deals with states and recently in some cases individuals, while private international law otherwise called conflict of laws deals with conflict of individuals from different jurisdictions or states. Public law is further divided into traditional and emerging fields. It is traditionally viewed as dealing with states responsibilities, law of treaties and the sea, whilst the modern or emerging fields, includes individual international criminal responsibilities, human rights and the environment.

International law often faces some challenges and criticisms; however, this is largely due to the usual attempt in comparing it with the domestic or national laws. It does not have legislature that enact it, executive to implement it and a properly structured court system. And yet it exist, it's ascertainable and adopts a horizontal approach; whereby, all states are treated as sovereign and equal before the law⁶.

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³ Malcolm N Shaw, International Law (6thedn, Cambridge University Press 2008) 44

⁴ Dapo Akande 'International Organizations' in Malcolm D Evans (ed), *International Law* (4thedn, Oxford University Press 2014) 248

⁵ Statute of the International Court of Justice 1945, Article 38 (1)

⁶ Shaw (n 1) 70

SOURCES OF INTERNATIONAL LAW

For a rule of international law to be binding, it must be derived from one of the recognized sources provided by Article 38(1) of the Statute of the International Court of Justice 1945⁷. They are the authoritative and conventional sources of international law being an integral part of the United Nations Charter⁸. The Article provides thus;

'Article 38 1. The Court, whose function is to decide in accordance with international law such disputes as are submitted to it, shall apply: a. international conventions, whether general or particular, establishing rules expressly recognized by the contesting states; b. international custom, as evidence of a general practice accepted as law; c. the general principles of law recognized by civilized nations; d. subject to the provisions of Article 59, judicial decisions and the teachings of the most highly qualified publicists of the various nations, as subsidiary means for the determination of rules of law'

The above section list in hierarchical order the sources of international law to be used by the international court of justice to settle dispute arising between states, this is however, not firm as there is not much priority on the hierarchy of the first three sources, while the last two are generally seen as subsidiary⁹.

However, experts in the field of international law expressed divergent opinions on the interpretation of Article 38 (1) (a)-(d) of the ICJ Statute¹⁰. One of the opinion is that the sources of international law listed in Article 38(1) (a)-(d) are to be treated and used equally without priority given to any one of them, while others opined that the provisions in Article 38 (1) (a)-(c) are different and have priority over the provision of Article 38 (1) (d)¹¹.

In terms of hierarchy, China for example, adopts treaties as having priority over customary international law and other sources. This is believed to be as a result of Chinas' perceived domination of the development of customary international law by the West. As such, customs are inapplicable by the laws of China¹².

Similarly, sources of international law are traditionally distinguished into material sources and formal sources. Material sources are those relating to the place usually a document where the rules or terms of an agreement are stated, this may be a convention, treaty, resolution of the United Nations or even a statement in a textbook¹³. The formal sources on the other hand, are those recognized by Article 38 (1) of the Statute of the International court of justice as mentioned above¹⁴. However, these sources of international law are to a large extent seen to be state oriented rather international and different from municipal laws¹⁵.

Although Articles 38 (1) of the statute of the ICJ have been provided in principle to provide guide and directions to the International Court of Justice in administering justice, it is mentioned whenever there is any meaningful discussion on the sources of international law¹⁶. It is frequently referred to and reproduced in subsequent instruments of international law even though it is only limited to the International Court of Justice¹⁷.

However, Navid R. Sato¹⁸ argued that even though the applicable law within the World Trade Organization (WTO), the scope of the sources of international law as contained in Article 38 of the Statute of the International Court of Justice is not limited to the court, but other international tribunals and arbitral bodies including the World Trade Organizations tribunal. Although, not much reported, the WTO acknowledges the provisions of Articles 38 (1) including customary international law, treaty and conventions and the general principles of law recognized by civilized nations. An example was the obligation on application and acceptance of good faith by all member states as general principles of law¹⁹.

⁷ Hugh Thirlway, 'The Sources of International Law' in Malcolm D Evans (ed), *International Law* (4thedn, Oxford University Press 2014)

⁸ Vladimir-DjuroDegan, On the Sources of International Criminal Law, *Chinese Journal of International Law* (2005) 45-83

⁹ Article 38 (1) (d) Statute of the ICJ

¹⁰ Aldo ZammitBorda, A Formal Approach to Article 38(1)(d) of the ICJ Statute from the Perspective of the International Criminal Courts and Tribunals, *Eur J Int Law* (2013) 24-649

¹¹ *ibid*

¹² *Asian Journal of International Law*, 1 (2011), pp. 233-248 Chinese Philosophy and International Law Pan Junwu

¹³ *ibid* n 5

¹⁴ *ibid*

¹⁵ *Human Rights Law Review* (2015) 15(3): 441-484 1 September 2015 NHRIs and the State: New and Independent Actors in the Multi-layered Human Rights System KatrienMeuwissen

¹⁶ R. McCorquodale and M. Dixon, *Cases and Materials on International Law* (4th edn, 2003), at 19

¹⁷ International Law Commission, Formation and Evidence of Customary International Law, (INT LAW COM UN No A/CN.4/659, 2013) 1

¹⁸ *Journal of International Trade Law and Policy* (2010) JITLP 9(2), 108-129 1 June 2010 Principle of necessity in China -- intellectual property rights Navid R. Sato

¹⁹ *ibid*

On the contrary, Rose Parfitt in an article 'The Spectre of Sources'²⁰ argued that the sources of international law should be rather far from those mentioned in Article 38 (1) of the Statute of the International Court of Justice. The argument was that limiting the focus of sources of international law to Article 38 (1) only signifies legitimacy and authority in the sources to the creation of the United Nations which when formed constitute only European and Neo-European countries with much European settlers. The author further argued, that there are other sources such as Islamic law and agreements of chartered companies who later transformed into colonialist agents having dual mandate of trade and colonialism on behalf of their original countries also contributed in a significant way to the development of international law and its sources. Looking at the sources from this perspective is more complex and global. This, it was argued in the article, was never the concern of international law experts because of the 'Eurocentrism' (focus of international law to Europe against other parts of the world) which dominated the historical development of international law and its sources²¹.

GENERAL PRINCIPLES OF LAW RECOGNIZED BY CIVILIZED NATIONS AS A SOURCE OF INTERNATIONAL LAW

General principles of law are relevant laws, legal principles and rules pronounced by the court as a result of analogy and consultation of existing and established principles of law that guide the legal system, public policy and other general principles of equity and justice. This is usually arrived at as a result of lack of existing law directly regulating that particular matter before the court²².

General principles of law as a source of international law were contemplated by the drafters (commission of jurist) of the Statute of the International court of justice for the future where a dispute may be before the court and no provision of a treaty and an established custom governs the issue. It was thought by the drafters that it will be inappropriate for the court to neither uphold nor reject the issue for lack of an existing law or custom²³. This is coupled with the foreseen and indeed relative under development of international law and judicial precedent compared to the municipal law and the lack of legislature to enact laws to govern lacunain the law as well as emerging and new situations²⁴.

At the time of drafting the statute of the International Court of Justice, treaty and custom were known and ascertained sources of international law and to avoid any future uncertainty,²⁵ which is legally referred to as *non liquet*, the general principles of law came into being. However, the 1965 Convention on the Settlement of Investment Disputes between States and Nationals of Other States adopted in Washington on 18 March 1965, a subsequent international convention has further discouraged the pronouncement of non liquet by international arbitral bodies, tribunals and the international court of justice²⁶. This provision came into being as a result of the increasing phase of relations between private individuals and states especially on economic matters²⁷.

However, international law experts are divided on the nature of principles to be used in arriving at the general principles of law recognized by civilized nations. While some are of the opinion that the principles of municipal laws generally applied or shared by majority of nations after a comparison should form the general principles. This view heavily relied on the phrase 'recognized by civilized nations'²⁸. Others on the other hand, opined that while the drafters may be referring to the municipal laws, regard should also be given to international legal relations and the general laws regulating international legal relationships between states²⁹. Meanwhile, the second view adopted the arguments of the first and made addition which is very important.

Schachter in his book³⁰ identified five categories of law to form the general principles of law as a source of international law to include; municipal laws, laws derived from specific nature of international community, laws basic to all legal systems, laws common to all societies and principles of justice which makes man a rational being³¹. To him, for an international law to be of general principles of law recognized by civilized nations, it must fulfill the above criteria.

Wang Tieya, China International law expert argued that general principles of law are found and created in the resolutions of the United Nations,also, lend support and advocate for the adoption of the resolutions of the United Nations General Assembly as a source of international law³². Wang further argued that it forms a better explanation of the provisions of the United Nations Charter particularly where it was adopted by majority or all memberstates of the United Nations.

²⁰Eur J Int Law (2014) 25 (1): 297 1 April 2014 The Spectre of Sources Rose Parfitt

²¹ ibid

²² ibid n 1

²³ ibid n 5

²⁴ ibid n 1

²⁵ ibid n 5

²⁶1965 CONVENTION ON THE SETTLEMENT OF INVESTMENT DISPUTES BETWEEN STATES AND NATIONALS OF OTHER STATES Adopted in Washington on 18 March 1965 section 42

²⁷Unif. L. Rev. (2016) 21(3), pp 184 Uniform Law Review, 1 August 2016: Private law and general principles of public international law PieroBernardini

²⁸ ibid n 5

²⁹ ibid n 5

³⁰Schachter O, *International Law in Theory and Practice* (1991) 50

³¹Ox. J Law Religion (2013) 2(1): 98-118 1 April 2013 The International Court of Justice and its Use of Islam: Between a Rock and a Hard Place? Urfan Khaliq

³²Asian Journal of International Law, 1 (2011), pp. 233-248 Chinese Philosophy and International Law Pan Junwu

Doctrines of equity are argued to form a significant part of the general principles of law recognized by civilized nations as a source of international law. An example of these includes the doctrine of estoppel, which was applied including; *Nicaragua v United States of America*, *North Sea Continental Shelf case* and *Cameroon v Nigeria*³³. Equitable doctrines in form of maxims such as 'equity will not suffer a wrong to be without a remedy', 'substance over form', 'he who seeks equity must do equity' and 'equality is equity' were applied by the international court of justice in order to bring the justice of the cases³⁴. The author further argued that equity as general principles of law recognized by civilized nations solves and have the capacity of solving new and emerging international law disputes that are not settled by international customary law, treaty and conventions by guiding the international community³⁵.

However, the general principle of law as a source of international law was mostly applied by arbitral bodies only but not in much instances by the international court of justice³⁶.

INTERNATIONAL CUSTOM AS A SOURCE OF INTERNATIONAL LAW: IS INTERNATIONAL CUSTOM EVIDENCE OF A GENERAL PRACTICE ACCEPTED AS LAW?

Customary international law is one of the two primary sources of international law the other being treaty. However, there are difficulties and arguments on its nature, formation and application³⁷.

Custom is 'any recurring mode of interaction among individuals and groups together with the more or less explicit acknowledgment by those groups and individuals that such patterns of interactions produce reciprocal expectations of conduct that ought to be satisfied'³⁸.

They are set of behaviors, values and rules adopted and practiced by a society or people over a long period of time that it has acquired historical legitimacy. These rules are later recognized either by the courts or statutory provisions³⁹.

Customs are argued to mean established practice and a psychological element known as *opinio juris* and are binding on all states⁴⁰. A study has shown that a close look at state practices and *opinio juris* has shown that customary international law has arisen and not only emerging⁴¹.

However, international law experts are divided on the position of international custom in the international law practice. States interact with each other in a particular manner and ways as a result of which these rules of customary practices sprang over time. They are sometimes seen to be a product of agreements and treaties and hence; the argument that only those states that are party to how it sprang should only be parties to it, this is discountenancing the argument that international custom or customary law have a universal application⁴². But in practice, it is also a double edged sword; this is because a state that rejects a particular custom in a particular case may be seen relying and adopting the same custom in another case if it is in its favor.

By its nature, customary law is a product of a process of informal creation. As such, the degree of formality found in creating other sources such as treaty cannot be seen in its formation⁴³.

Customary international law is argued to be the two element theory. These two elements are the established practice and the psychological element known as *opinio juris*. To the traditional law experts, these two elements must coexist for an act to be a custom or customary international law.

Practice means an act which is consistently practiced, established and widespread for it to acquire the first element of becoming a custom. *Opinio juris* on the other hand means belief or psychological condition of mind of the state that the act, principle or rule is customary is the second element to be fulfilled to be a customary international law⁴⁴.

³³ Asian Journal of International Law Asian Journal of International Law, 6 (2016), pp. 294-325 1 July 2016 Chasing the Frontier in Humanitarian Intervention Law: The Case for *Aequitas ad Bellum* Colin Seow

³⁴ *ibid*

³⁵ *ibid*

³⁶ *ibid* n 24

³⁷ INTERNATIONAL LAW ASSOCIATION LONDON CONFERENCE (2000) COMMITTEE ON FORMATION OF CUSTOMARY (GENERAL) INTERNATIONAL LAW Members of the Committee: Professor M. H. Mendelson, Q.C. (UK): Chairman page 2

³⁸ Unger R, *Law in Modern Society* (London 1976) 49

³⁹ *ibid* n 1

⁴⁰ *ibid* n 5

⁴¹ S Wiessner, 'Culture and the Rights of Indigenous Peoples' in A Vrdoljak (ed), *The Cultural Dimension of Human Rights* (OUP 2013) 146

⁴² *ibid* n 5

⁴³ *ibid* n 20

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DIFFERENCE BETWEEN 'GENERAL PRINCIPLE OF LAW' RECOGNIZED BY CIVILIZED NATIONS AND OTHER SOURCES OF INTERNATIONAL LAW

It is important to note from the beginning, that the incomplete nature of the provisions of international customary law, treaties and convention was what led to the creation and adoption of general principles of law as recognized by civilized nations⁴⁵ as a source of international law, and therefore, different from all other sources.

Although, there are divergent opinions on what the general principles of law as a source of international law refers to. And while some are of the opinion that it is a source of its own affirming and reiterating the natural law rules, others are of the opinion that it falls under the treaty and international custom as sources of international law and therefore, it does not add anything to international law⁴⁶. The majority of writers are of the opinion that it is a class of its own but with limited scope and hence, different from other sources of international law.

In considering the differences between general principles of law recognized by civilized nations as a source of international law with other sources of international law, it is important to note the difficulty in differentiating treaty and international custom, this is because, of the 'somewhat 'entangled' nature of the two sources; treaties may be reflective of pre-existing rules of customary international law or may have 'a crystallizing effect for emerging rules of customary international law'⁴⁷. However, notwithstanding, customary law is of its class, distinct and different from an international treaty even where they are identical⁴⁸ and distinct from the general principles of law as well.

There is also the difficulty in differentiating between general principles of law recognized by civilized nations and customary international law. This is because, the international court of justice constantly applied those customs that are not known to municipal laws and the question whether the general principles sprang from municipal law or not⁴⁹.

One basic difference between general principles of law recognized by civilized nations and customary international law and treaty, is that it (general principles) is used where there is no express and conventional provision to govern dispute between states⁵⁰.

Treaty and convention as a source of international law to be applied by the International Court of Justice, only binds states that are signatory to it⁵¹. Customary international law on the other hand must be significantly understood or practiced and the belief (psychological element) by quite a number of states to acquire the force of source of international law⁵². It can be formed as a result of discussions or dialogue or statement even before an action; that is modern development of customary international law⁵³. While, general principles of law is found and applied as a result of non-existence of either of the two.

WHETHER INTERNATIONAL CUSTOM AS EVIDENCE OF GENERAL PRACTICE COULD OR SHOULD HAVE BEEN BETTER DRAFTED

The question on whether international custom as evidence of general practice could or should have been better drafted have been an old question in the international law arena. The Article 38 (1) is often said to be badly drafted⁵⁴. This is as well an important question, particularly taking the International Law Commission in to consideration. The commission was established by the United Nations General Assembly in 1947 for the promotion, development and codification of international law pursuant to Article 13 of the United Nations Charter 1945.

Article 24 of the Statute⁵⁵ of the Commission provides that;

⁴⁵ *ibid* n 24

⁴⁶ *ibid* n 1

⁴⁷ International Law Commission (ILC), *First Report on Formation and Evidence of Customary International Law*, Doc A/CN.4/663 (17 May 2013) para 34

⁴⁸ *ibid*

⁴⁹ *ibid* n 24

⁵⁰ *ibid* n 24

⁵¹ *Journal of International Dispute Settlement J Int. Disp. Settlement* (2015) 6(1): 42-73 1 March 2015 The Problem of Accommodating Indigenous Land Rights in International Investment Law MihailKrepchev

⁵² *North Sea Continental Shelf, Judgment*, ICJ Rep 1969, 45, para 77

⁵³ *ibid* n 34

⁵⁴ *ibid* n 12

⁵⁵ Statute of the International Law Commission 1947 (emphasis mine)

'the Commission shall consider ways and means for making the evidence of customary international law more readily available, such as the collection and publication of documents concerning State practice and of the decisions of national and international courts and on questions of international law, and shall make a report to the General Assembly on this matter'

The commission is making efforts to provides the processes for identification of existing and new international customary law though not without challenges. Some of this challenges which are indeed challenges to the development as well as acceptance and adoption of international customary law as evidences of general practices includes; the fact that customary international law deals with controversial issues such as sovereignty of states, being through an informal process and so there is no precision like what is obtainable in the emergence of treaty and conventions, existence of international politics and politicians playing around with it; an example is the acceptance of United Nations resolutions as customary international law, increasing development of literature and writing of international law publicist and various utterances and speeches of state international and national politicians; which does not represent the position of their states on a particular international matter. Another difficulty faced is finding relevant and reliable materials, this is because some states do not publish official digest which contains their states position on international law issues and another major challenges is the evolution of the customary international law itself, and this is because, not until the end of 19th century, most bilateral agreements are not made public while there was no much multilateral agreements and treaties, but the trend has since changed⁵⁶, as there are increasing multilateral agreements and treaties which are public and open for all to see.

Wang, also, lending support to the possibility of redrafting Article 38 (1) of the Statute of ICJ, argued that resolutions of the United Nations General Assembly play a significant role in the formation of customary international law as a source of international law and should have priority over and above judicial decisions and writing and teaching of international law publicists⁵⁷.

CONCLUSION

In summary, while Article 38 (1) of the Statute of the International Court of Justice provides for the sources of international law as treaties, customary law, general principles of law, judicial precedent and teaching of international law publicist, to be referred to by the International Court of Justice, these sources which are indeed serving the purposes for which they were established are not yet left without criticisms as to what constitute the sources, their adoption and application by the court as well as the acceptability it receives from various nations around the world. This led to some suggestions for the adoption of other sources such as the resolutions of the United Nations General Assembly, principles of Islamic law and the agreements, actions and inactions of chartered companies whom have played a significant role in the development of international law and its sources.

The article had found out that it is obvious from the establishment of the Statute of the International Law Commission in 1947 (shortly after the establishment of the International Court of Justice) to the various opinions of international law experts, it is without any doubt that there is need for the review and redrafting of the provisions of Article 38 (1). This is also due to the overwhelming development in the field of international law and practice as well as the different of opinion of stakeholders.

⁵⁶ *ibid* n 23

⁵⁷ *ibid* n 29

Risk Factors Associated with Spontaneous Abortion at Al-Najaf City

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Abstract- Objective: this study aimed to identify risk factors associated with spontaneous abortion and To find out relationship between abortion and other variables such as Demographic variables, such as (Age, level of education) and Reproductive variables such as (gravida , parity).

Methodology: A descriptive case-control study was adopted in order to achieve the stated objectives. The study began from November 1st , 2016 until August, 2nd, 2017. A Non-Probability (Purposive Sample) of (100) women suffer from spontaneous abortion as case group who were selected from emergency ward and maternity ward depending on diagnosis of managing doctor , and (100) women without history for abortion as control group, selected from maternity ward . Both case group and control group are involved in the sample of the study. The data are collected through the use of constructed questionnaire, reliability of instrument is determined by the use of cornbach Alpha, and the instrument validity is determined by a panel of experts. Data was analyzed by using descriptive and Inferential data analysis.

Results: The results of the study showed that the most (50%) of study group women rang between age (20-29) years old while (48%) of control group (30- 39) years old. The majority of women with spontaneous abortion (81%) urban residents while the majority of the control group women are from urban area was (91%). Most of study group(28%) primary school graduated while control group(38%) secondary school graduated. Also increase parity number and early age at marriage (16-20) in aborted women compared with non-aborted women. in addition, there is a significant association between the exhibition of abortion and the toxoplasmosis ,urinary tract infection , accidents and injuries , congenital uterine anomalies, cervicitis, vaginitis, cervical incompetence, and There is a significant differences between the study &control groups anxiety levels , anxiety during pregnancy is a risk factor associated with spontaneous abortion.

Conclusion: The study concludes that among the risk factors relating to the spontaneous abortion, women with younger age, urban residency, primary school graduated, increase parity number and early age at marriage, Infections like (toxoplasmosis ,urinary tract infection, cervicitis and vaginitis), cervical incompetence, congenital uterine anomalies, accidents and injuries and anxiety during pregnancy is a risk factor associated with spontaneous abortion.

Recommendation: The study recommends that a population-based study should be conducted to increase the women awareness about the risk factors of spontaneous abortion especially among young women and those with low education level.

Index Terms- Risk factor, Spontaneous abortion.

I. INTRODUCTION

Abortion is an important cause of morbidity and mortality among mothers in reproductive age, especially in developing countries⁽¹⁾. Abortion is defined as the expulsion of concept products from the uterus when the fetus is not viable, before the 20th week of pregnancy, substitutional define for abortion is expulsion of a fetus with weight less than 500 g, abortion is involves spontaneous or induced, a spontaneous abortion or miscarriage, is the natural death of a fetus in the womb. Spontaneous abortion is the most common complication during early pregnancy in women with a rate of 15-20% among pregnant women nearly 80% of spontaneous abortion occurs in the first trimester⁽²⁾. There are two types of miscarriage sporadic and recurrent, recurrent miscarriage affects around 1% of couples by contrast, at least 25% and maybe as many as 50% of all women suffer from one or more sporadic miscarriages⁽³⁾. Abortion is considered not only a major reproductive health matter , but also health risk factor for mothers wellbeing which also threaten mothers lives and comfort⁽⁴⁾. A lot of pregnancies are wasted spontaneously before she recognizes that she is a pregnant, and the clinical signs of miscarriage are mistaken for a heavy or late menses⁽⁵⁾. The World Health Organization (WHO) estimation that worldwide 210 million women become pregnant every year and that about two-thirds of them, or approximately 130 million, delivery a live infants. The remaining one-third of pregnancies end in spontaneous abortion, stillbirth, or induced abortion⁽⁶⁾. The number of women get abortion care increased in thousands from 2013 to 2014, the abortion related complications reduced by half from 1998 to 2009, and the maternal mortality has decreased by more than half from 360 to 170 per 100,000 live births in the past decade in some countries⁽⁷⁾. Thirty percent of U.S. women will have a miscarriage before the age of 45⁽⁸⁾. The etiology of miscarriage are multiple ranging from genetic, infectious, structural, immunological, metabolic and the environmental factors⁽⁹⁾. Spontaneous abortion can diagnosed either when there has been a spontaneous removal of the fetus from the womb, or the fetus has died in the womb but has not been physically expelled⁽¹⁰⁾.

II. METHODOLOGY

Design of the Study: A descriptive case-control study Adopted in order to achieve the stated goals. The study began

from November 1st, 2016 until August, 2nd, 2017. Non-Probability (Purposive Sample) of (100) women was admitted to hospital suffering from spontaneous abortion a study group who were selected from emergency & maternal ward depending on diagnosis of managing doctor, and (100) healthy women as control group those who have delivery in maternal ward without history of abortion, both abortion and healthy women are involved in the sample of study. The researcher apply the following criteria in selecting the study sample:

- The age of the all participants between (18-45) years old.
- In case group only female factor spontaneous abortion is selected.
- In control group include women who have one or more child without previous history of miscarriage.

The study instrument is constructed by the researcher to identify the risk factors of spontaneous abortion. The complete instrument of study consists of (4) parts:

Part 1: Socio demographic Data:

This part consists of (8) items, which includes age, residency, level of education, type of family, occupational, socioeconomic status, body mass index and smoking.

Part 2: Reproductive characteristics:

This part consists of (12) items, which includes Family history of abortion, Type of present abortion, method of abortion termination, parity, gravidity, number of live children, number of still birth, number of abortion, interval between pregnancy, age at marriage, sexual activity and use of family planning method.

Part 3: medical and surgical History :

This part consists of (3) items, which includes item for chronic diseases such as (hypertension, kidney diseases, thyroid diseases, Congenital heart defect, Respiratory disease, Anemia, Toxoplasmosis, Rubella, Urinary tract infection, RH

incompatibility, Epilepsy, Cancer, Accident or trauma, Falls, Domestic violence), surgical history and type of surgical operation, item for reproductive health problem such as (endometritis, Congenital uterine anomalies, Cervicitis, vaginitis, and cervical incompetence).

Part 4: Anxiety :

This part consist of (15) question about anxiety answered by always get(1), sometimes get(2) and never get (3). To identify does anxiety effect on occurrence of spontaneous abortion.

Statistical Analysis

The following statistical data analysis approaches are used in order to analyze and asses the results of the study under application of statistical package (SPSS) version(19).

Adescriptive data analysis includes a. Tables (Frequencies, Percentages) [$\text{Percentages} = \frac{\text{Frequencies}}{\text{sample size}} * 100$] b. Mean of scores(M.S) C. Standard Deviation. d. Cornbach Alpha to estimate the internal consistency of study instrument. e. Statistical figure (Bar chart). and **Inferential Data Analysis** includes Chi-square test for testing the difference between study and control group.

Objective of the study:

The study aimed to identify risk factors associated with spontaneous abortion and To find out relationship between spontaneous abortion and other variables such as Demographic variables(Age, level of education) and Reproductive variables such as (gravida, parity).

III. RESULTS

Table (4-1) demographic characteristics of study sample:

Demographic data	Rating and intervals	Study group		Control group	
		Frequency	Percent	Frequency	Percent
Age / years	10-19	12	12	2	2
	20- 29	50	50	34	34
	30- 39	33	33	48	48
	40- 49	5	5	16	16
Residency	Rural	19	19	9	9
	Urban	81	81	91	91
Levels of education	Illiterate	18	18	11	11
	Able to Read and Write	14	14	6	6
	Primary School Graduated	28	28	23	23
	Secondary School Graduated	23	23	38	38
	Institute And More	17	17	22	22
Type of Family	Nuclear	42	42	53	53
	Extended	58	58	47	47
Occupation	Housewife	91	91	94	94
	Employee	9	9	6	6

Economic status	Adequate	65	65	70	70
	Adequate To Some Extent	29	29	26	26
	Inadequate	6	6	4	4
Body Mass Index	Underweight	1	1	34	34
	Normal	37	37	36	36
	Overweight	41	41	30	30
	Obese	21	21	34	34
Smoking	No	100	100	100	100

Table (4-1) shows that the majority of the study group participants are 20-29 years old(50%), urban residents(81%), primary school graduated(28%), living in an extended families(58%) , housewives(91%), have an adequate economic status(65%) , overweight(41%) , and non-smokers(100%). While for the control group participants , the study results indicate that the majority of the participants are 30- 39 years old(48%) , urban residents(91%) , secondary school graduated(38%) , living in a nuclear families(53%), housewives(94%) , have an adequate economic status(70%) , normal weight(36%) , and non-smokers(100%).

Table (4-2) reproductive characteristics of study sample:

Items	Rating and intervals	Study		Control	
		Frequency	Percent	Frequency	Percent
Gravidity	<= 3	62	62	72	72
	4 - 6	32	32	25	25
	7+	6	6	3	3
Parity	<= 3	33	33	72	72
	4 - 6	52	52	25	25
	7+	15	15	3	3
Number of still birth	No still birth	93	93	92	92
	1	6	6	7	7
	2	1	1	1	1
Number of lived children	No lived children	34	17.0	1	1
	1 - 3	26	63.0	73	73
	4 - 6	36	18.0	23	23
	7+	4	2.0	3	3
Family History of Abortion	Yes	29	29	33	33
	No	71	71	67	67
Number of abortion	1	59	59.0	0	0
	2	33	33.0	0	0
	3	7	7.0	0	0
	4	1	1.0	0	0
Type of abortion	Complete	20	20.0	0	0
	Incomplete	12	12.0	0	0
	Missed	58	58.0	0	0
	Threatened	10	10.0	0	0
Methods of termination of pregnancy	No	18	18	100	100
	Medical	3	3	0	0
	Surgical	79	79	0	0
Interval between pregnancy / years	Less than 2	58	58	47	47
	2 and more	42	42	53	53
Sexual activity / week	1-2	48	48	45	45
	3 and more	52	52	55	55
Age at marriage	11-15	7	7	1	1
	16 - 20	56	56	46	46
	21 - 25	34	34	41	41

	26+	3	3	12	12
Use of Family planning	Yes	36	36	49	49
	No	64	64	51	51

Table (4-2) shows that the majority of the study and control group , participants are have 3 and less than 3 gravidity(62%), 4-6 parity(52%) , have no still birth (93%) , have no family history of abortion(71%) , regarding number of present abortion the majority of study sample (59%) have one previous abortion, missed abortion (58%), regarding methods of pregnancy termination , the study results indicate that (79%)of study groups participants use surgical methods , while no one of the control group use the methods of pregnancy termination .In addition , (58%) of the study group are use of interval between pregnancyfor less than 2 years, while (53%) of the control group use 2 year & more . Also the majority of the control group and study groups participants are do 3 & more sexual activity per week(52%) , marry with age 16-20 years old(56%) , don't use family planning methods(64%).

Table (4-3) medical history of study sample:

Items	Rating and intervals	Study		Control	
		Frequency	Percent	Frequency	Percent
Hypertension	Yes	4	4	8	8
	No	96	96	92	92
Kidney diseases	Yes	1	1	1	1
	No	99	99	99	99
Diabetes mellitus	Yes	2	2	0	0
	No	98	98	100	100
Respiratory diseases	Yes	5	5	4	4
	No	95	95	96	96
Anemia	Yes	26	26	15	15
	No	74	74	85	85
Toxoplasmosis	Yes	12	12	0	0
	No	88	88	100	100
Urinary tract infections	Yes	23	23	7	7
	No	77	77	93	93
Rh incompatibility	Yes	3	3	0	0
	No	97	97	100	100
Accidents and injuries	Yes	5	5	0	0
	No	95	95	100	100
Fall	Yes	1	1	0	0
	No	99	99	100	100
Surgical history	Yes	29	29	29	29
	No	71	71	71	71
Operation type	CS	26	26	14	14
	Appendectomy	2	2	0	0
	Cholecystectomy	1	1	0	0
Congenital uterine anomalies	No	99	99	100	100
	Yes	1	1	0	0
Cervicitis	No	99	99	100	100
	Yes	1	1	0	0
Vaginitis	No	89	89	100	100
	Yes	11	11	0	0
Cervical incompetence	No	93	93	100	100
	Yes	7	7	0	0

Table (4-3) shows that the majority of the study and control groups participants don't exhibit medical history.

Table (4-4) association between the study subjects demographic data and their exhibition of abortion

demographic data	Rating and intervals	Study sample		Chi-square value	d.f.	p-value
		Study	Control			
Age / years	10-19	12	2	18.730	3	0.001 HS
	20.00 - 29.00	50	34			
	30.00 - 39.00	33	48			
	40-49	5	16			
Residency	Rural	19	9	4.153	1	0.042 S
	Urban	81	91			
Levels of education	Illiterate	18	11	9.709	4	0.046 S
	Able to read and write	14	6			
	Primary school graduated	28	23			
	Secondary school graduated	23	38			
	Institute of college	17	22			
Family type	Nuclear	42	53	2.426	1	0.119 NS
	Extended	58	47			
Occupation	Housewife	91	94	0.649	1	0.421 NS
	Employee	9	6			
Economic status	Adequate	65	70	0.749	2	0.688 NS
	Adequate to some extent	29	26			
	inadequate	6	4			
BMI	Obesity	1	0	3.040	3	0.386 NS
	Overweight	37	34			
	Normal	41	36			
	Underweight	21	30			

Table (4-4) shows that there is a significant association between the exhibition of abortion and the participants age , residency, and level of education . While there is a non- significant association with the others demographic data

Table (4-5) association between the study subjects reproductive history and their exhibition of abortion

Items	Rating and intervals	Study sample		Chi-square value	d.f.	p-value
		Study	Control			
Gravidity	<= 3	62	72	2.606	2	0.272 NS
	4 - 6	32	25			
	7+	6	3			
Parity	<= 3	33	72	32.071	2	0.001 HS
	4 - 6	52	25			
	7+	15	3			
Number of still birth	No	93	92	0.082	2	0.96 NS
	1	6	7			
	2	1	1			
Family History for Abortion	Yes	29	33	0.374	1	0.541 NS
	No	71	67			
Methods of termination of pregnancy	No	18	100	1.390	2	0.001 HS
	Medical	3	0			
	Surgical	79	0			
Pregnancy spacing / years	Less than 2	58	47	2.426	1	0.119 NS
	2 and more	42	53			
Sexual activity / week	1-2	48	45	0.181	1	0.671 NS
	3 and more	52	55			
Age of marriage	11-15	7	1	11.534	3	0.009

	16 - 20	56	46			HS
	21 - 25	34	41			
	26+	3	12			
Use of Family planning	Yes	36	49	3.458	1	0.063 NS
	No	64	51			

Table (4-5) shows that there is a high significant association between the exhibition of abortion and the number of parity, methods of pregnancy termination, and age at marriage. While there is a non-significant association with other reproductive history variables.

Table (4-6) association between the study subjects medical history and their exhibition of abortion

Items	Rating and intervals	groups		Chi-square value	d.f.	p-value
		Study	Control			
Hypertension	Yes	4	8	1.418	1	0.234 NS
	No	96	92			
Kidney diseases	Yes	1	1	.000	1	1 NS
	No	99	99			
Diabetes mellitus	Yes	2	0	2.020	1	0.155 NS
	No	98	100			
Respiratory diseases	Yes	5	4	.116	1	0.733 NS
	No	95	96			
Anemia	Yes	26	15	3.712	1	0.054 NS
	No	74	85			
Toxoplasmosis	Yes	12	0	12.766	1	0.001 HS
	No	88	100			
Urinary tract infections	Yes	23	7	10.039	1	0.002 HS
	No	77	93			
Rh incompatibility	Yes	3	0	3.046	1	0.081 NS
	No	97	100			
Accidents and injuries	Yes	5	0	5.128	1	0.024 S
	No	95	100			
Fall	Yes	1	0	1.005	1	0.316 NS
	No	99	100			
Surgical history	Yes	29	29	.000	1	1 NS
	No	71	71			
Operation type	CS	26	14	1.557	2	0.459 NS
	Appendectomy	2	0			
	Cholecystectomy	1	0			
Congenital uterine anomalies	No	99	100	56.929	1	0.001 HS
	Yes	1	0			
Cervicitis	No	99	100	56.929	1	0.001
	Yes	1	0			
Vaginitis	No	89	100	68.709	1	0.001
	Yes	11	0			
Cervical incompetence	No	93	100	60.188	1	0.001
	Yes	7	0			

Table (4-6) shows that there is a significant association between the exhibition of abortion and the toxoplasmosis ,urinary tract infection , accidents and injuries , congenital uterine anomalies, cervicitis, vaginitis, cervical incompetence. While there is a non-significant with other medical variables.

Table (4-7) Assessment of Study group for Anxiety

Items	m.s.	Std. dev.	RS%	Assessment
1-Are you afraid from death?	2.15	0.61	71.67	Moderate
2-Do you feel worried about your baby?	2.19	0.66	73	Moderate
3-Do you fear from died fetus?	2.54	0.64	84.67	Mild
4- Are you afraid from a deformed fetus?	2.93	0.29	97.67	Mild
5- Do you feel tired?	2.13	0.69	71	Moderate
6-Do you have a desire pregnancy?	1.69	0.73	56.33	Moderate
7-Are you Afraid about your health?	1.94	0.57	64.67	Moderate
8- Do you worry from pregnancy loss?	2.46	0.67	82	Mild
9-Are you worry from abortion or preterm labour?	2.54	0.64	84.67	Mild
10- Do you worry from other complications?	2.59	0.55	86.33	Mild
11-Are you worry from anesthesia complication?	2.74	0.48	91.33	Mild
12- Are you worry from job had effect on pregnancy?	2.86	0.45	95.33	Mild
13-Are you worry about the family future?	1.9	0.75	63.33	Moderate
14-Do have fear from the financial burden?	2.77	0.47	92.33	Mild
15-Are you worry about the gender of fetus?	2.54	0.58	84.67	Mild

N (100), m.s (2), cut off point (0.66), mild (mean of scores more than 2.33), moderate (mean of scores 1.67-2.33), severe (mean of scores 1-1.66).

Table (4-7) shows that the majority of the study group participants are suffering from mild anxiety at all items except at the items number (1,2,5,6,7,&13) their anxiety level is moderate.

Table (4-8) Overall Assessment of Study group for Anxiety

Main domain	Levels	Frequency	Percent	M.S.	Assessment
Overall assessment of anxiety	Mild	61	61.0	2.39	Mild
	Moderate	37	37.0		
	Severs	2	2.0		
	Total	100	100.0		

N (100), m.s (2), cut off point (0.66), mild (mean of scores more than 2.33), moderate (mean of scores 1.67-2.33), severe (mean of scores 1-1.66).

Table(4-8)shows that the (61%)of the study group participants are exhibit mild anxiety.

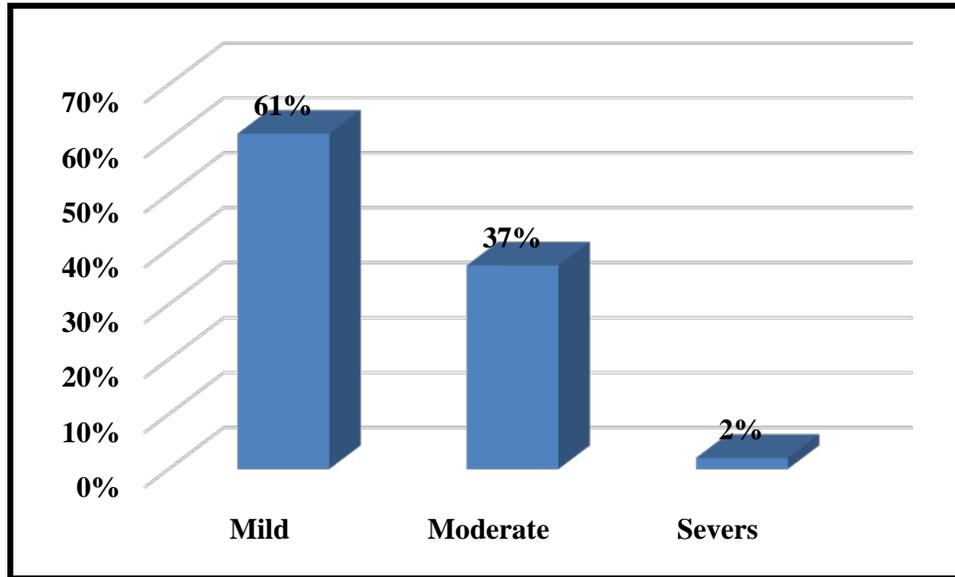


Figure (4-1) Overall Assessment of Study group for Anxiety

Table (4-9) Assessment of control group for Anxiety

Items	m.s.	Std. dev.	RS%	Assessment
1-Are you afraid from death?	1.98	0.14	66	moderate
2-Do you feel worried about your baby?	1.9	0.59	63.33	moderate
3-Do you fear from died fetus?	2.3	0.59	76.67	moderate
4- Are you afraid from a deformed fetus?	2.89	0.37	96.33	mild
5- Do you feel tired?	2.97	0.17	99	mild
6-Do you have a desire pregnancy?	2.27	0.6	75.67	moderate
7-Are you Afraid about your health?	1.81	0.73	60.33	moderate
8- Do you worry from pregnancy loss?	2.03	0.58	67.67	moderate
9-Are you worry from abortion or preterm labour?	2.91	0.29	97	mild
10- Do you worry from other complications?	2.91	0.29	97	mild
11-Are you worry from anesthesia complication?	2.87	0.34	95.67	mild
12- Are you worry from job had effect on pregnancy?	2.95	0.22	98.33	mild
13-Are you worry about the family future?	2.95	0.26	98.33	mild
14-Do have fear from the financial burden?	1.48	0.66	49.33	severe
15-Are you worry about the gender of fetus?	2.85	0.36	95	mild

N (100), m.s (2), cut off point (0.66), mild (mean of scores more than 2.33), moderate (mean of scores 1.67-2.33), severe (mean of scores 1-1.66).

Table (4-9) shows that the assessment of anxiety levels among control group participants is mild at all items , except at the items number (1,2,3,6,7,&8) the participants anxiety level is moderate , while at the item number (14) their anxiety level is severe.

Table (4-10) Overall Assessment of control group for Anxiety

Main domain	Levels	Frequency	Percent	M.S.	Assessment
Overall assessment of anxiety	Mild	76	76.0	2.49	Mild
	Moderate	24	24.0		
	Severs	0	0		
	Total	100	100.0		

N (100), m. s. (2), cut off point (0.66), mild (mean of scores more than 2.33), moderate (mean of scores 1.67-2.33), severe (mean of scores 1-1.66).

Table(4-10) shows that the majority of control group participants (76%) are suffering from mild anxiety.

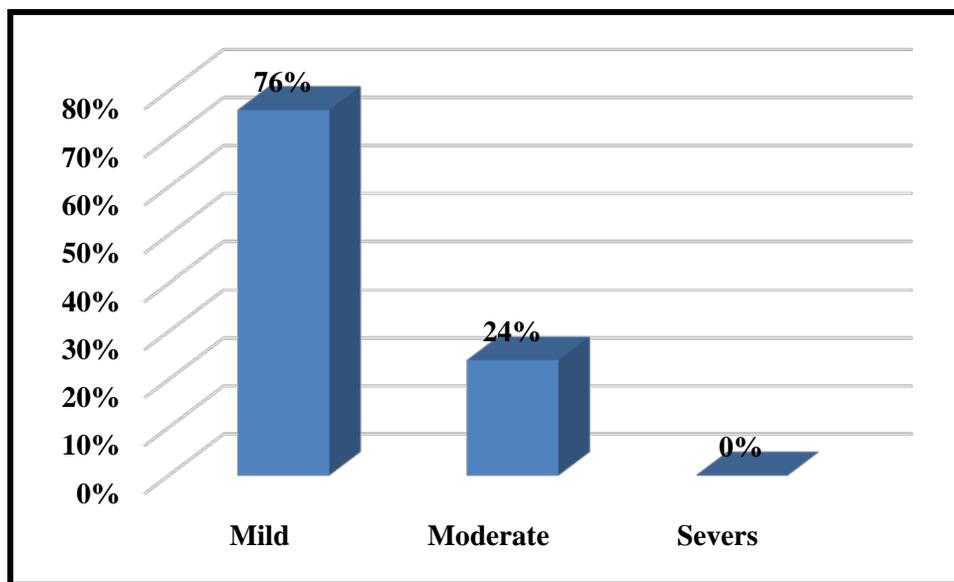


Figure (4-2) Overall Assessment of control group for Anxiety

Table (4-11) Mean Differences between the study an control groups anxiety levels

Main Domain	Groups	Mean	Std. Deviation	T-Value	D.F.	P-Value
Anxiety Levels	Study	2.39	0.32	2.56	198	0.011 S
	Control	2.49	0.18			

S(significant at p-value less than 0.05).

Table (4-11) shows that there is a significant differences between the study & control groups anxiety levels . With respect to the mean difference this table indicate that the study group exhibit anxiety more than those in control groups.

IV. DISCUSSION

Concerning to table (4-1) the results shows that the most of study group age (20-29) years old . this result supported with the result of a study conducted by **Kamble and Banerjee (2017)**, which found that the age of women even in their early age (20 to 30 years) associated with miscarriage because women in this age

are suffers from physical, emotional and social trauma that are associated with miscarriage .

Relative to the residency, the present study shows that the majority of study group and control group are living in urban residential area, This result matches with the result of **Ameen and Tawfeeq (2015)**, in their study when comparison between rural and urban results of pregnancy outcome showed spontaneous miscarriage was higher in urban than in rural area.

About educational level, the present study indicates that the majority of study group are primary school graduated, while in control group the highest percentage of sample were secondary school graduated .This results supported by **Zheng et al.,(2017)**, their study was found "educational attainment were inversely associated with the risk of spontaneous abortion" when they

"Compared with women in low educational attainment, women in higher educational attainment had a lower prevalence of SA".

Regarding to the type of family, the majority of study are living in an extended families. while the majority of control group live in a nuclear families. This results disagree with **Catak et al.,(2016)**, in their study found the majority of study and control group are living in a nuclear family. This due to in Iraqi society, the individuals are often lived in extended families due to the social, economic and may be due to the security factors.

Relative to housewives the majority of both study and control groups are housewives this results agree with **Fadhil,(2014)**, reported in her study that the majority of the sample are "Housewife", and they accounted for 160 (80.0%) of the total sample.

Regarding to the socio-economic status, high percentage of both study and control groups were withan adequate economic status . This results supported by **Zheng et al.,(2017)**, their findings indicate that the majority of the study participants are present with an adequate economic status.

Relative to theoverweight, in the present study most of study group are overweight. This resultsagreement with**Rittenberg et al.,(2011)** In their study, found 41% of women included were either overweight or obese and these can lead to occurrence of SA .

Concerning to smoking, in this study both study and control group are non-smoker. This results supported by **Huan et al .,(2016)**,in their study shows that the majority of study group are non-smoking. In addition, the cultural and social factors make a number of barriers prevent the female from experiencing of smoking as compared with male in our society. Furthermore, the awareness about the health problems associated with the smoking may plays an important role in decreasing the females interesting in smoking, smoking can lead to SA.

According to (table 4-2):The study results shows that the majority of the study and control groups' participants have three and less than three gravidity, 4-6 parity, These results supported by **Nilsson, et al., 2014**, they studied "the risk factors for miscarriage from a prevention perspective", their results indicate that the majority of the study subjects are multigravida and multipara, so multigravida and multipara lead to weakness in the uterus and cervix this can lead to SA .

Regarding to the number of still birth, the present study show high percentage of study group have no still births. This result agree with **Khalil et al., (2013)**, in their study found the majority of their study are have still births.

Also the study results shows that the majority of study and control group have no family history of abortion. This results agreement with**Huan et al .,(2016)**, in their study found that the majority of their study have no family history of abortion.

Regarding to number of present abortion, the present study show the majority of study sample have one previous abortion. This result agree with **Fadhil,(2014)**, reported in her study thatthe majority of the sample was reported at "previous one abortion", and they are accounted 105(52.5%) of the study sample.

Also the study results showed that the majority of study group have missed abortion. This result agree with **Fadhil,(2014)**, her study shows the majority of study sample have missed abortion.

Regarding to the methods of pregnancy termination , the study results indicate that the majority of study group participants use surgical methods for abortion management. this results supported by **Adeniran et al.,(2015)**,their study shows the majority of study are managing with surgical management this was because majority of the patients presented with significant vaginal bleeding.

[1] In addition , the study results shows that the majority of the study group are use of interval between pregnancyfor less than 2 years, while the majority of the control group use 2 year & more. This results disagree with **Poorolajal, et al., (2014)**, in their study found that the majority of study group and control group are use ≥ 3 interval between pregnancy.

And the majority of the study and control groups participants are do 3 & more sexual activity per week. This result supported by **Pauletaet al.,(2010)**, that reported in there study "most frequent period of sexual intercourse in the first trimester was (44.7%)".

Relative to age at marriage the present study shows that the majority of study group are marry with age 16-20 years old . This results supported by **Shamshad et al.,(2016)**, in their study found the majority of study married with were below 18 yearsbecause of early teenage marriage their age, "very young mothers place into a high risky category as they are biologically and psychologically immature". In addition in Iraq most familiespreferred early marriage because of socioeconomic position and traditions in country.

About family planning the majority of study sample don't use family planning methods. this results disagree with **Catak et al.,(2016)**, they found in their study the majority of study and control group are use family planning method.

Concerning to table (4-3) the present study shows that the majority of the study and control groups participants don't exhibit medical history. This results in present study disagree with **Adel and Abdul. Razzaq,(2013)**, that found in their study highest percentage of medical factors contributed to spontaneous abortion.

Table (4-4) the present study shows that there is a significant association between the exhibition of spontaneous abortion and the participants age , residency, and level of education. While there is a non- significant association with the others demographic data. This results disagree with**Adel et al.,(2015)**,their study concluded that there was no association between spontaneousabortion and any of the socio-demographic characteristics.

Relative to table (4-5) the results shows that there is a high significant association between the exhibition of abortion and the number of parity, methods of pregnancy termination , and age at marriage . While there is a non-significant association with other reproductive history variables.

Concerning to number of parity, in this table found there is a high significant association between the exhibition of abortion and the number of parity. This result comes along with **Kareem, 2012**, he found in his study show a strong relationship between parity and spontaneous abortion.

Also table (4-5) the results shows that there is a high significant association between the exhibition of abortion and methods of pregnancy termination. This result supported by

Carthy et al.,(2013), they found in their study "women managed with surgical method have an increased risk of having a pregnancy complicated".

Concerning to age at marriage table (4-5) the results shows that there is a high significant association between the exhibition of abortion and age at marriage. This result supported by **Shamshad, et al., 2016**, they stated that Early teenage marriage is replete with problems during the pregnancy period. Because of their age, very young mothers place into a high-risky category, as they are "biologically and psychologically immature". Women who marry before 18 years and with their blood relatives stay at high risk of spontaneous abortion, fetal death and infant mortality during the childbearing period. Moreover, early marriage minimize short the woman's education and employment chances. It burdens the girl with continual pregnancy, childbearing and excessive responsibilities at an immature age. These additional factors increase the impact of early age marriage upon the pregnancy outcome of these women.

About medical and reproductive history table (4-6) the results shows that there is a significant association between the exhibition of abortion and the toxoplasmosis ,urinary tract infection , accidents and injuries , congenital uterine anomalies, cervicitis, vaginitis, cervical incompetence, and placental disease. While there is a non-significant with other medical variables.

Concerning to toxoplasmosis infection in this table found a significant association between the exhibition of spontaneous abortion and the toxoplasmosis. This result disagree with **Saki et al., (2015)**in their study showed "no significant difference between the case and control groups in IgG anti-Toxoplasma antibody but detected one sample with IgM antibodies in woman with abortion during the first trimester of pregnancy".

Also the study results shows that there is a significant association between the exhibition of spontaneous abortion accidents and injuries. This result disagree with **Jibril et al.,(2014)**, in their study shows no significant associated between spontaneous abortion accidents and trauma due to they found a small number of woman exhibit to trauma or accident during first trimester.

Regarding to uterine anomalies the study result shows that there is a significant association between thecongenital uterine anomalies and spontaneous abortion. this result comes along with**Chan et al .,(2011)**, they found in their study "uterine defects were associated with reduced clinical pregnancy rates and increased rates of first-trimester miscarriage".

In addition; the study result shows that there is a significant association between the vaginitis, cervicitis and genital infection and spontaneous abortion. This result agree with **Giakoumelou et al.,(2016)**, reported in their study "The association of vaginal infection with bacterial vaginosis, with increased risk of miscarriage has been demonstrated".

About the cervical incompetence present study shows a significant association between thecervical incompetence and occurrence of spontaneous abortion. This result supported with **Carthy et al.,(3013)**, that reported in their study"Women with a previous miscarriage or termination managed by cervical dilatation and curettage had an increased risk of having a pregnancy complicated".This due to dilatation and curettage cause cervical dilated. Also women with age more than 35 and

those who have high number of parity they having cervical problems and pregnancy complication.

Regarding the effect of the anxiety on the occurrence of spontaneous abortion, the present study indicates the study results show that there is a significant difference between the study & control groups' anxiety levels. With respect to the mean difference this table indicate that the study group exhibit anxiety more than those in control groups. **Maconochie, et al.,(2006)**;**Wainstock et al.,(2013)**.,they studied the stress during pregnancy between two group as a case control and they find that "the psychological stress and anxiety are participated and increase risk the occurrence of abortion".

V. ETHICAL CONSIDERATION

This is one of the most basic principles before gathering the data, to keep the patient's values and self-respect. The researcher achieved this agreement from the Ethical committee at the Faculty of Nursing / University of Kufa (Appendix-B). The researcher promised to keep the patient's information confidential, and use these data for this study only then he explained the purpose of this study to each participant without affecting the routine visiting and care. In addition to above the researcher told each participant that this is voluntary work, and they can leave any time even the interview process is not completed.

VI. CONCLUSIONS

According to the study findings and discussion, the study concluded the following:

1. Half of study sample (50%) women range between age (20-29) years and (81%) urban residents and (28%) primary school graduated are high risky for miscarriage.
2. Increase parity number and age at marriage (16-20) years are high risk of miscarriage.
3. Infection like (toxoplasmosis ,urinary tract infection, cervicitis and vaginitis), cervical incompetence, congenital uterine anomalies and placenta problems, accidents and injuries are risk factors for spontaneous abortion.
4. There is a significant differences between the study &control groups in anxiety levels , anxiety during pregnancy is a risk factor associated with spontaneous abortion.

VII. RECOMMENDATIONS

Based on the study results discussion and conclusions the study recommended that:

1. An education programs should applied by the ministry of higher education and scientific research and the ministry of health to increase the population awareness about the risk factors of spontaneous abortion and how manage this factors .
2. Activate the nurses role in health education for women about the impact of the reproductive disorders on the reproductive health and the outcomes of pregnancy .
3. Mass media should utilize to educate the population about the risk factors of spontaneous abortion and the appropriate management for this factors.

Effectiveness of an Educational Program on Nurses' Knowledge about Management of Children with Nephrotic Syndrome in Nephrology Units at Al-Najaf Teaching Hospitals

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Abstract- Objectives: To assess the effectiveness of educational program on nurse's knowledge about management of children with nephrotic syndrome at Nephrology units.

Methodology: A quasi-experimental design study has been carried out in Al-Najaf City/Al-Najaf Al-Ashraf Health Directorate / Al-Sadder Medical City and AL-Zahra Teaching Hospital from November 1st, 2016 to 1st July, 2017. The educational program and the questionnaire format were constructed by the researcher to reach the purpose of the study. Purposive sample was conducted on 30 nurses divided into two groups: study group consisted of 15 nurses which exposed to the educational program and the control group consisted of 15 nurses were not exposed to the program. Reliability of instrument is determined through the use of test and re-test, and the instrument validity is determined through a panel of experts. The data were analyzed through the use of the descriptive and inferential analysis statistical methods.

Result: The study indicated that the effectiveness of educational program regarding nurses' knowledge about management of children with nephrotic syndrome was clearly positive with good development of high significant difference of the study group in pre and post-test at all items related to management of children with nephrotic syndrome.

Conclusion: The study concluded that the educational program was suitable and effective to improve the nurses' knowledge about management of children with nephrotic syndrome. Moreover, the study concludes that most nurses in nephrology units had insufficient knowledge regarding to management of children with nephrotic syndrome.

Recommendation: The study recommends to encourage nurses to be involved in special training courses and constructed educational pamphlets regarding the nephrotic syndrome disease and its management particularly in children in order to improve their knowledge.

Index Terms- Effectiveness, Educational program, Nurses' Knowledge, Management, Children with nephrotic syndrome.

I. INTRODUCTION

Nephrotic syndrome is an acquired disorder responsible for alterations in renal function if left untreated. This disorder may lead to renal failure even when treated appropriately.

Sometimes, appropriate response is not achieved and acute or chronic renal failure develops^(1,2).

Children with too much protein in their urine, sudden weight gain, and swelling in various body parts could have a condition called nephrotic syndrome. Childhood nephrotic syndrome is also called nephrosis⁽³⁾. All forms of nephrotic have early characteristics of edema and proteinuria, therefore, definite clinical differentiation cannot be made early in this disease. Nephrotic syndrome has a course of remissions and exacerbations that usually lasts for months. The recovery rate is generally good with the use of intensive steroid therapy and protection against infection⁽⁴⁾. Nursing care management is important for continuous monitoring of fluid retention or excretion that is an important nursing function. Strict intake and output records are essential but may be difficult to obtain from very young children. There are other methods of monitoring progress include urine analysis for albumin, daily weight, and measurement of abdominal girth⁽⁵⁾.

The important nursing role of the child with nephrotic syndrome includes observation of the child and his family during hospitalization, monitoring of vital signs, giving medications, making balance sheet between fluid intake and fluid output, daily urine analysis and teaching of child and his family treatment program and support to the children and their parents⁽⁶⁾.

Objectives the Study: -

1. To assess nurses' knowledge about children with nephrotic syndrome.
2. To determine the effect of educational program by comparing the pre-test and post-test score on nurses' knowledge toward management children with nephrotic syndrome.

Methodology:

Design of the study: A quasi experimental study.

Study Sample: Purposive sample consists of 30 nurses, divided in two groups (study group and control group). The study group was 15 nurses exposed to nursing education program, and the control group also were 15 nurses not exposed to the program.

Setting of the Study: Al-Najaf City/Al-Najaf Al-Ashraf Health Directorate / Al-Sadder Medical City (specialized center for kidney transplantation and nephrology disease) and Al-

Zahra'a teaching hospitals (nephrology units) , from 1st November to 1st July .

Instrument: The researcher constructs a questionnaire format in order to reach the aims of the study. It consists of two parts:

Part I: Self-administered questionnaire format related to demographic characteristics of nurses:

This part is concerned with the collection of basic socio-demographic data that are related to nurses (age, gender, residency, marital status, , education level, years of experience in nephrology units and number of training courses in nephrology disease).

Part II: Self-administered questionnaire format associated with (nurses knowledge about management of children with nephrotic syndrome) .

It was constructed to assess nurses' knowledge about management of children with nephrotic syndrome that is completed by the involved nurses. The knowledge test (within the questionnaire) composed from (26) items of multiple choice questions. Each question is scored as the correct answer get (2) point and the incorrect answer get (1) point.

Validity of the Questionnaire and the Program:

The content validity of the program and the study instruments are determined by the panel of (14) experts, who were skillful in their field to investigate the content of the educational program and questionnaire about management of children with nephrotic syndrome.

Reliability of the Instrument: (10) nurses who were selected from the nephrology units in Al-Sadder Medical City and Al-Zahra'a teaching hospitals for management children with Ns by test –retest revealed that (r =0.81) .

Statistical methods: The analysis of the data was used of spss ver.23, and descriptive statistics (frequencies, percentages, mean and standard deviations) and statistical inferential (t- test) in order to find the differences between the study group and the control group.

Result

Table (1): Distribution of the Study and Control Groups according to Demographic Data with Comparison Difference

Demographic data	Rating And Intervals	study		control	
		Freq.	Percent	Freq.	Percent
Age groups (years)	20-30	14	93.9	9	60%
	31-39	1	6.7%	3	20%
	40 and more	0	0%	3	20%
	Mean ± SD	25.79 ± 3.332		30.67 ± 7.49	
Gender	Male	5	33.3%	9	60.0%
	Female	10	66.7%	6	40.0%
Residence area	Urban	15	100.0%	13	86.7%
	Rural	0	0.0%	2	13.3%
Marital status	Single	9	60.0%	2	13.3%

	Married	6	40.0%	13	86.7%
	Divorced	0	0.0%	0	0.0%
	Widowed	0	0.0%	0	0.0%
	Separated	0	0.0%	0	0.0%
Educational level	Nursing School Graduate	3	20.0%	3	20.0%
	Nursing Institute Graduate	6	40.0%	8	53.3%
	Nursing College Graduate	6	40.0%	4	26.7%
	Postgraduate	0	0.0%	0	0.0%
Years of experience in nephrology units	1- 2	10	66.7%	8	53.3%
	3 - 6	4	26.7%	2	13.3%
	7 Up	1	6.7%	5	33.3%
	Mean ± SD	2.64 ± 2.098		3.93 ± 3.058	
Number of training courses in nephrology disease	No participation	7		5	
	1- 2	4	50.0%	4	40.0%
	3 - 6	4	50.0%	4	40.0%
	7 Up	0	0.0%	2	20.0%
Total		15	100%	15	100%

Freq. : Frequency , SD: standard deviation

Table (1) shows that mean of the study age group was (25.79 years) and the mean of control group was (30.67 years). In addition, it shows that high percentages of females participant in study group (66.7%) while the control group were higher among male participants percentage (60%) . Regarding residency, (100%) of the study group and (86.7%) of the control group were from urban residence area . Concerning the marital status, (60%) of the study group, and (86.7%) of control group were married. Regarding level of the education, (40%) of the study group were graduated from nursing institute and nursing college , while (53.3%) of the control group were institute graduated. In addition, the study results reveals the mean of their experience years at nephrology units was (2.64 years) among the study group with (50%) in (1-2) and (3-6) training courses in nephrology diseases. But mean of the experience years among the control group was (3.93years) with (40%) in (1-2) and (3-6) training courses in nephrology disease.

Table (2): Distribution the Study Group according to their overall Knowledge

Main Domain		Pre-test				Post-test			
		Freq.	%	M.S	Ass.	Freq.	%	M.S	Ass.
Overall knowledge	Poor	11	73.3%	1.27	Poor	4	26.7%	1.73	Good
	Good	4	26.7%			11	73.3%		
	Total	15	100%			15	100%		

M.s : mean of score(1.5) , Freq. : Frequency % : percent , Ass. : Assessment

Table (2) reveals that distribution of the study group through pre and post - test was poor knowledge with (1.27) mean of score in pre –test whereas in post-test was good knowledge with (1.73) mean of score.

Table 3: Distribution of the Control Group according to their overall Knowledge

Main Domain		Pre-test				Post-test			
		Freq.	%	M.S	Ass.	Freq.	%	M.S	Ass.
Overall knowledge	Poor	11	73.3%	1.27	Poor	14	93.3%	1.07	Poor
	Good	4	26.7%			1	6.7%		
	Total	15	100%			15	100%		

M.s : mean of score(1.5) , Freq. : Frequency % : percent , Ass. : Assessment

Table (3) expresses the distribution of the control group at pre and post -test was poor knowledge level, with mean of score (1.27) at pre -test and (1.07) at post-test .

Table (4): Statistical comparison of the knowledge between pre and post in study and control group by using paired t test.

		No.	Mean ± SD	T .Value	d.f	Sig. (2-tailed)
Study	pre	15	1.27 ± 0.458	3.5	14	0.004 (HS)
	post	15	1.73 ± 0.458			
Control	pre	15	1.27 ± 0.458	1.871	14	0.082 (NS)
	post	15	1.07 ± 0.258			
Total		30			28	

T-value (paired t-test value), d .f : degree of freedom ,NS (non-significant difference at p-value more than 0.05),HS (high-significant difference at p-value less than 0.05) , SD: standard deviation

Table (4) reveals that the distribution of study group through pre and post - test was highly and significantly different between nurses' knowledge, in pre-test and post-test at p- value (0.004), while the control group at pre and post -test was not-significant between nurses' knowledge at p- value (0.082).

II. DISCUSSIONS

The majority of the study sample (control and study) groups agewere at (20-30) years. This result agrees with the result of (7) who found that the majority of the study subjects age were between (20-29) years old. The study subjects were abundant females percentages in the study group that approved

with(8). But their results were disagreed with control group results of the present study with high male percentages . The present study shows that the majority of study sample were from urban area due to their work in critical care units (nephrology unit). The present study reveals that the single nurses have highest percentages (60%) in the study group this result is approved with (9), who indicated that the higher percentage (86.8 %) were single but the married was (12.9%). But the control group had higher percentage (86.7%) of married nurses that accepted by (10) who pointed in their study that the highest percentage were married .The highest percentage (40%) was among the study group (graduated from nursing institutes and nursing college), while the control group has the highest percentage (53.3%) of graduated from nursing institute. These results agreed by (8) who found that the high percentage majority of the study subjects were graduated from nursing institute in the study sample in one hand while in other hands disagreed with high percentage of the study group who was graduated from nursing college .According to years of nurses experience in nephrology units, the study results revealed that the majority of nurses in study and control groups were between (1-2) years of experience, that is supported by the study of (8), who indicated that higher percentage of study sample were between (1-10) years of experience in nephrology units.The present study found that (50%) of the study group had (1-2) , (3-6) training courses. While (40%) of the control group had (1-2) and (3-6) courses . These results disagree with (6)results who reported that (66%) of them did not attend any training programs in care of children with nephrotic syndrome while (34%) of nurses have training courses.Whereas , (6)study revealed that the majority of nurses has poor knowledge and incompetent practices skills as regarding care of children with nephrotic syndrome. There is not any kind of educational program about disease and training courses to nursing staff that agree with results of the present study sample .These tables shows nurses knowledge concerning nursing management for children with nephrotic

syndrome in the study group had been improved after involved in educational program that indicated with a significant difference between pre-test and post-test results, that supported by the study of ⁽¹¹⁾, Nurses' knowledge and performance toward children with nephrotic syndrome improved significantly post and at follow up implementation of nursing protocol, and ⁽¹²⁾ who indicated that there is a high significant difference between pre-posttest. Also the researcher confirms that the nurses knowledge among the control group didn't changed in post -test, and stabilized in all their knowledge measures. This was in agreement with ⁽¹¹⁾, "who indicated that most of nurses' knowledge had unsatisfactory about nephrotic syndrome; the most of nurses' performance had incompetent regarding to nephrotic syndrome. This study recommended that periodically educational training programs for nurses to help them to improve their performance for management of children with nephrotic syndrome in the pediatric nephrology units to alienate and reduce the complications of nephrotic .

III. CONCLUSION

The study concluded that the Nurses' knowledge among the study group were improved in their management of children with nephrotic syndrome at post –test after educational program. While, the control group didn't improved their knowledge among nephrotic syndrome at post-test because they didn't enrolled in the educational program .

IV. RECOMMENDATION

1. Emphases should be done on nurses working in nephrology units to be enrolled in an educational program about nephrology diseases and management with more regular training sessions to improve their knowledge about nephrotic syndrome in children.
2. Constructed of an educational pamphlets or posters regarding the nephrotic syndrome disease and its management particularly in children.

REFERENCES

- [1] Samuel, S., Scott, S., Morgan, C., Dart, A., Mammen, C., Parekh, R., ... & Wade, A. (2014). The canadian childhood nephrotic syndrome (CHILDNEPH) project: overview of design and methods. *Canadian journal of kidney health and disease*, 1(1), 17.
- [2] Kyle ,T. ; Carman, S. : **Essentials of pediatric nursing** ,2nd ed., Wolters Kluwer Health | Lippincott Williams & Wilkins,China, 2013, pp. 967-970.
- [3] National Kidney Foundation .(2016). Childhood nephrotic syndrome, available from <https://www.kidney.org/atoz/content/childns>.
- [4] Hatfield, N. T. : **Broadribb's introductory pediatric nursing**, 7th ed., Lippincott Williams & Wilkins, china, 2008, pp. 500-503 .
- [5] Hockenberry, M.J. & Wilson D. : **Wong's nursing care of infants and children**, 9th ed., Elsevier Mosby ,United States of America , 2013,pp. 912 – 915.
- [6] Sadky, F.S.(2010).Assessment Of Nurses Knowledge And Skills About Nephrotic Syndrome In Children, Benha University, master thesis . available from <http://www.bu.edu.eg/portal/index.php?act=143&thesisID=18195>.
- [7] Kahrman, I., Bostan, S. (2017). Problems Related to Nursing Services at the Department of Pediatrics ,*Journal of Nursing and Health Sciences*, 3(1), 46-56.
- [8] Mukhlif , A.A. , Hattab, K. M. (2016). Assessment of Nurses' Knowledge and Practices toward Children with Nephrotic Syndrome at Pediatric Teaching Hospitals in Baghdad City, *International Journal of Scientific and Research Publications*, 8(6), 2250-3153.
- [9] Prem, V., Karvannan, H., Kumar, S. P., Karthikbabu, S., Syed, N., Sisodia, V., & Jaykumar, S. (2012). Study of nurses' knowledge about palliative care: a quantitative cross-sectional survey. *Indian journal of palliative care*, 18(2), 122.
- [10] Abd, A. H., Ahmad, A. R., & Zaky, F.(2012). Assessment of Nurses' Knowledge and Practice Related to Nursing Care of Children Undergoing Hemodialysis at Assiut City.
- [11] Hassan , E.M. (2014). Developing Clinical Protocol for Nursing Practice: Improving Care of Children with Nephrotic Syndrome, Faculty of Nursing Ain Shams University, dissertation.
- [12] Chun-yan, L. (2011). Effect of nursing intervention on nephrotic syndrome in children ,*Hainan Medical Journal*. Available from www.cnki.com.cn.

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Rooting and acclimatization of *in vitro* raised plantlets of guava cv. Allahabad safeda

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Abstract

In the present investigation the effort was made to develop an efficient protocol for rooting and acclimatization of *in vitro* raised plantlets of guava cv. Allahabad safeda. *In vitro* plantlets were generated through nodal segment explant using 1.0 mg/l BA + 0.25 mg/l GA₃ in MS medium. Maximum rooting (83.4%) and length of root/shoot (7.5 cm) and minimum days to root initiation (8.0 day) was observed in full strength of MS medium supplemented with 0.4 mg/l IBA. While, maximum length of shoots (8.1 cm) and maximum number of roots (5.52) were observed in treatment (Full MS + 0.2 mg/l IBA) followed by treatment ½ MS + 0.2 mg/l IBA. The plantlets grown in potting mixture containing vermicompost + soil (1:1v/v) showed better survival of plantlet (90.00 %). Survival of plantlets and growth of plantlets were significantly influenced by different climate conditions. Maximum survival of plantlets (86.79 %) and length of shoot was maximum (9.33 cm) was reported in net house condition.

Keywords: *In vitro*, Rooting, Acclimatization and Explants

Introduction

Guava (*Psidium guajava* L.) is one of the important fruit crop of the Indian subcontinent and serves as staple food in many countries (Amin and Jaiswal, 1987). Guava fruit is one of the richest natural sources of vitamin C and good source of calcium, phosphorus, iron, dilatory fibres and pectin. The major guava growing states in the country are Uttar Pradesh, Bihar, Madhya Pradesh, Karnataka, Andhra Pradesh, Maharashtra, Gujarat and Chhattisgarh. In Uttar Pradesh, Allahabad district is well known for producing best quality guava in the world (Radha and Mathew, 2007). In general guava is propagated by vegetatively through budding, inarching, veneer grafting, and air layering. However, multiplication rate is slow and difficult to propagate vegetatively on large scale from better genotype. Although, careful realization of treatments against pest, diseases, fungus, bacterial and virus infection cannot be prevented totally. *In vitro* propagation has become a rapidly expanding reality as is now evident from the number of species being successfully propagated through this technique. This has emerged as a potential means of rapid vegetative propagation of plants which can go a long way in solving many problems in fruit crops. *In vitro* propagation technique has increased rate of multiplication, disease free uniform propagals, rapid selection and multiplication of elite genotypes and year round availability of planting materials. *In vitro* shoot multiplication and proliferation of guava has been successfully demonstrated by many workers i.e. (Amin and Jaiswal, 1987; Joshee *et al*; 2002; Ali *et al*; 2003; and Kumar *et al*; 2006) by using shoot tip and nodal segment explants. However, *in vitro* rooting and acclimatization of plantlets remains a crucial step for success of tissue culture protocols of guava. Acclimatization of *in vitro* plantlets is one of the least explored avenues (Bajpai *et al*; 2003). The ultimate goal of *in vitro* plant propagation is to obtain a large scale of plantlets in a short period of time with high survival rate. High mortality of *in vitro* raised plants during transfer from laboratory to field is a major limitation in large scale application of micro propagation technology. *In vitro* raised plantlets are susceptible to transplantation shocks that cause high mortality during the final stage of micro propagation (Dhawan and Bhojwani, 1986). Acclimatization is essential in the case of *in vitro* produced plantlets as these are not able to adopt directly *in vivo* conditions (Brainerd and Fuchigami, 1981). The success in acclimatization of *in vitro* produced plantlets is mainly dependent upon not only the post-transfer growth conditions but also the pre-transfer culture conditions (Ziv, 1986). *In vitro* plantlets are very poorly adopted to resist the low humidity, high light levels and more variable temperatures prevailing outside (Wainwright, 1988). Thus, light, temperature and relative humidity are the major factors to be controlled during acclimatization to natural environment. Physical, chemical and biological properties of the potting mixtures are also important in the establishment of *in vitro* produced plantlets. However, the survival of *in vitro* plantlets also depends upon the potting mixture used for raising *in vitro* plantlets under greenhouse condition. A few reports are available on *in vitro* rooting and acclimatization in Guava var. Allahabad Safeda. Hence, the present investigation has been under taken to standardize the rooting and acclimatization procedure of *in vitro* raised plantlets of guava from nodal segment explants.

Materials and methods

Plant material and culture condition: Present experiment was conducted at biotechnology laboratory Aspee college of horticulture and forestry, Navsari Gujarat. *In vitro* plantlets were generated by using nodal segment explants from four to five year mature mother plant of guava var. Allahabad Safeda. Surface sterilization of explants was made using 0.1 % mercuric chloride solution for five minutes. Proliferated shoots obtained on MS (Murashige and Skoog, 1962) medium containing with 1.0 mg/l BA + 0.25 mg/l GA₃ with 3% sucrose from nodal segments were used for rooting study. For rooting, ½ MS, MS and White media

with different concentration (0.1, 0.2 and 0.4 mg/l) of both IBA and IAA were tested for root induction. *In vitro* raised plantlets having three to four roots and six leaves were taken out from bottle. The roots were washed thoroughly in tap water to remove adhering agar. Then, plantlets were transplanted in plastic cup containing different types of potting mixtures viz. vermicompost, soil, cocopeat, vermicompost: soil (1:1 v/v) and FYM: soil (1:1 v/v).

Acclimatization of rooted plantlets: Plantlets in cup were covered with plastic cup continuously for one week and kept in air conditioned room. The cover was gradually removed after seven days, initially for three hours followed by six hours and twelve hours in next three days. The cover was removed during night and lights put-off for next three to four days. Subsequently, the period of keeping the plantlets without any cover was gradually increased. Then, after two weeks they were brought in to different climate condition i.e. net house, air condition room, and low tunnel net house for *ex vitro* hardening. Plants were kept in individually as well as in group. Each treatment was replicated three times.

Statistical analysis

Experiments were set up in the (CRD) completely randomized design and repeated three times, each treatment consisted of 50 explants and the means separation were done according to Least Significant Differences (LSD) at 5% level (Panse, and Sukhatme, 1985).

Results and discussion

***In vitro* root induction:** The data on rooting response to different levels of IBA and IAA on half and full strength of MS and White medium are presented in (Table 1). Rooting was significantly influenced by media and auxins. Maximum rooting (83.4%) and number of root/shoot (5.5) with minimum days to root initiation (8.0) was recorded in Full MS + 0.2 mg/l IBA (Fig.1A) followed by treatment ½ MS + 0.2 mg/l IBA. While, maximum length of root/shoot (7.5 cm) was observed in Full MS + 0.4 mg/l IBA. It was noticed that the rooting of *in vitro* shoot on full strength MS medium was found better in respect to all the rooting characters than that observed on half strength MS medium and White medium. These results are in accordance with earlier worker by (Shinde, 2008) in grape. In general, auxins like IAA and IBA are widely use for root induction and considered as an important factor for adventitious root formation from *in vitro* raised shoots (Xiuli *et al.*, 2010). Similarly, Ali *et al.*, (2003) also found that 0.2-0.4 mg/l IBA was effective in inducing adventitious root formation in guava, addition of IBA to the culture medium enhanced root proliferation. Whereas, addition of IAA in the medium found in effective in root growth. Further increase in the concentration of the IBA decreased the rooting percentage and also number of roots. Similar results were also obtained by (Hari Prakash and Tiwari, 1996) in guava. Higher concentration of auxins also inhibits root formation in plants (Blakesley *et al.*, 1991). Response of auxins on root induction is dependent on endogenous hormonal level of mother plant. These results are in conformity with earlier workers (Rai *et al.*, 2009 and Singh *et al.*, 2002) in guava.

Effect of different potting mixtures: The results obtained on survival of plantlets and plant growth in different potting mixtures is presented in (Table 2). The survival rate of plantlet was significantly influenced by potting mixtures. Maximum survival of plantlets (90.0%) was reported in vermicompost + soil (1:1v/v) followed by treatment FYM: soil: sand (1:1:1v/v), soil, vermicompost and cocopeat. Minimum days for new sprouting (8.5 days) and maximum length of shoots (11.0 cm) was also observed in vermicompost : soil (1:1v/v) (Fig.1.B) followed by treatment FYM : soil : sand (1:1:1v/v) and cocopeat. The potting mixture containing vermicompost: soil (1:1v/v) was found to be the most suitable for better growth and survival of plantlets. Physical, chemical and biological properties of potting mixture are important in the establishment of *in vitro* produced plantlets. Better performance of vermicompost may be attributed to its ability to improve biological properties of soil. Hence, mixing vermicompost and soil resulted in giving grip for roots, ample aeration and efficient organic matter. The participation of organic matter for better establishment of guava plantlets was described by (Amin and Jaiswal, 1987 and Amin and Jaiswal, 1988) they achieved better establishment in pots containing non sterile garden soil and compost. (Papadatou *et al.*, 1990) successfully established *in vitro* rooted shoots of guava in peat based compost in pots, whereas, (Hari Prakash and Tiwari, 1996) reported soil, sand, and FYM (1:1:1 v/v) as the potting mixture for better establishment of guava plantlets. (Rai *et al.*, 2009) successfully hardened *in vitro* grown guava plantlets in mixture of sand: garden soil (3:1 v/v).

Effect of different climate control conditions on survival of *in vitro* raised plantlets: The survival and growth of plantlets were significant influenced by different climate control conditions (Table 3). Maximum survival of plantlets (86.79%) was reported in net house condition, kept in group (Fig.1C) followed by individual plantlets in net house condition, low tunnel net house with minimum days taken for new sprouting (10.27 days) and maximum length of shoots (11.17 cm) was observed in net house condition (Fig.1D). Whereas, least survival of plantlets was observed in air condition either in individual or group. Similarly, length of shoot was maximum in net house condition either in individual or group. Hardening the *in vitro* raised plantlets, so as to make them to adopt the natural environment, it is a critical process due to their anatomical and physiological peculiarities. On transplanting, excessive water loss from the plantlets was recorded which was attributed to the improper critical and slowness of stomatal response to water stress (Brainerd and Fuchigami, 1981 and Fabbri *et al.*, 1984). Therefore, a period of humidity in acclimatization was considered necessary for the newly transferred plantlets to adapt to the natural environment, during which the plantlets undergo a morphological and physiological adoption enabling them to develop typical terrestrial plant water control mechanism (Grout and Aston, 1977 and Sutter *et al.*, 1984). In present study maximum plantlets survived when they covered by plastic cup and kept individually under net house. Method of covering the newly transferred plantlets with plastic bag, glass or microscope covers allowed by misting in greenhouse, polyhouse, nethouse for initial period and subsequently removing the cover in a gradual process was successfully adopted by number of earlier workers for hardening the plantlets (Rajeevan and Pandey, 1986 and Rout *et al.*, 1989)

Acknowledgement

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References

- Ali, N.M, R.M.S. Mulwa, M.A. Notron and R.M. Skirvin, 2003. Micropropagation of guava (*Psidium guajava*). *J. Hort. Sci. Biotechnol.*, 78 (5): 739 -741.
- Amin, M.N and V.S. Jaiswal, 1987. Rapid clonal propagation of guava through *in vitro* shoot proliferation on nodal explants of mature trees. *Plant Cell Tiss. Org. Cult.*, 9: 235-243.
- Amin, M.N and V.S. Jaiswal, 1988. Micropropagation as an aid to rapid cloning of a guava cultivar. *Sci. Hort.*, 36(12): 89-95.
- Bajpai, A., G. Singh and R. Chandra, 2003. Acclimatization of horticultural crops: concepts and approaches. p. 261-274. In: Precision Farming in Horticulture, H.P Singh, G. Singh, J.C Samuel and R.K. Pathak (eds.). NCPAH, DAC/PFDC, CISH.
- Blakesley, D.G., D. Weston, J.F. Hall, 1991. The role of endogenous auxin in root initiation. Part I. "Evidence from studies on auxin application and analysis of endogenous levels. *J. Plant Growth Regul.*, 10: 341-353.
- Brainerd, K.E and L.H. Fuchigami, 1981. Acclimatization of aseptically cultured apple plants to low relative humidity. *J. Amer. Soc. Hort. Sci.*, 106: 515-518.
- Dhawan, V. and S.S. Bhojwani, 1986. Micropropagation in crop plants. *Glimpses Plant Res.*, 7: 1-75.
- Fabbri, A., E.G. Sutter, and S. K. Dunston, 1984. Morphological adaptation of strawberry plant grown *in vitro* to growth chamber conditions. *HortScience*. (Abstr. p554).
- Grout, B.W.W. and M.J. Aston, 1977. Transplanting cauliflower plants regenerated from meristem culture. 1. Water loss and water transfer related to changes in leaf wax and to xylem regeneration. *Hort. Res.*, 17: 1-7.
- Hari Prakash, H. and J.P. Tiwari, 1996. Micropropagation of guava (*Psidium guajava* L.). *J. Appl. Hort.*, 2(1&2): 98 -101.
- Joshee, N., M. Mutua, A. K. Yadav, and F. Zee, 2002. *In vitro* shoot bud induction and plant regeneration in guava as influenced by genotype. *Acta Hort.*, 635: 279-285.
- Kumar, R., J. P. Tiwari, and K. K. Misra, 2006. *In vitro* cloning of chinese guava (*Psidium friedrichsthalianum*) (Berg) *Nierdz. Prog. Hort.*, 38(1): 15 -21.
- Murashige, T. and F. Skoog, 1962. A revised medium for rapid growth and bioassays with tobacco tissue cultures. *Physiol.Plant.* 15: 473-497.
- Panase, V.G. and P.V. Sukhatme, 1985. Statistical methods for agricultural workes. (eds.). ICAR, New Delhi.
- Papadatou, P., C.A. Pontikis, E. Ephtimiadou and M. Lydaki, 1990. Rapid multiplication of guava seedlings by *in vitro* shoot tip culture. *Scientia. Hort.*, 45: 99-103.
- Radha, T. and L. Mathew, 2007. Fruit crops. p.59-60. In: Horticulture Science Series, Volume 3: (eds.). K.V. Peter, T. Radha, L. Mathew, New India publishing agency New Delhi.
- Rai, M.K., V.S. Jaiswal and U. Jaiswal, 2009. Shoot multiplication and plant regeneration of guava (*psidium guajava* L.) from nodal explants of *in vitro* raised plantlets. *J. Fruit & Ornl. Plant. Res.*, 17 (1): 29-38.
- Rajeevan, M.S. and R.M. Pandey, 1986. Lateral bud culture of papaya (*Carica papaya* L.) for clonal propagation. *Plant. Cell. Tiss. Org. Cult.*, 6 (2): 181-188.
- Rout, G.R, B.K. Delda and P. Das, 1989. *In vitro* mass scale propagation of *Rosa hybrida* L. cv. Landora. *Current. Sci.*, 58 (15): 876-878.
- Shinde, K.A. (2008). *Micropropagation in grape cv. Thompson Seedless*. M. Sc. Thesis., Navsari Agricultural University, 150 pp
- Singh, G., J.P. Tiwari and S. Lal, 2007. *In vitro* callus induction in guava (*Psidium guajava* L.) *Proceeding of the 1st International Guava symposium. Acta Hort.*, (eds.). R.K. Pathak, G. Singh, R. Kishun, R. Chandra. Lucknow 2007, p 139-143.
- Singh, S.K., P.R. Meghawal, H.C. Sharma and S.P. Singh, 2002. Direct shoot organogenesis on hypocotyls explants from *in vitro* germinated seedlings of (*Psidium guajava* L.) cv. Allahabad Safeda. *Scientia Hort.*, 95: 213-221.
- Sutter, E.G and M. Hutzell, 1984. Use of humidity and antitranspirants in the acclimatization of tissue cultured plantlets to the greenhouse. *Scientia Hort.*, 23: 303-312.
- Wainwright, H. 1988. Overcoming problems in establishing micropropaguals-guidelines for growers." *Professional Hort.*, 2(3): 67-72.
- White, P. R. 1963. Potentially unlimited growth of excised plant callus in an artificial medium. *Amer. J. Bot.*, 26: 263-269.
- Xiuli, S., S.C. William, G. Frederick and Jr. Gmitter, 2010. *In vitro* shoot proliferation and root induction of shoot tip explants from mature male plants of *Casuarina cunninghamiana* Miq. *HortScience*. 45(5): 797-800.
- Ziv, M. 1986. *In vitro* hardening and acclimatization of tissue cultured plantlets. In: Plant tissue culture and items Agricultural Applications., p.187-196, L. A. Withers, and P. G. Alderson, (eds.). Butterworths, London.

Table 1: Effect of IBA, IAA and strength of media on induction of rooting in Guava cv. Allahabad Safeda

Treatments	Root initiation (days)	Rooting (%)	Length of root (cm)	No. of root/shoot	Length of shoot (cm)
1/2 MS + IBA 0.1 mg/l	15.2	53.3 (47.0)*	5.0	2.0	6.0
1/2 MS + IBA 0.2 mg/l	9.7	73.4 (59.1)	6.1	2.6	7.2
1/2 MS + IBA 0.4 mg/l	14.2	50.2 (45.1)	6.7	1.9	5.3
1/2 MS + IAA 0.1mg/l	15.0	33.3 (35.4)	2.5	1.0	3.2
1/2 MS + IAA 0.2 mg/l	12.7	30.0 (33.3)	2.1	1.1	4.3
1/2 MS + IAA 0.4 mg/l	0.0	00.0 (0.5)	0.0	0.0	0.0
Full MS + IBA 0.1 mg/l	16.1	53.3 (47.0)	7.0	3.3	6.2
Full MS + IBA 0.2 mg/l	8.0	83.4 (66.1)	6.2	5.5	8.1
Full MS + IBA 0.4 mg/l	11.1	60.1 (50.8)	7.5	3.3	6.0
Full MS + IAA 0.1 mg/l	13.0	45.0 (42.2)	4.0	2.1	4.0
Full MS + IAA 0.2 mg/l	10.0	63.3 (52.7)	3.1	2.3	4.2
Full MS + IAA 0.4 mg/l	17.2	31.6 (35.2)	2.0	1.0	3.0
White Medium + IBA 0.1 mg/l	20.0	40.2 (39.3)	3.0	1.2	3.2
White Medium + IBA 0.2 mg/l	19.1	43.3 (41.3)	3.2	1.5	3.0
White Medium + IBA 0.4 mg/l	21.2	36.6 (37.3)	2.1	1.2	2.1
White Medium + IAA 0.1 mg/l	20.0	26.6 (31.1)	1.8	1.0	3.0
White Medium + IAA 0.2 mg/l	22.0	31.6 (34.3)	2.1	1.2	2.5
White Medium + IAA 0.4 mg/l	0.0	0.0 (0.5)	0.0	0.0	0.0
S. Em. ±	0.15	0.28	0.10	0.06	0.07
C.D. at 5%	0.44	0.84	0.30	0.18	0.20

*Figures in parentheses are arcsine transformed value.

Table 2: Effect of different potting mixtures on acclimatization of guava cv. Allahabad Safeda

Treatments	Survival of plantlets (%)	Days taken for new sprouting	Length of shoot (cm)
Vermicompost	53.33 (46.89)*	12.00	6.00
Soil	63.33 (52.71)	10.50	7.17
Cocopeat	56.44 (48.61)	11.17	6.67
Vermicompost : Soil (1:1v/v)	90.00 (71.54)	8.50	11.00
FYM : Soil : Sand (1:1:1v/v)	76.66 (61.09)	10.17	9.00
S. Em. ±	0.33	0.44	0.24
C.D. at 5%	1.06	1.38	0.77

*Figures in parentheses are arcsine transformed value.

Table- 3: Effect of different climate control conditions on acclimatization of *in vitro* raised plantlets of Guava cv. Allahabad Safeda

Climate control conditions	Survival of plantlets (%)	Days taken for new sprouts	Length of shoot (cm)
Net house	86.79 (68.66)*	10.27	9.33
Air condition	73.61 (59.07)	11.27	6.83
Low tunnel net house	70.00 (56.77)	11.83	6.33
S.Em. ±	0.63	0.15	0.14
CD at 5%	2.00	0.49	0.42

*Figures in parentheses are arcsine transformed value.

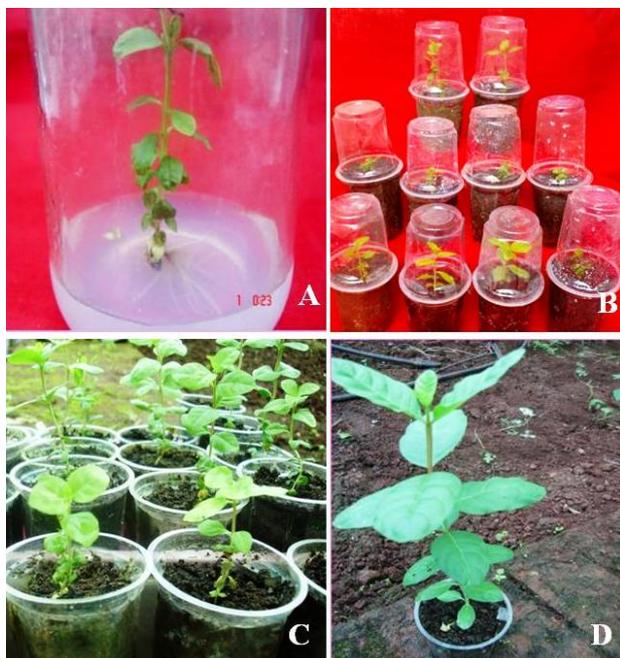


Fig.1 (A) Profuse rooting in full MS + IBA 0.2 mg/l (B) *in vitro* rooted plantlets in air condition room after one week of transplanting in plastic cups (C) Two weeks old plantlets in net house (D) *in vitro* rooted plantlet after four in vermicompost : Soil (1:1v/v) medium in net house

FLUID STRUCTURE INTERACTION ANALYSIS ON ELLIPSOIDAL SUBMERGED BODIES BY USING CFD

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Abstract- The interaction between a semi-rigid structure and the surrounding fluid environment is a sober issue in the stability investigation of different foil availabilities and design of aircraft blade machinery. To study about these types of phenomena, it requires the modeling of both fluid and structural domains. The two methods available to calculate the Fluid-Structure Interaction (FSI) effects in the time domain are the strongly coupled or partially coupled governing equations. In the fully coupled model, the flow field and structure respond simultaneously by exchanging the aerodynamic forces and structural displacement. Logically, the fully coupled model is rigorous in the physical sense, because the structural displacement responds instantly to the forces imposed by the fluid. In this algorithm, the fluid and structural analysis equations are combined together to form a unified set of equations. Then it is solved and integrated simultaneously in time domain to update all the variables including those at the fluid-structure interface. This implies solving the complete system in one step; hence there is no information transfer in fully-coupled method. The fully coupled algorithm usually requires an almost complete rewrite of the CFD and CSD codes into one single coupled code. In this project, the modeling is done in Creo Parametric 2.0 and Computational fluid dynamics analysis and fluid structure interaction (FSI) is done in ANSYS 15.0 solver. The static structural analysis is carried out initially. The flow analysis of various angles of attack is carried out and FSI is done for the respective models. The later and the former are compared for pressure distributions and velocity magnitudes for various angles of attack. The pressure coefficients and velocity magnitudes are comparably good for Fluid structure interaction.

Index Terms- *Creo parametric 2.0, Fluid Structure Interaction, Pressure Distributions, Velocity Magnitudes.*

I. INTRODUCTION

Fluid-structure interaction (FSI) is the interaction of some movable or deformable structure with an internal or surrounding fluid flow. Fluid-structure interactions can be stable or oscillatory. In oscillatory interactions, the strain induced in the solid structure causes it to move such that the source of strain is reduced, and the structure returns to its former state only for the process to repeat. Fluid-structure interactions are a crucial consideration in the design of many engineering systems, e.g. aircraft, engines and bridges. Failing to consider the effects of oscillatory interactions can be catastrophic, especially in structures comprising materials susceptible to fatigue. Tacoma Narrows Bridge (1940), the first Tacoma Narrows Bridge, is probably one of the most infamous examples of large-scale failure. Aircraft wings and turbine blades can break due to FSI oscillations. Fluid-structure interaction has to be taken into account for the analysis of aneurysms in large arteries and artificial heart valves.

A reed actually produces sound because the system of equations governing its dynamics has oscillatory solutions. The dynamic of reed valves used in two stroke engines and compressors is governed by FSI. The act of "blowing a raspberry" is another such example. Fluid-structure interactions also occur in moving containers, where liquid oscillations due to the container motion impose substantial magnitudes of forces and moments to the container structure that affect the stability of the container transport system in a highly adverse manner. The propagation of a pressure wave through an incompressible fluid in a flexible tube is as shown in the Fig. 1

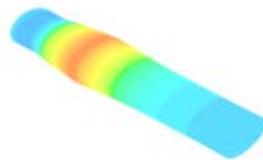


Fig. 1 Propagation of a Pressure wave

II. PROBLEM IDENTIFICATION

The present study made computational prediction of Fluid Structure Interaction of submerged bodies using commercially available RANS code, Fluent, with suitable User Defined Functions (UDFs) as well as a CFD Code, developed in-house. The fluid and structure has been created with appropriate dimension for understanding the interaction between the fluid and the structure. Fluid structure interaction is carried out at different angle of attack. The differences in fluid forces acting on a structural member for both the ways of coupling have been analyzed. The pressure coefficient and the velocity magnitude are compared with interaction and without interaction.

III. MODELING OF ELLIPSOIDAL MODEL

The modeling of the Ellipsoidal Body is done in Creo Parametric 2.0.

Introduction to Creo Parametric:

Creo Parametric is a computer graphics system for modeling various mechanical designs and for performing related design and manufacturing operations. The system uses a 3D solid modeling system as the core, and applies the feature-based, parametric modeling method. In short, Creo Parametric is a feature-based, parametric solid modeling system with many extended design and manufacturing applications.

Creo Parametric is the first commercial CAD system entirely based upon the feature-based design and parametric modeling philosophy. Today many software producers have recognized the advantage of this approach and started to shift their product onto this platform.

Creo Parametric was designed to begin where the design engineer begins with features and design criteria. Creo Parametric's cascading menus flow in an intuitive manner, providing logical choices and pre-selecting most common options, in addition to short menu descriptions and full on-line help. This makes it simple to learn and utilize even for the most casual user. Expert users employ Creo Parametric's "map keys" to combine frequently used commands along with customized menus to exponentially increase their speed in use. Because Creo Parametric provides the ability to sketch directly on the solid model, feature placement is simple and accurate.

The model is as shown in the figure 1 as shown below:

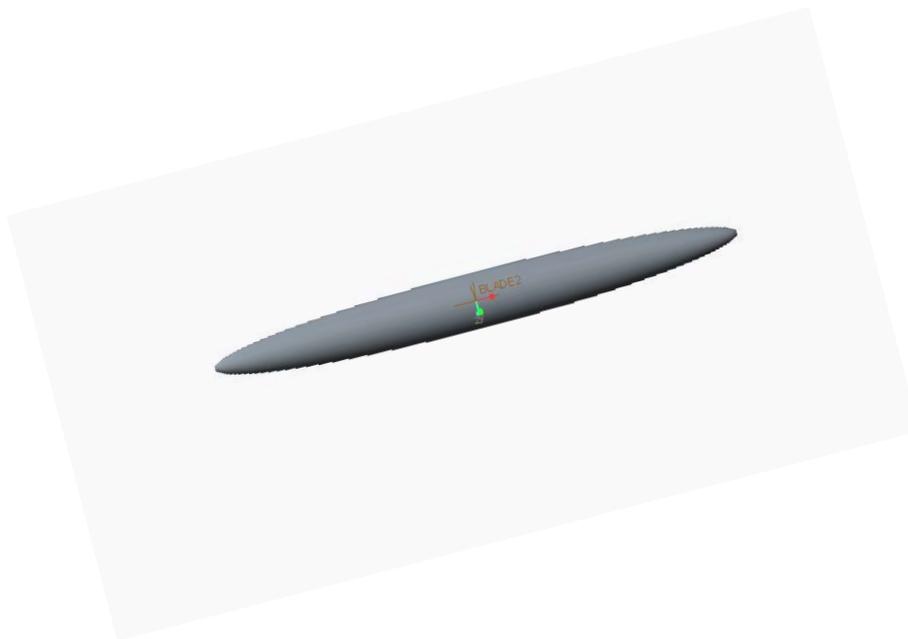


Fig 1. Ellipsoidal Model

The drawing Specifications taken are as shown in the Figure 2 below:

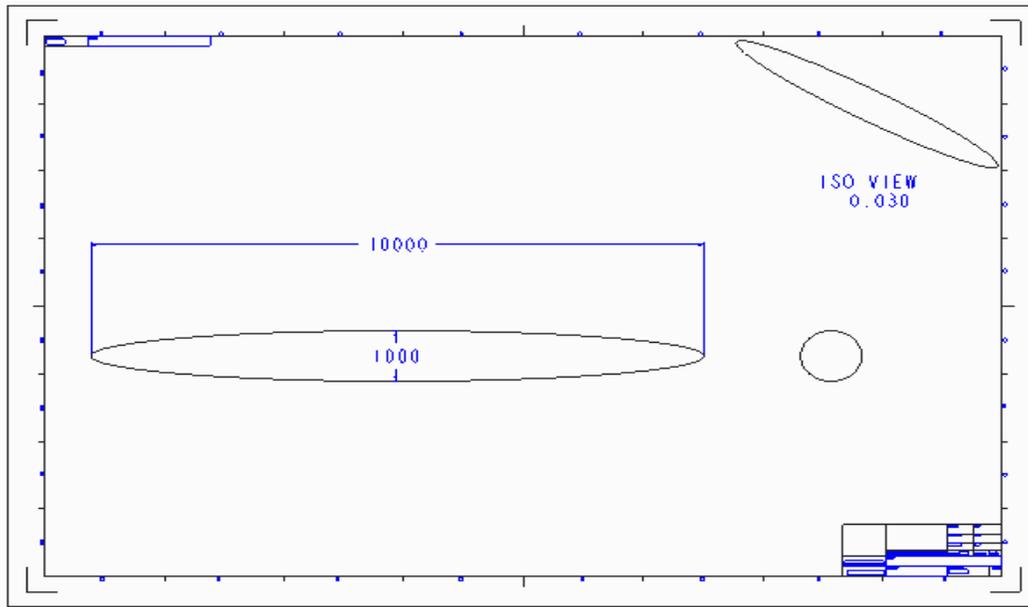


Fig. 2 Drawing Specifications for the Ellipsoidal Model.

IV. ANALYSIS OF ELLIPSOIDAL MODEL

The analysis of the Ellipsoidal Model is done in Ansys 15.0 and the analysis reports are as shown below. The geometry and the mesh model in Ansys are as shown in the Fig.3 and Fig. 4 below respectively.

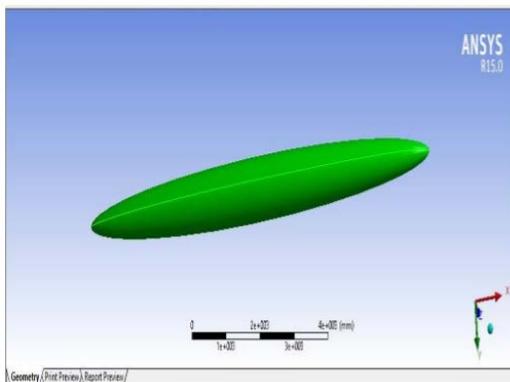


Fig. 3 Geometry of the Ellipsoidal Model

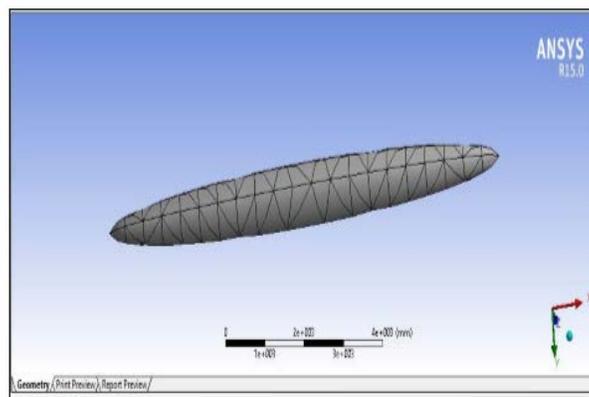


Fig.4 Mesh of the Ellipsoidal Model

Analysis of Ellipsoidal Model:

The deformation and Equivalent Stress reports for the Ellipsoidal Models are as shown in the Fig. 5 and Fig. 6 respectively.

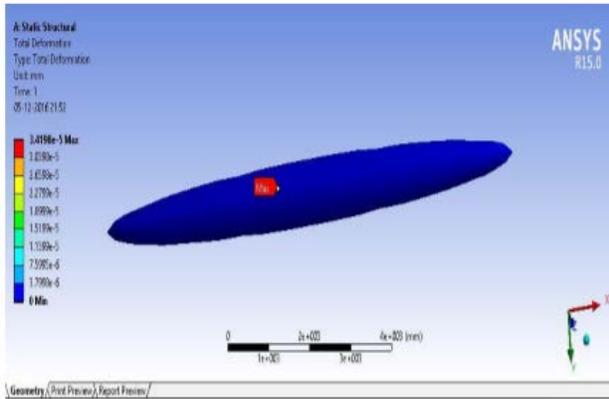


Fig. 5 Deformation of the Ellipsoidal Model

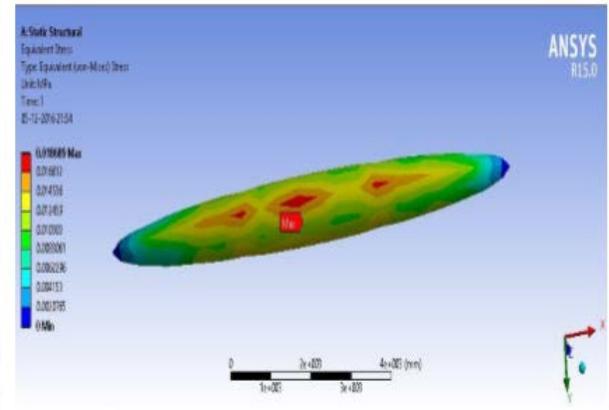


Fig.6 Equivalent Stress of the Ellipsoidal Model

The Pressure Coefficient and Velocity magnitude reports of Zero degree for the Ellipsoidal Models are as shown in the Fig. 7 and Fig. 8 respectively.

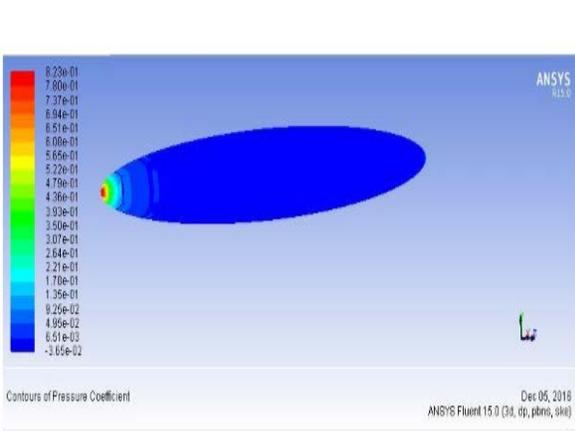


Fig. 7 Pressure Coefficient of the Ellipsoidal Model

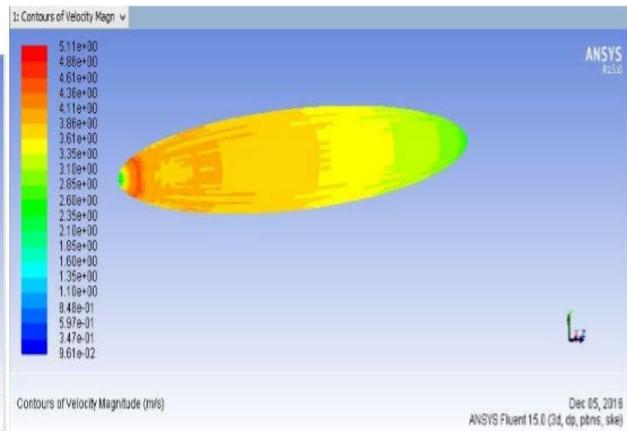


Fig.8 Velocity magnitude of the Ellipsoidal Model

Also the analysis is carried out for the fluid structure interaction treating as a one way FSI. The Pressure Coefficient and Velocity magnitude reports of Zero degree with structural interaction for the Ellipsoidal Models are shown in the Fig. 9 and Fig. 10 respectively.

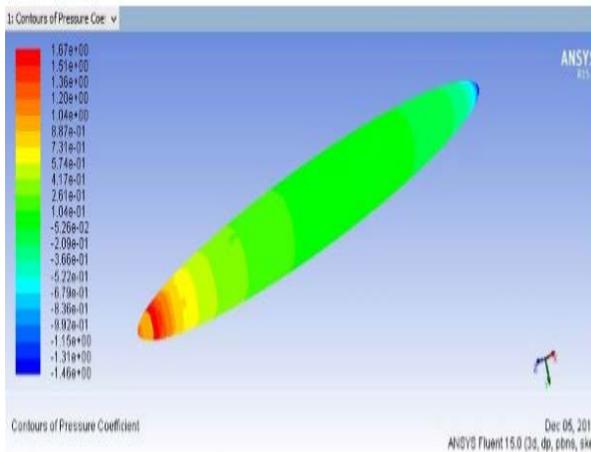


Fig. 9 Pressure Coefficient of the FSI Ellipsoidal Model

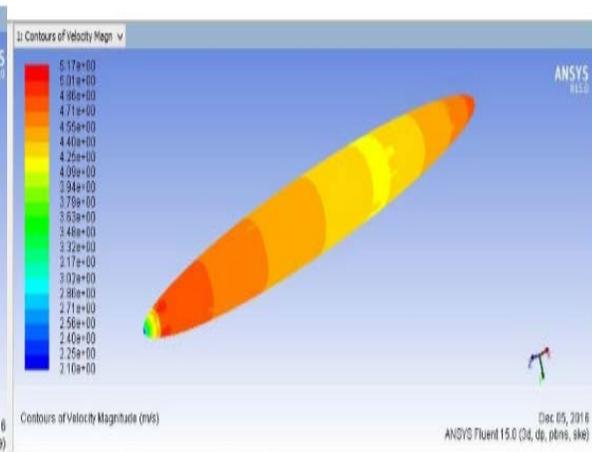


Fig.10 Velocity magnitude of the FSI Ellipsoidal Model

V. RESULTS AND DISCUSSION

The Pressure Coefficients for Various Angles of attack is as shown in the Table

Angle of Attack	Fluid Flow Analysis (Max) (m/s)	Fluid Structure Interaction (Max)(m/s)
0	0.8231	1.6702
2	0.8232	1.8243
4	0.8233	2.0036
6	0.8252	2.7496
8	1.1195	3.7181

The Velocity Magnitudes for Various Angles of attack is as shown in the Table

Angle of Attack	Fluid Flow Analysis (Max) (m/s)	Fluid Structure Interaction (Max)(m/s)
0	5.1093	5.1676
2	5.4836	5.2018
4	5.9352	5.3801
6	6.4099	5.5350
8	6.8643	5.6772

In the fluid structure interaction analysis of different angles of attack we observed the values of pressure coefficients are better than fluid flow analysis pressure coefficient values. The fluid structure interaction analysis is comparatively good. The work is performed by method of coupling ie. One way coupling. This is implemented by creating a large domain in which the structural member is placed in an appropriate position. The meshing of the ellipsoidal body is obtained good mesh quality which is best in the flow analysis.

And the same way we observed the velocity magnitude for the flow analysis and the fluid structure interaction analysis. The fluid structure interaction has much more max values at different angles of degree. The values of pressure coefficient and velocity magnitude are tabulated in the above. By comparing these fluid structure interaction analysis and the flow analysis results we notified that the fluid structure interaction analysis is best way to study the fluid flow over the structure. There are many instances of structural damages of such platforms due to extreme weather conditions like hurricanes. These circumstances have a created an awareness in offshore industries on things like structural durability and reliability and the requirements of setting a safer air gap.

By this analysis we conclude that the fluid structure interaction analysis is applicable for study more advancement in the underwater submerged bodies for new development in marine engineering.

VI. CONCLUSION

As a part of real time application model, an ellipsoid body of 1:10 is taken into consideration for evaluation. The model is run at a free attack at a velocity of 5m/s initially and pressure distribution along the run is observed. The fluid flow analysis for different angle of attacks is done. Pressure and velocity distributions are observed. The structure analysis is carried out. The fluid structure interaction for the model is run and pressure and velocity distributions are observed after CFD simulation considering it as an FSI application. The pressure coefficients and velocity magnitudes are comparably good for Fluid structure Interaction. As the angle of attack increases, the pressure coefficient is linearly increasing.

Scope for future work: 1. As CFD results were found in good agreement with standard or experimental results, more complex shapes of interest can be developed in order to find the variations of pressure coefficients and velocity distributions. 2. The present work contributes a one way method to the problem solution. Different other types of methodologies can be used to solve the problem using CFD Simulation.

REFERENCES

- [1] Rammohan Subramania Raja, 2012 Master's Thesis 2012:55 ISSN 1652-8557 Department of Applied Mechanics Division of Fluid mechanics Chalmers University of Technology Sweden.
- [2] E Reynolds, B Anderson and G Walker, "Effects of Turbulence and Velocity Profile Variation in a Circulating Water Channel as Determined by Sphere and Ellipsoid Tests", presented at MCMC'97, Croatia, and REPORT AME CRC C 98/17, 1997.
- [3] K B S V D Prasad, Dr.K.Balaji Reddy, R Sam Sukumar, Amruthaluri Sai Teja, Vanamali Rambabu, Gubbala Rajesh, Ravi Wesley Moses, Pilli Ashok Kumar, "Fluid Structure Interaction of Liquid Lubricated Cylindrical Journal Bearing using CFD", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, Issue 3, March 2016.
- [4] Dinesh Dhande, Dr D W Pande, Vikas Chatarkar, "Analysis of Hydrodynamic Journal Bearing Using Fluid Structure Interaction Approach", International Journal of Engineering Trends and Technology (IJETT) - Volume 4 Issue 8- August 2013.
- [5] Thomas Ponweiser, Peter Stadlmeyer, Tomáš Karásek, "Fluid-Structure Simulations with OpenFOAM for Aircraft Designs", Partnership for Advanced Computing in Europe. 2013.
- [6] Bruce Ralphin Rose, J. Jinu. G. R. Manivel. M, "Partly Coupled Fluid Structure Interaction Analysis of an Aircraft Wing at Subsonic Speeds", International Journal of Mechanical & Mechatronics Engineering IJMME-IJENS Vol:14 No:03, 2014.
- [7] G.Szabó, J.Györgyi, "Fluid-structure interaction analysis with the ANSYS software in bridge aero elasticity", EACWE 5, 2009.
- [8] Gene Hou, Jin Wang, Anita Layton, "Numerical Methods for Fluid-Structure Interaction A Review", Global-Science Press, Vol. 12, No. 2, pp. 337-377 August 2012.
- [9] Scott T. Miller, R. L. Campbell, C. W. Elsworth, J. S. Pitt, D. A. Boger, "An Overset Grid Method for Fluid-Structure Interaction", World Journal of Mechanics, 4, 217-237, 2014.
- [10] Jon Tomas Gretarsson, Nipun Kwatra, Ronald Fedkiw, "Numerically Stable Fluid Structure Interactions between Compressible Flow and Solid Structures", Stanford University, January 28, 2011.
- [11] Stefan Frei, Thomas Richter, Thomas Wick, "Eulerian Techniques for Fluid-Structure Interactions - Part II: Applications", Published in Lecture Notes in Computational Science and Engineering Vol. 103, Proceedings of ENUMATH 2013, pp. 755-762, Springer, 2014.

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(Assessment of nurses' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals)

(تقييم معارف الممرضين تجاه جهاز ضغط المجربالهوائي الايجابي المستمر في وحدة العناية المركز ةلحديثي الولادة فيمستشفيات مدينة الديوانية)

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الخلاصة:

الهدف: تقييم معارف الممرضين المتعلقة بجهاز ضغط المجربالهوائي الايجابي المستمر في وحدة العناية المركز ةلحديثي الولادة فيمستشفيات مدينة الديوانية، ولايجاد العلاقة بين معارف الممرضين المتعلقة بجهاز ضغط المجربالهوائي الايجابي المستمر في وحدة العناية المركز ة والمعلومات الديموغرافية الاجتماعية.

المنهجية: دراسة وصفية أجريت في وحدة العناية المركز ة في مستشفيات مركز مدينة ا لديوانية وشملت (مستشفى النسائية والأطفال التعليمي ومستشفى الحسين للأطفال)، فترة الدراسة السادس والعشرون من كانون الأول من العام 2016 ولغاية الخامس عشر من أيار من العام 2017. عينة غير احتمالية (غرضية) هادفة من (24) ممرض، ممن يعمل في وحدة العناية المركز ةلحديثي الولادة فيمستشفيات مدينة الديوانية. أداة الدراسة اشتملت على الاستبيان الذي يحوي خمسة أجزاء رئيسية. دقة الاستبيان حددت من خلال الاتساق الداخلي من خلال دراسة تجريبية. صدق محتوى استبيان حدد من خلال مجموعه من الخبراء. وقد تم تحليل البيانات من خلال تطبيق التكرارات الوصفية والنسب المئوية والمتوسط من النتيجة والتحليل الاحصائي الاستنتاجي.

النتائج: أظهرت الدراسة عدم وجود علاقة ذات دلالة إحصائية بين عمر الممرضين ، جنس الممرضين ، سنوات الخدمة في مجال التمريض ، المستوى التعليمي للممرضين، عدد سنوات الخبرة في وحدة العناية المركز ةلحديثي الولادة ، الدورات التدريبية حول جهاز ضغط المجربالهوائي الايجابي المستمر ومعارفهم المتعلقة بجهاز ضغط المجربالهوائي الايجابي المستمر عند مستوى الدلالة القيمة $P < 0.05$. وخلصت

الدراسة الى ان نسبة عالية من الكادر التمريضي هم من خريجي اعدادية التمريض ومعظمهم قد شاركوا في دورات تدريبية متعلقة بجهاز ضغط المجربالهوائي الايجابي المستمر.

الاستنتاج: (1) اغلب عينة الدراسة كانوا من الاناث (2) اغلب اعمار عينة الدراسة كانت بين (25-29) سنة. (3) نسبة عالية من عينة الدراسة شاركت في الدورات التدريبية المتعلقة بجهاز ضغط المجربالهوائي الايجابي المستمر.

التوصيات: اوصت الدراسة بما يلي : (1) ضرورة تطوير مهارات الممرضين. (2) إعطاء فرصة للمشاركة في الدورات التدريبية لتحسين الرعاية التمريضية المقدمة للطفل تحت جهاز ضغط المجربالهوائي الايجابي المستمر. (3) وتوفير الكتيبات والكراسات للممرضات لتحسين معرفتهم

حولجهاز ضغط المجربالهوائي الايجابي المستمر

مفاتيح الكلمات:تقييم معارف ، جهاز ضغط المجربالهوائي الايجابي المستمر، وحدة العناية المركز ةلحديثي الولادة.

Abstract- Objectives: To assess nurses' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals and to find out the relationships between the nurses' knowledge concerning The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit and socio-demographic information.

METHODOLOGY: a descriptive study was carried out at Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals During the period from December 26th -2016 to the 15th of May -

2017. A non-probability (purposive) sample of (24) nurses, who worked at Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals. The tool of the study included a questionnaire, which has five main parts. The Reliability of questionnaire was determined through internal consistency and through a pilot study, and the content validity of the questionnaire was determined through an expert panel. The data were analyzed through the application of descriptive frequencies, percentages, mean of score and the inferential statistical analysis.

RESULTS: The study revealed that there is no statistical significant association between nurses' age, nurses' gender, nurses' level of education, years of service in nursing field, nurses' years of services in NICU, nurses' training course and their knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine follow up (p value > 0.05). The present study concluded that high percentage of staff nurses were graduate junior high nursing and most of them had been participated in training courses about CPAP.

CONCLUSIONS: (1) Most study sample was females. (2) Mostly the ages of study sample were (25-29) Year. (3) A High percentage of the sample had been participated in training courses about CPAP.

RECOMMENDATION: (1) The study recommended the necessity to develop the nurses' skills. (2) Policy should be initiated to providing a special educational course about Neonates with Continuous Positive Airway Pressure (CPAP) Machine. (3) Providing updating booklets, pamphlets and boosters for nurses to upgrading their knowledge about Continuous Positive Airway Pressure (CPAP) Machine.

I. INTRODUCTION

Continuous Positive Airway Pressure (CPAP) is a noninvasive method for applying a constant distending pressure level (above atmospheric) during inhalation and exhalation to support spontaneously breathing newborn infants with lung disease. CPAP is an "open-lung approach" used to manage newborn infants predisposed to developing airway instability, edema, and atelectasis⁽¹⁾. CPAP is employed in infants with acute respiratory failure to correct hypoxemia. It permits a higher inspired oxygen content than other methods of oxygen supplementation, increases mean airway pressure, and will improve ventilation to collapsed areas of the lung. The recruitment of under ventilated lung is similar to the use of positive end expiratory pressure (PEEP) in the intubated mechanically ventilated patient⁽²⁾. Nasal continuous positive airway pressure (CPAP) is the most widely used non-invasive continuous distending airway pressure modality and a cornerstone of modern neonatal care. Whereas there has been emphasis on understanding which devices and pressure sources best implement CPAP, the optimal duration of this therapy is less well studied. At birth, premature infants have life-threatening anatomic and physiologic immaturities of the respiratory system. CPAP attenuates this pathophysiology until sufficient stability develops and continuous distending pressure is no longer needed⁽³⁾. Initial respiratory support of all spontaneously breathing preterm infants with respiratory distress may be provided by CPAP, rather than intubation. A randomized controlled trial (ARCT) enrolling 2358 infants born at < 30 weeks gestation demonstrated that CPAP is beneficial when compared to initial tracheal ventilation and PPV in reducing threat of intubation and duration of mechanical ventilation without any short term disadvantages⁽⁴⁾. Continuous Positive Airway Pressure (CPAP) applying via the nasal route to children presenting with clinical pneumonia (tachypnea plus retractions and/or nasal flaring Continuous distending pressure during the expiratory phase of respiration has been used clinically for a number of years the use of CPAP in spontaneously breathing hypoxic newborn infants,

and this therapy is in widespread use today. Measured physiological effects of CPAP include increased functional residual capacity, decreased intrapulmonary shunting, increased tidal volume, and decreased airway resistances⁽⁵⁾. Continuous positive airway pressure (CPAP) therapy has been used for many decades to treat acute hypoxemic respiratory failure (ARF) due to acute pulmonary edema, and pneumonia. Not only can it reduce the work of breathing, but it may also recruit alveoli and improve functional residual capacity. In ARF the work of breathing may increase such that the metabolic demand for oxygen increases to 25 per cent of total oxygen delivery. If cardiac function is depressed, oxygen delivery is reduced to vital organs and cardiac ischemia will exacerbate the cardiopulmonary decline⁽⁶⁾. Continuous positive airway pressure (CPAP) is the first line therapy for moderate to severe obstructive sleep apnea syndrome (OSAS). Both randomized controlled studies and observational cohort studies have demonstrated beneficial effects in terms of cardiovascular, metabolic, daytime vigilance and quality of life Outcomes⁽⁷⁾.

Objectives of the study

To find out demographic characteristics of nurses like age, gender, level of education ...etc.

To assess nurses' knowledge toward children with continuous positive airway pressure machine.

Finding out the relationship between nurses' knowledge toward CPAP and their general information characteristics such as (age, gender, nurses' educational level, years of experience in hospitals and years of experience at respiratory care unit).

II. METHODOLOGY

Administrative Arrangement:-After getting the approval of the council of Nursing College for the study, the researcher submitted a detailed description including the objectives and methodology of the study to the Ministry of Planning (Central Statistical Organization and to the Al-Diwanyia Health Directorate (Training and Development department) in order to obtain an official permission.

SETTING OF THE STUDY: To obtain a comprehensive data, the study was conducted in selected hospitals in Al-Diwanyia City, where Neonatal Intensive Care Units are available at the following Pediatric Teaching Hospitals: AL-Hussein Pediatric Hospital and The Pediatric and Maternity Teaching Hospital in Al-Diwanyia city, Iraq. The study was carried out during the period from (26 December 2016 to 15 May 2017).

DESIGN OF THE STUDY:A descriptive quantitative design was carried out to assess the nurses' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit.

THE SAMPLE OF THE STUDY: A non-probability (purposive) sample of (24) nurses was chosen. All of them working in Neonatal Intensive Care Units (NICU) at Pediatric Teaching Hospitals.

THE STUDY INSTRUMENTS: For the purpose of the present study, a questionnaire was conducted by the researcher, Scale of the questionnaire is (Yes or No)(36 questions) the correct answer code was (2) and the wrong answer code was (1).

The study instrument consisted of (5) parts. Part I: Socio-demographic information of the nurses. Part II: General information about Continuous Positive Airway Pressure (CPAP) Machine: It consists of (7) items. Part III: Nurses' knowledge about the Uses of (CPAP) Machine for premature babies and newborns. It included (10) items. Part IV: Nurses' knowledge about the Contraindications for using of the (CPAP) Machine for newborn and premature infants. It included (11) items. V: Nurses' knowledge about the Fundamentals for using CPAP Machine and The sign for (CPAP) failure in the treatment of respiratory distress syndrome. It included (8) items.

DATA COLLECTION:The data were collected through the utilization of the self-administrative questionnaire; the data were collected from (25) nurses at intensive care unit to provide care for neonate with Continuous Positive Airway Pressure (CPAP) Machine.

STATISTICAL ANALYSIS: The following statistical data were obtained by using the analysis approach (SPSS) to analyze and assess the data of the study Descriptive Data Analysis and Inferential statistical analysis.

III. RESULTS

Table(1): Distribution of the Study Sample According to their Sociodemographic Characteristic.

Variables	No.	%	
Ages (years)	20-24 years	6	25
	25-29 years	12	50
	30-34 years	4	16.7
	35-39 years	1	4.2
	40 years and more	1	4.2
	Total	24	100
Gender	Male	11	45.8
	Female	13	54.2
	Total	24	100
Level of education	graduate nursing Course	-	-
	Graduate Nursing school	2	8.3
	graduate Junior high nursing	10	41.7
	Graduate Institute of Nursing	8	33.3
	Graduate of the College of Nursing and over	4	16.7
	Total	24	100
Years of service	1-5 years	16	66.7
	6-10 years	5	20.8
	11-15 years	2	8.3
	16-20 years	1	4.2
	21 years and more	-	-
	Total	24	100
Years of experience in neonatal intensive care unit	1-5 years	18	75
	6-10 Years	6	25
	11-15 Years	-	-
	16 years and more	-	-
	Total	24	100
Training course about CPAP	Yes	15	62.5
	No	9	37.5
	Total	24	100
No. of training course	1-2	10	66.7
	3-4	5	33.3
	5-6	-	-
	7 and more	-	-
	Total	15	100

No. = number, %= percentage

This table (1) shows that 50% of the study sample was between (25-29) years of age, females were 54.2%, 41.7% had graduate Junior high nursing, 66.7% had (1-5) years of services, 75% of them had (1-5) years of experience in neonatal intensive care unit, 62.5% of them participated in intensive care courses for newborn, from the 15 nurses who participated in intensive care courses for newborn 66.7% of them had (1-2) courses.

Table (2):Distribution of Nurses Responses toward CPAP Knowledge

No.	Questions	True answer		False answer		M. S	Ass.
		f	%	f	%		
General information about device (CPAP)							
1.1	Maintenance of an increased (positive) trans pulmonary pressure during the inspiratory & expiratory phase of respiration.	16	66.7	8	33.3	1.67	M
1.2	It works to increase the effort during the process of breathing	3	12.5	21	87.5	1.12	L
1.3	It Conserves surfactant	4	16.7	20	83.3	1.17	L
1.4	It Increase the lung compliance	5	20.8	19	79.2	1.21	L
1.5	The unit of measurement for (CPAP) Machine is (Cm H2O).	9	37.5	15	62.5	1.38	M
1.6	It fails to work if the child continues the status of the chest retraction, asphyxia and snoring.	3	12.5	21	87.5	1.12	L
1.7	From its complication is Nasal obstruction.	5	20.8	19	79.2	1.21	L
Uses of device (CPAP) for premature babies and newborns							
2.1	It is used for patients with respiratory distress syndrome (RDS).	12	50	12	50	1.50	M
2.2	The Machine uses for treat Apnea of premature babies.	3	12.5	21	87.5	1.12	L
2.3	It can be used in case of premature baby with respiratory dysfunction and bradycardia movement.	-	-	24	100	1	L
2.4	It used if there was a possibility to infect the child with Pneumothorax.	1	4.2	23	95.8	1.04	L
2.5	If the child has bleeding in the upper gastrointestinal tract is used.	1	4.2	23	95.8	1.04	L

No.	Questions	True answer		False answer		M. S	Ass.
		f	%	f	%		
2.6	Used to eliminate excessive respiratory secretions of Baby.	-	-	24	100	1	L
2.7	When there is pulmonary bleeding may not use the (CPAP) Machine.	2	8.3	22	91.7	1.08	L
2.8	Used when low peak respiratory desired pressure in infants.	9	37.5	15	62.5	1.38	M
2.9	It works to increase intracranial pressure (ICP) for premature.	3	12.5	21	87.5	1.12	L
2.10	The goal of (CPAP) is to reduce the need for respiratory tube in emergencies.	4	16.7	20	83.3	1.17	L
Contraindications to use device (CPAP) for newborn and premature babies							
3.1	There is no mind to use the machine despite of the certain birth defects in the respiratory tract of a child its present, such as cleft lips or cleft palate.	4	16.7	20	83.3	1.17	L
3.2	It can be used in case of severe cardiovascular instability, such as low blood pressure.	3	12.5	21	87.5	1.12	L

3.3	If the child is unconscious and does not respond to stimuli, cannot use the (CPAP) machine in this condition.	8	33.3	16	66.7	1.33	L
3.4	It contraindicates the Machine in the case of pneumonia.	4	16.7	20	83.3	1.17	L
3.5	It Prevents use if the child suffers from nausea and vomiting.	4	16.7	20	83.3	1.17	L
3.6	If the child has surgery in the stomach, that does not affect the use of CPAP machine.	1	4.2	23	95.8	1.04	L
3.7	Abdominal distention is one of the most complication that can be happen.	8	33.3	16	66.7	1.33	L
3.8	Use of the machine does not reduce the proportion of urine and sodium excretion output.	-	-	24	100	1	L
3.9	The machine is not effective in the case of meconium aspiration.	-	-	24	100	1	L
3.10	CPAP Machine prevent to use in the case of Post-extubation in preterm VLBW infants.	-	-	24	100	1	L
3.11	CPAP cannot be used together with the Nebulizer.	-	-	24	100	1	L

No.	Questions	True answer		False answer		M. S	Ass.
		f	%	f	%		
Fundamentals in the use of device CPAP							
4.1	Pressure FIO2 for treatment of Respiratory Distress Syndrome (RDS) should be start at 4 Cm H2O.	-	-	24	100	1	L
4.2	Pressure FIO2 for treatment of Apnea of Prematurity (AOP) should be start at 5 Cm H2O.	-	-	24	100	1	L
4.3	The sign for (CPAP) failure in the treatment of respiratory distress syndrome is worsening respiratory distress and/or hypoxemia.	11	45.8	13	54.2	1.46	M
4.4	Recurrent episodes of apnea is not a sign for CPAP failure in the treatment of Apnea of premature infants.	4	16.7	20	83.3	1.17	L
4.5	Chronic obstructive pulmonary disease (COPD) the maximum level of the pressure (CPAP) machine to be provided is 10cm H2O.	-	-	24	100	1	L
4.6	Congestive heart failure (CHF) the maximum level of the pressure (CPAP) machine to be provided is 5cm H2O.	-	-	24	100	1	L
4.7	The appropriate position for the child when using the CPAP machine be lifting the head and put a pillow under it.	2	8.3	22	91.7	1.08	L
4.8	There is no need to match the size of the probe with a premature baby's nose.	8	33.3	16	66.7	1.33	L
Total score of nurses' knowledge		Poor (36-48)		Acceptable (49-60)		Good (61-72)	
		No.	%	No.	%	No.	%
		24	100	-	-	-	-

f= frequency, %= percentage, M. S= mean of score, Ass.= assessment, level of assessment: (1-1.33) = low = L, (1.34-1.67) = moderate = M, (1.68-2.00) = high = H

This table shows that, the nurses had low level of assessment when respond to the scale items except the items (1.1, 1.5, 2.1, 2.8, 4.3) the nurses had moderate level. According to the total score of nurses' knowledge, they had a poor level of knowledge.

Table (3): Distribution and Association of Nurses' Knowledge with Their Age.

Variables	Nurses' Knowledge	
	No.	Mean ± S.D.
Age (Years)		
20-24	6	1.16±0.015
25-29	12	1.16±0.014
30-34	4	1.15±0.017
35-39	1	1.17±0
40 and more	1	1.17±0
Total	24	1.16±0.014
		F =0.389 d.f.= 4 P = 0.814

$\bar{x} \mp S. D.$ =Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value.

This table shows that there is no statistical significant association between nurses' age and their knowledge concerning CPAP machine(p value > 0.05).

Table (4): Distribution and Association of Nurses' Knowledge with Their Gender.

Variables	Nurses' Knowledge	
	No.	Mean ± S.D.
Gender		
Male	11	1.16±0.014
Female	13	1.16±0.014
Total	24	1.16±0.014
		F =0.032 d.f.= 1 P = 0.859

$\bar{x} \mp S. D.$ =Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value.

This table shows that there is no statistical significant association between nurses' gender and their knowledge concerning CPAP machine(p value > 0.05).

Table (5): Distribution and Association of Nurses' Knowledge with Their Level of Education.

Variables	Nurses' Knowledge	
	No.	Mean ± S.D.
Level of Education		
graduate of the School of Nursing	2	1.15±0.021

graduate Junior high nursing	10	1.16±0.015
Graduate Institute of Nursing	8	1.17±0
Graduate of the College of Nursing and over	4	1.15±0.17
Total	24	1.16±0.014
		F =1.809 d.f. = 3 P =0.178

$\bar{x} \pm S. D.$ = Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value.

This table shows that there is no statistical significant association between nurses' level of education and their knowledge concerning CPAP device (p value > 0.05).

Table (7): Distribution and Association of Nurses' Knowledge with Their years of service.

Variables	Nurses' Knowledge	
	No.	Mean ± S.D.
years of service		
1-5 years	16	1.16 ±0.13
6-10 years	5	1.16 ±0.16
11-15 years	2	1.15±0.021
16-20 years	1	1.17±0.0
Total	24	1.16±0.014
		F = 0.366 d.f. = 3 P = 0.778

$\bar{x} \pm S. D.$ = Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value, < = Less than, ≥ = equal and more.

This table shows that there is no statistical significant association between nurses' years of services and their knowledge concerning CPAP device (p value > 0.05).

Table (8): Distribution and Association of Nurses' Knowledge with Their years of service in NICU.

Variables	Nurses' Knowledge	
	No.	Mean ± S.D.
years of service in NICU		
1-5 years	18	1.16 ±0.14

6-10 years	6	1.16 ±0.15
Total	24	1.16±0.014
		F = 0.062 d.f. = 1 P = 0.806

$\bar{x} \mp S. D.$ = Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value, < = Less than, ≥ = equal and more.

This table shows that there is no statistical significant association between nurses' years of services in NICU and their knowledge concerning CPAP device (p value < 0.05).

Table (9): Distribution and Association of Nurses' Knowledge with Their Training course about CPAP.

Variables	Nurses' Knowledge	
	No.	Mean ± S.D.
Training course about CPAP		
Yes	15	1.16±0.015
No	9	1.17±0.01
Total	24	1.16±0.014
		F = 2.301 d.f.= 1 P = 0.144

$\bar{x} \mp S. D.$ = Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value, ≥ = equal and more.

This table shows that there is no statistical significant association between nurses' training course and their knowledge concerning CPAP device (p value > 0.05).

IV. DISCUSSION

The data analysis of the present study as shown in Table (1) of the sociodemographic variables reveal that the majority of the participants age that 12 (50%) in the study sample were within (25-29) years, this results supported by Otheeb, (2016) study (Assessment of Nurses' Knowledge and Practices toward Isolation Techniques among Children with Hepatitis at Pediatric Teaching Hospitals in Baghdad City). who mentioned that most of his study sample were within (20-29) years⁽⁸⁾. Concerning to the nurses' gender, most of nurses in the study sample were female 13 (54.2 %) these results supported by Obaid et al., (2016) study (Nurses' Knowledge Concerning Neonatal Sepsis In Neonatal Intensive Care Units At Pediatric Teaching Hospitals In Baghdad City).who mentioned that the most of his study sample was female 40 (70%)⁽⁹⁾. In regard to the level of education, most of nurses 10 (41%) in the study sample were graduate Junior high nursing working in the Neonatal Intensive Care Unit, these results agree with Al-Jubouri, (2014) study

(Assessment of Nurse's Knowledge about Nosocomial Infection at Hospitals in Baghdad City)⁽¹⁰⁾. In relation to the number of years of experiences in nursing field 16 (66%) of nurses in the study sample had services of (1-5) years in the employment, As for years of experience in Neonatal Intensive Care Unit 18 (75%) of nurses had expert ≥1 years of provide in care for children, these results agree with Hammod, (2016) in her study (Effectiveness of an Educational Program on Nurses Knowledge Concerning Complications Prevention of Mechanical Ventilation at Intensive Care Unit in Al- Hussein Teaching Hospital at Nasiriya City). who mentioned that most of her study sample had experience 1-4 years were 17 (68.0%)⁽¹¹⁾. The results of the study also reveals that nurses participants in session of Continuous Positive Airway Pressure (CPAP) machine training (37%) who did not having training sessions This results supported by Al- Ftawy, (2011) in his study (Determination of Nurses' knowledge Toward Care Provided to Patients with Acute Myocardial Infarction in Al-Najaf City). Who mentioned that 18 (47.4%) who did not have training sessions⁽¹²⁾. The findings of the study sample showed that there is no statistical significant association between nurses' age, nurses' gender, nurses' level of education, years of service in nursing field, nurses' years of services in NICU, nurses' training course and their knowledge

toward The Continuous Positive Airway Pressure (CPAP) Machine at (p value > 0.05).

V. CONCLUSIONS

Most study sample were females, Mostly the ages of study sample were (25-29) Years, a High percentage of the sample had been participate in training courses about CPAP Machine.

VI. RECOMMENDATIONS

Nurses must participate in training course about CPAP inside or outside Iraq. The study recommended the necessity to develop the nurses' skills. In addition, Policy should be initiated to providing a special educational course about Neonates with Continuous Positive Airway Pressure (CPAP) Machine. Providing updating booklets, pamphlets and boosters for nurses to upgrading their knowledge about Continuous Positive Airway Pressure (CPAP) Machine.

REFERENCES

- [1] Diblasi R. Nasal Continuous Positive Airway Pressure (CPAP) for the Respiratory Care of the Newborn Infant. **Respiratory Care**. 2009 September; vol. 54 (9): 1209 – 1235.
- [2] Baudouin S, Blumenthal S, Cooper B, Davidson C, Davison A and Elliott M. Non-invasive ventilation in acute respiratory failure. **British Thoracic Society Standards of Care Committee**. 2002; vol. (57):192–211.
- [3] Bamat N, Jensen E and Kirpalani H. Duration of continuous positive airway pressure in premature infants. **Seminars in Fetal & Neonatal Medicine**. 2016: 1-7.
- [4] Wyllicia B, Bruinenberg J, Roehrd C, Rudigerf M, Trevisanutoc D and Urlesberger B. Resuscitation and support of transition of babies at birth. **Resuscitation**. 2015; vol. 95: 249–263.
- [5] Keenan W. Possible Continuous Positive Airway Pressure Treatment of Children with Pneumonia. **The Journal of Pediatrics**. 2012; Vol. 162 (5): 892-893.
- [6] Simonds A. **Non-Invasive Respiratory Support: A Practical Handbook**. 3rded. London: the United Kingdom, 2007: 57-58.
- [7] Borel J, Tamisier R, Domingos S, Sapene M, Martin F, Stach B, Grillet Y, Muir J, Levy P, Series F and Pepin J. Type of Mask May Impact on Continuous Positive Airway Pressure Adherence in Apneic Patients. **PLOS ONE**. May 2013; vol. 8(5): 1-8.
- [8] Otheeb A and Dr. Aburaghif L. Assessment of Nurses' Knowledge and Practices toward Isolation Techniques among Children with Hepatitis at Pediatric Teaching Hospitals in Baghdad City. **International Journal of Scientific and Research Publications**. 2016; Vol. 6(10): 168-173.
- [9] ObaidKh, Hussein A And Noori A. Nurses' Knowledge Concerning Neonatal Sepsis In Neonatal Intensive Care Units At Pediatric Teaching Hospitals In Baghdad City. **Asian Academic Research Journal Of Multidisciplinary**. 2016; Vol. 3(7): 56-65.
- [10] Al-Jubouri M. Assessment of Nurse's Knowledge about Nosocomial Infection at Hospitals in Baghdad City. **Journal of Kufa for Nursing Science**. 2014; Vol. 4(1):1-6.
- [11] Hammod H and Mohammed S. Effectiveness of an Educational Program on Nurses Knowledge Concerning Complications Prevention of Mechanical Ventilation at Intensive Care Unit in Al- Hussain Teaching Hospital at Nasiriya City. **KUFA JOURNAL FOR NURSING SCIENCES**. 2016; Vol. 6(2): 1-11.
- [12] Al- Ftawy D. Determination of Nurses' knowledge Toward Care Provided to Patients with Acute Myocardial Infarction in Al-Najaf City. **Kufa Journal for Nursing Sciences**. 2011; vol. 2(2): 1-14.

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(Effectiveness of an Educational Program upon nurses' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals)

فاعلية برنامج تعليمي لمعلمي التمريض في استخدام جهاز ضغط المجرى الهوائي الايجابي المستمر في وحدة العناية المركزية لحديثي الولادة في مستشفى مدينة الديوانية

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Abstract- Objectives: To assess nurses' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals and to find out the relationships between the nurses' knowledge concerning The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit and socio-demographic information.

METHODOLOGY: a descriptive study was carried out at Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals During the period from December 26th -2016 to the 15th of May -2017. A non-probability (purposive) sample of (24) nurses, who worked at Neonatal Intensive Care Unit at Al-Diwanyia City Hospitals. The tool of the study included a questionnaire, which has five main parts. The Reliability of questionnaire was determined through internal consistency and through a pilot study, and the content validity of the questionnaire was determined through an expert panel. The data were analyzed through the application of descriptive frequencies, percentages, mean of score and the inferential statistical analysis: F-test, T-test and ANOVA.

RESULTS: The study revealed that there is statistical significant association between nurses' level of education and nurses' years of services in NICU and their knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine at (post-2) of educational program follow up (p value > 0.05). There is no statistical significant association between nurses' age, nurses' gender, years of service in nursing field, nurses' training course and their knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine at (pretest, post-1 and post-2). The present study concluded that high percentage of staff nurses were graduate junior high nursing and most of them had been participated in training courses about CPAP.

CONCLUSIONS:(1) Most study sample was females. (2) Mostly the ages of study sample were (25-29) Year. (3) A High percentage of the sample had been participated in training courses about CPAP. (4) Highly significant differences between the two periods (pre and post-1 tests) of study sample in all domains of (toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit).

RECOMMENDATION: (1) The study recommended the necessity to develop the nurses' skills. (2) Policy should be initiated to providing a special educational course about Neonates with Continuous Positive Airway Pressure (CPAP) Machine.

I. INTRODUCTION

The Continuous Positive Airway Pressure is a technique of airway management in which Positive intrapulmonary pressure is applied artificially to the airways, whereby distending pressure is created in the alveoli in a spontaneously breathing baby throughout the respiratory cycle. Continuous Positive Airway Pressure (CPAP) is a noninvasive method for applying a constant distending pressure level (above atmospheric) during inhalation and exhalation to support spontaneously breathing newborn infants with lung disease. CPAP is an "open-lung approach" used to manage newborn infants predisposed to developing airway instability, edema, and atelectasis⁽¹⁾. It is applied when the infant is breathing spontaneously. It can be applied by nasal prongs or nasopharyngeal prongs. Nasal prongs constitute a simple system for application of CPAP. Mouth leak provides pressure pop off but introduces variation in level of CPAP. This system requires high flow of oxygen. Nasopharyngeal prongs are as endotracheal tube inserted through nose to hypopharynx. The length and diameter of any long prong in CPAP system increases resistance and work of breathing. It is very useful in postoperative high-risk infant with severe nonhypercapnic oxygenation failure and avoids reintubation⁽²⁾. The use of early NCPAP, showing that CPAP initiated in the delivery room decreases the need for intubation and lowers the risk of other comorbidities of prematurity such as IVH, NEC, or prolonged oxygen delivery. This applies to all but the smallest premature infants (less than 25 wG) and thus should be considered as respiratory support prior to intubation for all patients with suspected RDS. Other studies have supported extubation and NCPAP immediately after surfactant delivery, showing that it prevents later need for MV the use of NCPAP can use it to help decrease the need for prolonged ventilatory support for patients with RDS and potentially decrease the incidence of

chronic lung disease (CLD) ⁽³⁾. Among more than 130 million births per year globally, approximately ten percent of newborns require some form of intervention immediately at birth. It is estimated that 25% of approximately 4 million neonatal deaths worldwide are secondary to birth asphyxia ⁽⁴⁾. Nasal continuous positive airway pressure (CPAP) is the most widely used non-invasive continuous distending airway pressure modality and a cornerstone of modern neonatal care. Whereas there has been emphasis on understanding which devices and pressure sources best implement CPAP, the optimal duration of this therapy is less well studied. At birth, premature infants have life-threatening anatomic and physiologic immaturities of the respiratory system. CPAP attenuates this pathophysiology until sufficient stability develops and continuous distending pressure is no longer needed ⁽⁵⁾. Non-invasive respiratory support in the neonatal intensive care unit (NICU) has been used for nearly 40 years as a means to reduce complications of invasive mechanical ventilation. Specific types of non-invasive support have been implicated in preventing respiratory failure in spontaneously breathing infants, especially those with Respiratory Distress Syndrome (RDS). Technological progress, along with a better understanding of the applications of equipment, advances in the care of the neonate, and documented favorable patient outcomes have translated into trends that continue to promote non-invasive respiratory support for care of the neonate ⁽⁶⁾.

Objectives of the study

To find out demographic characteristics of nurses like age, gender, level of education ...etc.

To assess nurses' knowledge toward children with continuous positive airway pressure machine.

To assess the effectiveness of an educational program on nurses' knowledge toward The Continuous Positive Airway Pressure machine on study group (pre – posttest).

Finding out the relationship between effectiveness of an educational health program and nurses' general information characteristics such as (age, gender, nurses' educational level, years of experience in hospitals and years of experience at respiratory care unit).

II. METHODOLOGY

Administrative Arrangement:-After getting the approval of the council of Nursing College for the study, the researcher submitted a detailed description including the objectives and methodology of the study to the Ministry of Planning (Central Statistical Organization and to the Al-Diwanyia Health

Directorate (Training and Development department) in order to obtain an official permission.

SETTING OF THE STUDY: To obtain a comprehensive data, the study was conducted in selected hospitals in Al-Diwanyia City, where Neonatal Intensive Care Units are available at the following Pediatric Teaching Hospitals: AL-Hussein Pediatric Hospital and The Pediatric and Maternity Teaching Hospital in Al-Diwanyia city, Iraq. The study was carried out during the period from (26December 2016 to 15 May 2017).

DESIGN OF THE STUDY: A (quasi experimental) study was carried out to assess the Effectiveness of an Educational Program on nurses' knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine in Neonatal Intensive Care Unit.

THE SAMPLE OF THE STUDY: A non-probability (purposive) sample of (24) nurses was chosen. All of them working in Neonatal Intensive Care Units (NICU) at Pediatric Teaching Hospitals.

THE STUDY INSTRUMENTS: For the purpose of the present study, a questionnaire was conducted by the researcher, The questionnaire was used before and after conducting a special program designed to increase the knowledge of the sample, Scale of the questionnaire is (Yes or No)(36 questions) the correct answer code was (2) and the wrong answer code was (1) . The study instrument consisted of (5) parts. Part I: Socio-demographic information of the nurses. Part II: General information about Continuous Positive Airway Pressure (CPAP) Machine: It consists of (7) items. Part III: Nurses' knowledge about the Uses of (CPAP) Machine for premature babies and newborns. It included (10) items. Part IV: Nurses' knowledge about the Contraindications for using of the (CPAP) Machine for newborn and premature infants. It included (11) items. V: Nurses' knowledge about the Fundamentals for using CPAP Machine and The sign for (CPAP) failure in the treatment of respiratory distress syndrome. It included (8) items.

DATA COLLECTION: The data were collected after conducting a pretest questionnaire, applying the program then the posttest by the personal direct intervention of the researcher. The data collection process was performed for the period from the 8th January until the 2nd of March 2016.

STATISTICAL ANALYSIS: The following statistical data were obtained by using the analysis approach (SPSS) to analyze and assess the data of the study Descriptive Data Analysis and Inferential statistical analysis that include F test, T test and ANOVA.

III. RESULTS

Table(1): Distribution of the Study Sample According to their Sociodemographic Characteristic.

Variables	No.	%	
Ages (years)	20-24 years	6	25
	25-29 years	12	50
	30-34 years	4	16.7
	35-39 years	1	4.2
	40 years and more	1	4.2

	Total	24	100
Gender	Male	11	45.8
	Female	13	54.2
	Total	24	100
Level of education	graduate nursing Course	-	-
	Graduate Nursing school	2	8.3
	graduate Junior high nursing	10	41.7
	Graduate Institute of Nursing	8	33.3
	Graduate of the College of Nursing and over	4	16.7
	Total	24	100
Years of service	1-5 years	16	66.7
	6-10 years	5	20.8
	11-15 years	2	8.3
	16-20 years	1	4.2
	21 years and more	-	-
	Total	24	100
Years of experience in neonatal intensive care unit	1-5 years	18	75
	6-10 Years	6	25
	11-15 Years	-	-
	16 years and more	-	-
	Total	24	100
Training course about CPAP	Yes	15	62.5
	No	9	37.5
	Total	24	100
No. of training course	1-2	10	66.7
	3-4	5	33.3
	5-6	-	-
	7 and more	-	-
	Total	15	100

No. = number, %= percentage

This table (1) shows that 50% of the study sample was between (25-29) years of age, females were 54.2%, 41.7% had graduate Junior high nursing, 66.7% had (1-5) years of services, 75% of them had (1-5) years of experience in neonatal intensive care unit, 62.5% of them participated in intensive care courses for newborn, from the 15 nurses who participated in intensive care courses for newborn 66.7% of them had (1-2) courses.

Table (2): Distribution the Levels of Assessment through the "Mean of Score" Among the Three Period (Pre, Post-1 and Post-2) for Nurses' Knowledge of the Study Sample

Period	Level of Assessment	Frequency	Percent
Pre-test	(1.00 - 1.33) Low	24	100
	(1.34 – 1.67)Moderate	-	-
	(1.68 – 2.00) High	-	-
	Total	24	100
	$\bar{x} \pm S. D$	1.16±0.014	
Post 1-test	(1.00 - 1.33) Low	-	-
	(1.34 – 1.67)Moderate	-	-
	(1.68 – 2.00) High	24	100
	Total	24	100

	$\bar{x} \pm S. D$	1.84±0.024	
Post 2-test	(1.00 - 1.33) Low		
	(1.34 – 1.67)Moderate		
	(1.68 – 2.00) High	24	100
	Total	24	100
	$\bar{x} \pm S. D$	1.9158±0.008	

$\bar{x} \pm S. D.$ =Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.)

This table shows low level of assessment to the mean of score 24 (100%) of suggested group of assessment (1.00-1.33) for pre-test of study sample with mean score and standard division (1.16±0.014). This table Also, shows high level of assessment to the mean of score 24 (100%) of suggested group of assessment for the high level (1.68-2.00) for post-1 test of study sample, with mean score and standard division (1.84±0.024) and 24 (100%) of suggested group of assessment for the high level (1.68–2.00) for post-2 test of study sample, with mean score and standard division (1.9158±0.008).

Table (3): Comparison Significant Among the Three Period (Pre, Post-1 and Post-2) for Nurses’ Knowledge toward the Continuous Positive Airway Pressure (CPAP) Machine in the Neonatal Intensive Care Unit of the Study Sample

Over all items	Periods		Matched Paired t-test	Sig. P- value	C.S.
Over all responding	Pre test	Post-1	-1.2	0.000	HS
		Post-2	-2.414	0.000	HS
	Post-1	Post-2	-12.037	0.000	HS

C.S.: Comparison Significant, NS: Non Significant at $P \geq 0.05$, S: Significant at $P < 0.05$, HS: Highly Significant at $P < 0.01$

This table shows that there is a highly significant different at $P < 0.01$ between the initial period of pre time and post-1, then followed with a highly significant different at $P < 0.01$ between the initial period of pre time and post-2, and finally a highly significant different at $P < 0.01$ between the initial period of post-1 and post-2.

Table (4): Distribution and Association of Nurses' Knowledge with Their Age.

Variables	Nurses' Knowledge			
	No.	Pre-test Mean ± S.D.	Post 1 Mean ± S.D.	Post 2 Mean ± S.D.
20-24	6	1.16±0.015	1.83±0	1.92±0.00
25-29	12	1.16±0.014	1.84±0.029	1.91±0.009
30-34	4	1.15±0.017	1.87±0.015	1.91±0.01
35-39	1	1.17±0	1.83±0	1.92±0.00
40 and more	1	1.17±0	1.86±0	1.9±0.00
Total	24	1.16±0.014	1.84±0.024	1.9158±0.008
		F =0.389 d.f.= 4 P = 0.814	F =1.853 d.f.= 4 P =0.16	F =1.517 d.f.= 4 P = 0.237

$\bar{x} \pm S. D.$ =Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value.

This table shows that there is no statistical significant association between nurses' age and their knowledge concerning CPAP machine at (pretest, post-1 and post-2) of educational program follow up(p value > 0.05),there are no differences between age groups and mean of knowledge when analyzed ANOVA .

Table (5): Distribution and Association of Nurses' Knowledge with Their Gender.

Variables	Nurses' Knowledge			
Gender	No.	Pre-test Mean ± S.D.	Post 1 Mean ± S.D.	Post 2 Mean ± S.D.
Male	11	1.16±0.014	1.85±0.025	1.9145±0.009
Female	13	1.16±0.014	1.84±0.022	1.9169±0.007
Total	24	1.16±0.014	1.84±0.024	1.9158±0.008
		F =0.032 d.f.= 1 P = 0.859	F = 2.969 d.f.=1 P = 0.099	F =0.478 d.f.= 1 P = 0.496

$\bar{x} \pm S.D.$ = Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value.

This table shows that there is no statistical significant association between nurses' gender and their knowledge concerning CPAP machine at (pretest, post-1 and post-2) of educational program follow up(p value > 0.05), there are no differences between gender and mean of knowledge when analyzed ANOVA

Table (6): Distribution and Association of Nurses' Knowledge with Their Level of Education.

Variables	Nurses' Knowledge			
Level of Education	No.	Pre-test Mean ± S.D.	Post 1 Mean ± S.D.	Post 2 Mean ± S.D.
graduate of the School of Nursing	2	1.15±0.021	1.84±0.035	1.91±0.014
graduate Junior high nursing	10	1.16±0.015	1.84±0.028	1.92±0.00
Graduate Institute of Nursing	8	1.17±0	1.84±0.017	1.91±0.01
Graduate of the College of Nursing and over	4	1.15±0.17	1.87±0.015	1.92±0.00
Total	24	1.16±0.014	1.84±0.024	1.9158±0.008
		F =1.809 d.f. = 3 P =0.178	F = 1.88 d.f.= 3 P = 0.165	F = 3.889 d.f.=3 P =0.024

$\bar{x} \pm S.D.$ = Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value.

This table shows that there is statistical significant association between nurses' level of education and their knowledge concerning CPAP device at post-2 of educational program (p value < 0.05). There is no statistical significant association between nurses' level of education and their knowledge concerning CPAP device at (pretest and post-1) of educational program (p value > 0.05).

Table (7): Distribution and Association of Nurses' Knowledge with Their years of service.

Variables	Nurses' Knowledge			
years of service	No.	Pre-test Mean ± S.D.	Post 1 Mean ± S.D.	Post 2 Mean ± S.D.

1-5 years	16	1.16 ±0.13	1.84±0.025	1.917±0.006
6-10 years	5	1.16 ±0.16	1.85±0.025	1.912±0.01
11-15 years	2	1.15±0.021	1.85±0.021	1.92±0.00
16-20 years	1	1.17±0.0	1.86±0	1.9±0.00
Total	24	1.16±0.014	1.84±0.024	1.9158±0.008
		F = 0.366 d.f. = 3 P = 0.778	F = 0.578 d.f. = 3 P = 0.636	F = 2.279 d.f. = 3 P = 0.111

$\bar{x} \pm S.D.$ = Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value, < = Less than, ≥ = equal and more.

This table shows that there is no statistical significant association between nurses' years of services and their knowledge concerning CPAP device at (pretest, post-1 and post-2) for educational program follow up (p value > 0.05), there are no differences between years of service in nursing field and mean of knowledge when analyzed by ANOVA.

Table (8): Distribution and Association of Nurses' Knowledge with Their years of service in NICU.

Variables	Nurses' Knowledge			
	No.	Pre-test Mean ± S.D.	Post 1 Mean ± S.D.	Post 2 Mean ± S.D.
years of service in NICU				
1-5 years	18	1.16 ±0.14	1.84±0.024	1.917±0.006
6-10 years	6	1.16 ±0.15	1.85±0.023	1.91±0.01
Total	24	1.16±0.014	1.84±0.24	1.9158±0.008
		F = 0.062 d.f. = 1 P = 0.806	F = 1.747 d.f. = 1 P = 0.2	F = 4.568 d.f. = 1 P = 0.044

$\bar{x} \pm S.D.$ = Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value, < = Less than, ≥ = equal and more.

This table shows that there is statistical significant association between nurses' years of services in NICU and their knowledge concerning CPAP device at post-2 of educational program (p value < 0.05). There is no statistical significant association between nurses' years of services in NICU and their knowledge concerning CPAP device at (pretest and post-1) of educational program (p value > 0.05).

Table (9): Distribution and Association of Nurses' Knowledge with Their Training course about CPAP.

Variables	Nurses' Knowledge			
	No.	Pre-test Mean ± S.D.	Post 1 Mean ± S.D.	Post 2 Mean ± S.D.
Training course about CPAP				
Yes	15	1.16±0.015	1.85±0.024	1.917±0.007
No	9	1.17±0.01	1.84±0.025	1.91±0.01
Total	24	1.16±0.014	1.84±0.024	1.9158±0.008

		F = 2.301 d.f.= 1 P = 0.144	F = 1.663 d.f. = 1 P = 0.211	F = 1.326 d.f. = 1 P = 0.262
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$\bar{x} \pm S. D.$ = Arithmetic Mean (\bar{x}) and Std. Dev. (S.D.), No. = Number of frequencies, F = Fisher test, d.f. = degree of freedom, P = probability value, \geq = equal and more.

This table shows that there is no statistical significant association between nurses' training course and their knowledge concerning CPAP device at (pretest, post-1 and post-2) for educational program follow up (p value > 0.05), there are no differences between years of service in nursing field and mean of knowledge when analyzed by ANOVA.

IV. DISCUSSION

The data analysis of the present study as shown in Table (1) of the sociodemographic variables reveal that the majority of the participants age that 12 (50%) in the study sample were within (25-29) years, this results supported by Otheeb, (2016) study (Assessment of Nurses' Knowledge and Practices toward Isolation Techniques among Children with Hepatitis at Pediatric Teaching Hospitals in Baghdad City). who mentioned that most of his study sample were within (20-29) years⁽⁷⁾. Concerning to the nurses' gender, most of nurses in the study sample were female 13 (54.2 %) these results supported by Obaid et al., (2016) study (Nurses' Knowledge Concerning Neonatal Sepsis In Neonatal Intensive Care Units At Pediatric Teaching Hospitals In Baghdad City). who mentioned that the most of his study sample was female 40 (70%)⁽⁸⁾. In regard to the level of education, most of nurses 10 (41%) in the study sample were graduate Junior high nursing working in the Neonatal Intensive Care Unit, these results agree with Al-Jubouri, (2014) study (Assessment of Nurse's Knowledge about Nosocomial Infection at Hospitals in Baghdad City)⁽⁹⁾. In relation to the number of years of experiences in nursing field 16 (66%) of nurses in the study sample had services of (1-5) years in the employment, As for years of experience in Neonatal Intensive Care Unit 18 (75%) of nurses had expert ≥ 1 years of provide in care for children, these results agree with Hammod, (2016) in her study (Effectiveness of an Educational Program on Nurses Knowledge Concerning Complications Prevention of Mechanical Ventilation at Intensive Care Unit in Al- Hussein Teaching Hospital at Nasiriya City). who mentioned that most of her study sample had experience 1-4 years were 17 (68.0%)⁽¹⁰⁾. The results of the study also reveals that nurses participants in session of Continuous Positive Airway Pressure (CPAP) machine training (37%) who did not having training sessions This results supported by Al- Ftawy, (2011) in his study (Determination of Nurses' knowledge Toward Care Provided to Patients with Acute Myocardial Infarction in Al-Najaf City). Who mentioned that 18 (47.4%) who did not have training sessions⁽¹¹⁾. The findings of the study sample showed that there is statistical significant association between nurses' level of education and nurses' years of services in NICU and their knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine at (post-2) of educational program follow up (p value > 0.05). There is no statistical significant association between nurses' age, nurses' gender, years of service in nursing

field, nurses' training course and their knowledge toward The Continuous Positive Airway Pressure (CPAP) Machine at (pretest, post-1 and post-2).

V. CONCLUSIONS

Most study sample were females, Mostly the ages of study sample were (25-29) Years, a High percentage of the sample had been participate in training courses about CPAP Machine. Highly significant differences between the two periods (pre and post-1 tests) of study sample in all domains of (nurses' information toward The Continuous Positive Airway Pressure Machine in the Neonatal Intensive Care Unit).

VI. RECOMMENDATIONS

Nurses must participate in training course about CPAP inside or outside Iraq. The study recommended the necessity to develop the nurses' skills. In addition, Policy should be initiated to providing a special educational course about Neonates with Continuous Positive Airway Pressure (CPAP) Machine.

REFERENCES

- [1] Diblasi R. Nasal Continuous Positive Airway Pressure (CPAP) for the Respiratory Care of the Newborn Infant. **Respiratory Care**. 2009 September vol. 54 (9): Pp. 1209 – 1235.
- [2] Khilnani P. **Pediatric and Neonatal Mechanical Ventilation**. 2nd ed. New Delhi: India, 2011: Pp. 170 – 177, 181-191.
- [3] Perretta J. **Neonatal and Pediatric Respiratory Care**. 1st ed. Philadelphia: United States of America, 2013: Pp. 82 – 86.
- [4] Vali P, Mathew B and Lakshminrusimha S. Neonatal resuscitation: evolving strategies. **Maternal Health, Neonatology, and Perinatology**. 2015 vol. 1 (4): Pp. 1 – 14.
- [5] Bamat N, Jensen E and Kirpalani H. Duration of continuous positive airway pressure in premature infants. **Seminars in Fetal & Neonatal Medicine**. 2016: Pp. 1-7.
- [6] Deakins K. Non-invasive Respiratory Support in the Neonatal Intensive Care Unit: Clinical Foundations. 2009: Pp. 1-12.
- [7] Otheeb A and Dr. Aburaghif L. Assessment of Nurses' Knowledge and Practices toward Isolation Techniques among Children with Hepatitis at Pediatric Teaching Hospitals in Baghdad City. **International Journal of Scientific and Research Publications**. 2016; Vol. 6(10): Pp. 168-173.
- [8] Obaid Kh, Hussein A And Noori A. Nurses' Knowledge Concerning Neonatal Sepsis In Neonatal Intensive Care Units At Pediatric Teaching Hospitals In Baghdad City. **Asian Academic Research Journal of Multidisciplinary**. 2016; Vol. 3(7): Pp. 56-65.
- [9] Al-Jubouri M. Assessment of Nurse's Knowledge about Nosocomial Infection at Hospitals in Baghdad City. **Journal of Kufa for Nursing Science**. 2014; Vol. 4(1): Pp.1-6.
- [10] Hammod H and Mohammed S. Effectiveness of an Educational Program on Nurses Knowledge Concerning Complications Prevention of Mechanical Ventilation at Intensive Care Unit in Al- Hussain Teaching Hospital at Nasiriya City. **KUFA JOURNAL FOR NURSING SCIENCES**. 2016; Vol. 6(2): Pp. 1-11.

- [11] Al- Ftlawy D. Determination of Nurses' knowledge Toward Care Provided to Patients with Acute Myocardial Infarction in Al-Najaf City. **Kufa Journal for Nursing Sciences**. 2011; vol. 2(2): Pp. 1-14.
- [12] Khudhair S. Effectiveness of Health Educational Program upon Nurses' practices toward Care of Newborns with Neonatal Jaundice. **Journal of the Faculty of Medicine, Baghdad**. 2016; Vol. 58(2): Pp. 154-158.

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The Current Situation Analysis on Gender Equality and Discrimination in Kenya

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Abstract- It is now acceptable globally that gender discrimination and inequality are major stumbling blocks to women's rights advancement. Historical injustices continue in some parts of the world without serious efforts to address them. This paper is a desk review on various articles on the situational analysis of gender inequality and discrimination in Kenya. It is presented in the following format; Introduction; Historical practices that favor inequality and discrimination against women in Kenya; Current practices that favor inequality and discrimination against women; Legislative framework for the protection of women against inequality and discrimination; Achieving gender equality and non-discrimination. The paper concludes that, with substantial progress underway a lot still has to be done. The social and cultural circumstances hinder women's rights advancement, but with legislation, no efforts should be spared in the fight against inequality and discrimination of women

Index Terms- gender, discrimination, inequality, women, rights

I. INTRODUCTION

Gender is the array of socially constructed roles and relationship traits, behaviours, values and society influence and not physical appearance. The concept of feminism was introduced by Francios Marie¹ as a movement to end sexism, sexist exploitations and oppression² with the feminist jurisprudence focusing on the laws and philosophies based on the political, social and economic equality of the sexes.³ In a nutshell, it mainly evolved around human rights, equity, equality, non-discrimination and human dignity.

Equality is the doctrine that all persons, regardless of wealth, social status, or the political power wielded by them, are to be treated the same before the law. It relates to the dignity and value of both men and women.⁴ Jeremy Bentham stated that all men are born equal, an indisputable fact to achieve justice.⁵ It

should be to the benefit and happiness of the greater majority. Fletcher stated that equality under the law is grounded in a holistic view of human dignity applying to every person on the account of them being independent and that all alike things should be treated like; men and women are alike⁶. They should therefore be treated alike.

Gender Equality refers to the practice of fairness and justice in the distribution of benefits, access and control of resources, responsibilities, power, opportunities and services. This is a basic right for all people including women, men, young people and children. It is equal opportunities for groups of men and women to access and control social, economic and political resources including equal protection under the law. Equality between women and men is both a human rights issue and as well as a precondition for, and indicator of, sustainable people-centered development.⁷ Equality involves ensuring that the perceptions, interests, needs and priorities of women and men (which can be very different because of the differing roles and responsibilities of women and men) will be given equal weight in planning and decision-making.⁸ According to the Gender Inequality Index by the United Nations Development Programme which measures gender disparities between men and women, Kenya ranks 126 with a Gender Inequality Index of 0.552⁹. Gender inequalities manifest in almost all aspects of life: social, political & economic.

Gender discrimination is the prejudicial treatment of an individual or group due to their gender. There is positive discrimination and negative discrimination. Physically a female's role is to look after house, children, family, and relatives while on the other hand men are made for bread earners, hardship and for struggle for earning. Both are equal in human right. The distinct roles and behavior may give rise to gender discrimination. There are situations where men are sometimes discriminated upon as seen with the rise of advocacy in girl child

⁶ Fletcher G.P (1999), 'In God's Image: The Religious Imperative of Equality under Law,' Columbia Law Review Vol.99 p.16008

⁷ UN WOMEN; United Nations Entity for Gender Equality and the Empowerment of Women; <<http://www.un.org/womenwatch/osagi/gendermainstreaming.htm>> accessed on 27th June, 2017.

⁸ Kenya at 50: 'What Next for Gender Equality in Kenya', Nancy Baraza.

⁹ The higher the GII value the more disparities between females and males and the more loss to human development. Human Development Report 2015.

¹Journal of the History of Ideas.

²Hooks Bell, 'Ain't I a Woman': Black Women and Feminism (1981).

³<http://www/law.cornell.edu/wex/feminist_jurisprudence> accessed 27th June 2017.

⁴ Western P, 'The Empty idea of Equality, 'Harvard Law Review Vol.95 no. 3 of 1982 p.542

⁵ Bedau H.A 'Anarchical Fallacies: Bentham's Attack on Human Rights Quarterly, Volume 22, number1 February 2000, p261.

education in Kenya and the same can be said when we are discussing employment for women. Although gender discrimination is on both sides, this study mainly focuses on discrimination against women and the inequality they generally face.

Kenya is party to international and regional treaties on gender equality such as the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW) which was ratified 09/03/1984, Nairobi Forward Looking Strategies (1985), the Beijing Platform for Action (1995), the African Charter on Human and People's Rights and the Rights of Women in Africa (Maputo Protocol, 2003), the Solemn Declaration on Gender Equality in Africa (2004) and the African Union Gender Policy. These treaties provide that states should develop national legislation that promote gender equality within the state.

The structural outline of the paper is as follows; (i) Introduction which basically gives not only the definition of key terms but introduces the reader to the subject matter and makes them conversant with it. (ii) Aftermath of the 2010 Constitution. (iii) Historical practices that favoured inequality and discrimination against women. (iv) Current practices (v) Legislative framework that fights gender discrimination (vi) Gender Equality with regard to Socio-Economic concerns (vii) The Maputo Protocol provisions (viii) Conclusion

Kenya is a country of diverse communities who practise different customs and practises. Being a patriarchal society, cultural beliefs and stereotypes remain a major hurdle towards the empowerment of women who for the past few decades have been literally fighting to be recognized as equal partners to their male counterparts. This has in return created gender inequality because of the gender based differentiation that exists in our society.¹⁰

Traditionally, many communities in Kenya were ruled by a group of elders, all men except for the exceptional case of Wangu wa Makeri, who made important decisions concerning the communities and resolved disputes. Women were treated like children and therefore lacked a voice in all the decisions made. The progress towards gender equality and women empowerment in Kenya like many African countries, cannot, thus, be examined outside the traditional cultural setting. Though their efforts bore fruits, women still have a long way to go because at the top of both industry and government the faces remain stubbornly male. This is because progress in terms of gender equality is uneven.

The law that is meant to protect women from all the injustices that they have undergone has actually been one that has facilitated all the opportunities that have ensured women are discriminated upon and gender equality is ignored completely. Claire Robertson states that the African governments

have in fact done a little worse than merely paying lip service to the ideal equality of women in the form of laws.¹¹

Women have suffered human rights violations due to a weak legal framework that does not adequately address the inequalities and discriminations suffered in a patriarchal society.¹² The weak legal framework that has been in existence since Kenya got its independence, has further allowed the application of harmful cultural practices such as female genital mutilation, early marriage, widow cleansing, forced evictions, widow inheritance and discriminatory property inheritance practices which prevent women from inheriting property, that in turn increases women's vulnerability to abuse.

The 1963 Independence Constitution of Kenya lacked express protection of the freedom from discrimination. Section 82(3)¹³, defined discrimination as follows:

"affording different treatment to different persons attributable wholly or mainly to their respective descriptions by race, tribe, place of origin or residence or other local connection, political opinions, colour, creed, or sex, whereby persons of one such description are subjected to disabilities or restrictions to which persons of another such description are not made subject or are accorded privileges or advantages which are not accorded to persons of another such description"

Thus, traditional customs backed in some instances by discriminatory colonial laws continued to dominate and govern the various facets of community living.

The application of African customary laws found grounding in the Judicature Act¹⁴ which provided that 'The High Court, the Court of Appeal and all subordinate courts shall be guided by African customary law in civil cases in which one or more of the parties is subject to it or affected by it, so far as it is applicable and is not repugnant to justice and morality or inconsistent with any written law, and shall decide all such cases according to substantial justice without undue regard to technicalities of procedure and without undue delay'.¹⁵

Although protection against discrimination was eventually introduced into the old repealed Constitution, it was not until the year 1997 that section 82 was amended to specifically outlaw 'sex' as one of the forbidden grounds of discrimination.¹⁶ The section nevertheless retained provisions allowing for enactment of discriminatory laws with respect to adoption, marriage, divorce, burial, distribution of property upon death and other matters of personal law.¹⁷

The New Constitutional Dispensation

¹¹ Claire Robertson, 'Developing Economic Awareness: Changing Perspectives in Studies of African Women,' 1976-1985, *Feminist Studies* 13 (Spring 1987).

¹² Federation of Women Lawyers Kenya (FIDA), 'Advancing Women's Rights in Kenya'.

¹³ Constitution of Kenya, 1969

¹⁴ Chapter 8, Laws of Kenya, section 3 (2)

¹⁵ Ibid, see 2 above

¹⁶ Amendment brought through the Constitution of Kenya (Amendment) Act No. 9 of 1997, section 9.

¹⁷ Section 82 (4) (b) Constitution of 1963

¹⁰ Celestine Nyamu 'Achieving Gender Equality in a Plural Legal Context: Custom and Women's Access to and Control of Land in Kenya' [1999] 15(3) *Third World Legal Studies* <<http://scholar.valpo.edu/twls/vol15/iss1/3>> accessed 22nd December 2016

Kenya promulgated a new constitution in 2010. The right to equality and non-discrimination as expressed in Article 27 of the 2010 Constitution represents a substantial improvement on the right as provided in Article 82 of the previous 1969 Constitution. The Article begins with a guarantee of equality before the law and equal protection and benefit of the law,¹⁸ a guarantee which was not present in the previous Constitution. Moreover, equality is defined as including “full and equal enjoyment” of all rights and freedoms.¹⁹ These provisions provide important additional protection which goes beyond the protection from discrimination provided in Article 27 (4). Article 27 (4) prohibits discrimination on an extensive list of specified grounds: “race, sex, pregnancy, marital status, health status, ethnic or social origin, colour, age, disability, religion, conscience, belief, culture, dress, language or birth”. It is clear that the list of protected grounds provided in the new Constitution is indicative rather than exhaustive, beginning with the phrase “The State shall not discriminate directly or indirectly on any ground, including²⁰...” This creates the possibility of legal challenges by those suffering discrimination on grounds which are not explicitly listed in article 27(4).

Institutions and Policies in place to deal with Gender discrimination

a) Kenya National Human Rights and Equality Commission

This institution was established by the Constitution 2010 under Article 59 and its functions are stipulated²¹ to include, inter alia, promoting respect for human rights and develop a culture of human rights in the Republic, Promoting the protection and observance of human rights in public and private institutions, to act as the principal organ of the State in ensuring compliance with obligations under treaties and conventions relating to human rights and to investigate any conduct in state affairs, or any act or omission in public administration in any sphere of government, that is alleged or suspected to be prejudicial or improper or to result in any impropriety or prejudice.

b) National Gender and Equality Commission

The National Gender and Equality Commission Act 2011²² established the National Gender and Equality Commission (NGEC).²³ The functions of the commission are stipulated in Section 8 of the Act which include, inter alia, promoting gender equality and freedom from discrimination. It inherits the status and powers of its parent Commission (the Kenya National Human Rights and Equality Commission) as outlined in Chapter 15 – Commissions and Independent Offices of the 2010 Constitution, Article 59 of Chapter 4. The NGEC is empowered by Article 252 to initiate investigations based on suspicions or claims of discrimination, and have the authority of a Court to summon a witness in the course of such investigations.

c) Ministries

The Ministry of Public Service, Youth and Gender Affairs was created to provide leadership, coordinate and create enabling environment for transforming public service delivery, empowering youth and women, and promoting gender equity and equality. This has been one of the tools used to fight gender discrimination and inequality in the country.

d) Universities

Gender inequality in enrollment rates is evident in all levels of education in Kenya. Historically, girls’ enrollment in schools during the colonial period has been discouraged through perceptions that deemed education unnecessary. In 1936, girls accounted for only a third of total enrollments. Statistics show that enrolment of girls into primary schools in was 48.7 % in 1990. Admissions figures for universities show a difference between the numbers of women and men admitted. Statistics from the Ministry of Education reveal that female students comprised 30.5 per cent of the total enrolment of 40,613 students at the five public universities in the 1998/99 academic year²⁴. Kenyatta University, with 38.9 per cent, had the highest percentage of female students, while Jomo Kenyatta University had the lowest percentage (20.1 per cent). The Ministry observed that the gender gap in public university student enrolment is an issue that needs urgent attention and over the years, the numbers for female enrollment is increasing.

The University of Nairobi, School of Law recently started offering a unit known as Gender and the Law as an elective for the fourth years. The unit is eye opening to the misconceptions of the society that have fertilized gender discrimination and inequality and is one way to fight this through education. The unit, if offered in all universities, would be a step forward to ensure that gender discrimination is a thing of the past.

e) Vision 2030 Policy

The 2030 vision for gender, youth and vulnerable groups is equity in power and resource distribution between the sexes, improve livelihoods for vulnerable groups and responsible globally competitive and prosperous youth.²⁵ Its flagship projects for 2012 included inter alia to institutionalize the Women Enterprise Fund and increase its overall amounts and efficiency in projects launched by its beneficiaries and establish a consolidated social protection fund. The goals for 2012 were therefore to increase opportunities all round among women, youth and all disadvantaged groups.

Specific strategies will involve increasing the participation of women in all economic, social and political decision-making process (e.g. starting with higher representation of women in Parliament), improve access to all disadvantaged groups (e.g. business opportunities, health and education services, housing and justice) and minimising vulnerabilities through prohibition of retrogressive practices e.g. FGM and child labour.²⁶

¹⁸ The Kenyan Constitution 2010, article 27(1)

¹⁹ Ibid

²⁰ Kenyan Constitution 2010

²¹ Under Article 59 (2)

²² Cap 5C of Kenya Laws

²³ See Section 3(1) of the National Gender and Equality Commission Act 2011.

²⁴ Government of Kenya (2000), Ministry of Education, Science and Technology, Statistics Planning Section, Nairobi: Government Printers

²⁵ Vision 2030 Kenya

²⁶ Ibid, See 23

II. HISTORICAL PRACTISES THAT FAVOUR INEQUALITY AND DISCRIMINATION AGAINST WOMEN

a) Property Ownership and Inheritance

The primary and most widely held justification for the exclusion of women from ownership and control of land is that African customary law of most communities does not permit women to own or have major control over land. In most Kenyan customs, land was communally owned and passed on through the male members of the family line. In matters of inheritance, the same customs did not allow women and girls to inherit property. As such, women and girls were left out in wills and in cases of intestate succession, they were never considered. Married daughters were especially not entitled to inherit the estate of their deceased father. In Divorce, the distribution of property also favoured the husband.

Okoth Ogendo in one of his articles argues that African land tenure relations are more usefully understood as being based on the "production functions... assigned to individual members of society at different points in the social cycle".²⁷ He goes on to argue that access to power to control land is "attached to membership of some unit of production". Therefore, the extent of a person's property in land will be determined by his/her membership status.²⁸

The Law of Succession Act²⁹ has made big strides in the way of eliminating discrimination of female persons in matters of succession³⁰. The Act does not differentiate between the female and male children of the deceased or married and unmarried daughters. The term "dependant" under section 29 was defined to include, 'the children of the deceased whether or not maintained by the deceased immediately prior to his death'.

To cure the injustices regarding the right of women to inherit, courts invoked decisions that were meant to avert discrimination. One such case was in *Mary Rono v Jane Rono & another* in which under Keiyo customs a woman had no right to inherit.³¹ In this matter, the deceased was survived by two wives and nine children (six daughters and three sons), some were unmarried others divorced. One household had daughters only. It was proposed that the household with boys should get the larger share of their deceased's father's property. After all, the girls had an option of getting married and leaving the home, it was argued. On appeal, the court found no reasonable basis for drawing a distinction between the sons and the daughters ordered equal subdivision of property regardless of gender.³²

²⁷Okoth-Ogendo 'Some Issues of Theory in the Study of Tenure Relations in African Agriculture' supranote 10, at 6, 10.

²⁸ Ibid

²⁹Chapter 160 of the Laws of Kenya

³⁰Patricia Kameri Mbote, Law of Succession in Kenya: Gender Perspectives in Property Management and control, Women and Law in East Africa, 1995

³¹Civil Appeal No 66 of 2002, (2008) 1 KLR (G&F) 803. In this case, the boys claimed a larger share of their deceased's father's property than their sisters and the father's widow.

³²Section 40(1) of the Law of Succession Act provides for subdivision of deceased's estate in polygamous unions as follows; "Where an intestate has married more than once under

In *Ole Ntutu*³³, it was observed that the Maasai customary law could not apply if the same was discriminatory regardless of whether the area in question was among those gazetted under section 32. This would be against the spirit of section 3(2) of the Judicature Act and the Constitution which curtails application of customary law if, 'repugnant to justice and morality or inconsistent with any written law'³⁴.

Despite its limited gains in engendering gender equality, the Law of Succession Act ironically has also perpetuated inequality. This can be seen in section 35(1) of the Act which partly states; Subject to the provisions of section 40, where an intestate has left one surviving spouse and a child or children, the surviving spouse shall be entitled to:

(i) the personal and household effects of the deceased absolutely; and

(ii) a life interest in the whole residue of the net intestate estate: Provided that, if the surviving spouse is a widow, that interest shall determine upon her re-marriage to any person. Section 36(1) goes on further to say, where the intestate has left one surviving spouse but no child or children, the surviving spouse shall be entitled out of the intestate estate to:-

(iii) the personal and household effect of the deceased absolutely; and

(iv) the first ten thousand shillings out of the residue of the net intestate estate, or twenty per centum thereof, whichever is the greater; and

(v) a life interest in the whole of the remainder; Provided that if the surviving spouse is a widow. From this section, it is clear that a widow's life interest in the property terminates upon her remarriage but the same case does not apply to the widower. This is one example of discrimination and inequality that the law has actually created.

Despite the presence of laws to curb this particular injustice, Kenyan women are largely excluded from control of land in current times. Statistically, most of the registered land is held in men's names. Although gender disaggregated statistics are difficult to obtain, some studies have established that only 4% of land is registered in women's names.³⁵

The following case scenario is a good example of how land issues have been addressed after the promulgation of the Constitution 2010:

Samson Kiogora Rukunga v Zipporah Gaiti Rukunga 2011 [eKLR]

The deceased, Rukunga Kaimathiri was survived by fourteen children, among them Samson Kiogora and Consolata Ntibuka. He died intestate. Subsequently, Samson filed an

any system of law permitting polygamy, his personal and household effects and the residue of the net intestate estate shall, in the first instance, be divided among the houses according to the number of children in each house, but also adding any wife surviving him as an additional unit to the number of children".

³³In Re Estate of Lerionka Ole Ntutu (Deceased) [2008] eKLR.

³⁴Article 2 (4) of the Constitution Kenya 2010

³⁵This estimate is given in a study conducted by EarthCare Africa. See Land Legislation Shuts out Women, DAILY NATION (Nairobi) August 7, 1997, at page 20.

application for confirmation of grant which made no provision for daughters of the deceased. His application provoked protest from Consolata. Consolata's protest was on the ground that although she was at one time married, she got divorced in 1981 and returned to her deceased father's land. More specifically she stated that she was living on what was her deceased mother's portion of land up to and until the time confirmation of the grant was being sought. She had further stated that she lived in the house that belonged to her late mother and cultivates the rest of her late mother's portions of land.

Kiogora's testimony to the court confirmed that Consolata lived and cultivated a portion of that land. Witnesses to Samson and Consolata stated that although Consolata had once gotten married to a man called Njogu, the two were no longer living together and that Consolata was living on a piece of land that had been earmarked for her late mother. It was further stated that the house in which Consolata lived had been constructed for her mother by one of her step brothers who lived in the US.

The issues for determination were whether Consolata was entitled to inherit her deceased father's estate and the rightful owner the house in which Consolata was living. While holding in favour of Consolata, the court stated that Kiogora was forbidden not only by Article 60 (f) of the Constitution from discriminating against Consolata because of her marital status but was also prohibited by Article 27 of Constitution. Article 27 of the constitution provides that every person is equal before the law and has the right to equal protection and equal benefit of the law.³⁶

b) Distribution of matrimonial property in divorce and separation

A widow was not entitled to any of the matrimonial property. Without title to property, the woman was left vulnerable and at the mercy of in-laws who would evict her from the matrimonial property at which which is a common case that has been experienced by majority of widows all over the country.

Kenya operated on an old English statute of general application in the name of Married Women's Property Act (MWPA) of 1882 prior to the Matrimonial Property Act of 2013. Insistence on direct financial contribution by some judges disadvantaged the female folk whose primary contribution was in other forms such as farm work, domestic chores, looking after children and generally caring for the family which if we go to the discussion of gender roles in the society, will support that a woman's purpose was to fulfil the mentioned activities because of social construction.

Courts tried to intervene and bring justice to an otherwise unfair situation. In *Kivuitu v Kivuitu*³⁷, the Court of appeal put into consideration the wife's indirect contribution and granted her an equal share of the family home.³⁸ The Court of Appeal in

³⁶ Kenyan Constitution 2010

³⁷ [1991] 2 KAR 241.

³⁸ One judge remarked; 'The time when an African woman was presumed to own nothing at all and all that she owned belonged to her husband and was regarded as a chattel to her husband has long gone. Women are now honourably employed and occupy high positions equal to men in the Government and in

*Peter Mburu Echaria v Priscilla Njeri Echaria*³⁹ rejected the indirect contribution of a woman insisting on proof of direct financial contribution, giving a blow to the progress already established. Nevertheless, courts have subsequently distinguished this case in order to take into account a wife's non-monetary contributions.

c) Right to bury Spouse

The case of *Virginia Edith Wambui v Joash Ochieng Ougo and Omolo Siranga*⁴⁰ (commonly referred to as the *S.M. Otieno Case*) showcased the vulnerable position of a widow vis a vis her in-laws even in matters regarding the place of burial of her deceased husband.

When SM Otieno a prominent lawyer died in 1986, a protracted legal battle ensued over his place of burial. This dispute pitted the widow, Wambui Otieno, against the deceased's brother and members of the deceased's clan. Specifically, they objected to her announced intention to bury the remains of her late husband in Nairobi. Efforts to resolve the matter amicably failed after the widow labelled the clan members as thieves merely interested in 'looting' her house. Consequently, she filed suit in the High Court seeking a declaration entitling her to claim her husband's body from the City Mortuary and perform the burial ceremony. She also sought injunctive orders restraining the clan from ever removing or in any way interfering with the remains of the deceased until the dispute was resolved.⁴¹ The clan contested this claim on the grounds that the deceased was a Luo, and thus, needed to be buried in accordance with Luo custom. They indicated that Luo custom demanded that a person of the deceased's stature had to be buried in his ancestral home.⁴²

The protagonists articulated their claims differently. While the widow's claim was based on the English Common law right of a wife to bury her husband, the clan members appealed to the customarian responsibility imparted by the instrumentality of Luo customary law. The case was adjudicated up to the highest court of the land, the Court of Appeal, which decided in favour of Luo customary law. The court argued that when it comes to matters of personal law such as death and burial rites, it is the customary law of the deceased that applies.

The jurisprudence has since then developed asserting the priority of the marriage union in deciding the place of burial.⁴³

the private sector ... The situation has changed and so have customs'.

³⁹ eKLR Nairobi Civil Appeal No. 75 of 2001.

⁴⁰ (1982-88)1 KAR

⁴¹ J Osogo Ambani & Ochieng Ahaya, 'The Wretched African Traditionalists in Kenya: The Challenges and Prospects of Customary Law in the New Constitutional Era' (2015)

⁴² For a detailed analysis of the case, see Juma, 'Reconciling African customary law', 482

⁴³ In *Njoroge v Njoroge & another* [2004] 1 KLR, the court for instance, held that the marriage regime was more important than the succession regime. See also *Lucy Kemboi v Cleti Kurgat & 5 others* [2012] eKLR where the court held, "The Constitution of Kenya (2010) at Article 27 (3) and (4) gives both women and men the right to equal opportunities in cultural and social spheres and also provides that there should be no

d) Employment Opportunities

Gender pay gap, gender wage gap, male-female income difference, and gender earnings gap are various terms used to describe the statistical difference in the average yearly income between males and females. The difference is measured as the ratio of female to male median yearly earnings among full-time, year-round workers. The female-to-male median yearly earnings ratio was 0.77 in 2011, meaning females earned 77 percent of what their male counterparts were paid, a gap of 23 percent.⁴⁴ This ratio is calculated annually and is based on data obtained by the Bureau of Labour Statistics Current Population Survey on the median annual earnings of all men and women classified as full time workers.⁴⁵

Sexist gender stereotypes were well imported by British officials during the colonial rule, who were accustomed to living in a society with a marked gender gap. The gender pay gap has been described as an untrue feminist notion that does not take in account factors other than wage discrimination. According to this theory, women make less money because of the choices they make such as less education, lower-paying occupations, and prioritizing the responsibilities of being a mother.⁴⁶

Consequently, wage labour and economic opportunities were opened up to men, with the expectation that women would stay behind to look after the family and such similar attitudes held back women in a variety of other ways.⁴⁷ Men strove to portray themselves as having absolute power over women and other members of their families. They portrayed gender inequality as 'customary'.⁴⁸

In both formal and informal job sectors, women were discriminated upon and lacked these opportunities that were enjoyed by the men. In case they were employed, they were paid

discrimination directly or indirectly against any person on any ground"

⁴⁴U.S. Census Bureau, 2012. Highlights of women's earnings in 2011: Report 1038. From www.bls.gov/cps/cpswom2011.pdf accessed on 30th June, 2017.

⁴⁵U.S. Census Bureau. (2012). Current population reports. Income, poverty, and health insurance coverage in the United States: 2011. <www.census.gov/prod/2012pubs. Accessed on 30th June, 2017.

⁴⁶Farrell, Warren (2005). 'Why men earn more: The startling truth behind the pay gap and what women can do about it.' New York: AMACON.

⁴⁷[Nic Cheeseman](http://democracyinfrance.org/kenya-needs-reduce-gender-gap/), DEMOCRACY IN AFRICA; The Gender Gap in Kenya – Taking Stock and Moving Forward <http://democracyinfrance.org/kenya-needs-reduce-gender-gap/> accessed on 30th June, 2017.

⁴⁸MARTIN CHANOCK, 'LAW, CUSTOM AND SOCIAL ORDER: THE COLONIAL EXPERIENCE IN MALAWI AND ZAMBIA' 38 (1985). See also T. Nhlapo, Indigenous Law and Gender in South Africa: Taking Human Rights and Cultural Diversity Seriously. 1994-95 THIRD WORLD LEGAL STUDIES 49, 58-60. Nhlapo shows that in fact through 'officialised' customary law in the colonial setting, women were placed outside of the domain of law which, under the influence of Roman-Dutch law, recognized only the 'head of household' as the only true person in law.

less money compared to their male counter parts despite the fact that they were doing the same job. This practise has continued to current times. With the growing economy, many men have been able to secure formal employment. This could be influenced by the fact that previously, it was only the men who would be educated if they were in a family of both boys and girls. Because of this, the informal sector has been filled by women mainly because they lack education qualifications and also they are more prone to discrimination and being taken advantage of.

Due to past injustices, inequalities and discrimination against women, there have been fewer women in the senior ranks of employment.⁴⁹ Senior positions are denied women on the basis that in their reproductive ages will be more absent than their male counterparts in order to devote time to family care and child nurturing.⁵⁰

In many cases, men are paid higher incomes for the same work as their female counterparts with the argument that men are perceived to be breadwinners.⁵¹ Although there are as many females as males, the female share of total wage employment was about 37% of the total wage employment in both 2013 and 2014. The employment to population ratio (EPR) for females is lower than that of males for all age groups above 15 years.⁵² This suggests that females are disadvantaged in accessing employment.

Females and males also differ on the sector of employment. Males tend to outnumber females by between two to five times in the sectors/industries that are deemed to be more lucrative, such as manufacturing and professional, scientific and technical activities.⁵³

Available evidence indicates that the pay gap exists, although Kenya ratified the Equal Remuneration Convention in 2001. Women were likely to earn about 67 to 70 percent of the salary of men in 2005 and 2014. About 70% of managing directors meet the two-thirds gender rule in overall distribution of employment by sex. However, within the upper job groups A to D, cadres of the public service, the constitutional threshold is rarely met.⁵⁴

Women must collectively work together if they want their employers to treat them fairly based on their merit. They have an

⁴⁹Kameri-Mbote P, *Protection Of The Employed Women's Rights In Kenya: A Case-Study Of The Female Academic Staff Members At The University Of Nairobi*, Project paper submitted in partial fulfillment of the requirements for the award of the Diploma in Women's Law (Dip. WL), Faculty of Law, University of Zimbabwe

⁵⁰Kameri-Mbote P, *Protection Of The Employed Women's Rights In Kenya: A Case-Study Of The Female Academic Staff Members At The University Of Nairobi*, Project paper submitted in partial fulfillment of the requirements for the award of the Diploma in Women's Law (Dip. WL), Faculty of Law, University of Zimbabwe

⁵¹Ibid See 31

⁵²Employment under the Official Launch of the Status Report of Equality and Inclusion in Kenya-2017 as seen in the Daily Nation, Wednesday July 5th, 2017.

⁵³Ibid See 47

⁵⁴Ibid See 47

obligation to help the women who come after them. Change will not happen without women persevering in their professional lives to end gender imbalances in the workplace.⁵⁵ Kenya as well has to put emphasis to the employment sector where they should actually implement Article 13 of the Maputo Protocol to the letter since it is one of the conventions that She has ratified and deals with key issues such as equality of access to employment, equal remuneration and to ensure the equal application of taxation laws to women and men inter alia.⁵⁶

III. CURRENT PRACTISES THAT FAVOUR INEQUALITY AND DISCRIMINATION AGAINST WOMEN

a) Women in governance

Representation is a core concept in the study and practice of politics.⁵⁷ It is necessary to consider three facets of representation; who represents, what is represented and how it is represented.⁵⁸

The Constitution of Kenya, 2010 presented various gains towards gender equality as stipulated in Article 27 (3)⁵⁹ and (8)⁶⁰. The preamble to the Constitution recognises the aspirations of all Kenyans for a government based on essential values of human rights, equality, freedom, democracy, social justice and the rule of law. Right to Participation in the Political and Decision-Making Process has also been emphasized in the Maputo Protocol which Kenya has ratified.⁶¹

Equal participation of the gender in leadership and governance is an important step towards ensuring gender equality in many other facets. It is only by having real power through participation in decision making and policy formulation that sex equality can be achieved.

The participation of women in legislative process shows a slow progress towards equality of the two genders. In fact, there was no Kenyan woman representative in the first Parliament and it was not until the second General election in 1969 that the first woman got elected as a Member of Parliament.⁶² This shows the inherent patriarchal nature of the political system and parties.

⁵⁵Cheryl Lynn Kelsey, 'Gender inequality: Empowering women'

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⁵⁶ Protocol to the African charter on Human and People's Rights on the Rights of Women in Africa (MAPUTO Protocol), Article 13

⁵⁷Yvonne Galligan, '*International Political Science Review*', Vol. 28, No. 5 (Nov., 2007) available at

<http://www.jstor.org/stable/20445117>>accessed on 1 November 2016

⁵⁸Ibid

⁵⁹ Women and men have the right to equal treatment, including the right to equal opportunities in political, economic, cultural and social spheres.

⁶⁰ In addition to the measures contemplated in clause (6), the State shall take legislative and other measures to implement the principle that not more than two-thirds of the members of elective or appointive bodies shall be of the same gender.

⁶¹ Ibid, See 54

⁶² Ms Grace Onyango representing Kisumu Town constituency

The inclusion of women is in reality cooptation of them in a male-centric system.⁶³

As quoted earlier, Article 27(8) places a duty on the State to take legislative (through Parliament) and other measures to implement the two-thirds gender principle⁶⁴. Under Article 81(b) the electoral system is mandatorily directed to comply with the principle that not more than two-thirds of the members of elective public bodies shall be of the same gender. Further, Article 100 mandates Parliament to enact legislation promoting representation in Parliament of women. These provisions should have a substantial positive effect on women's representation and role in the decision-making process at all levels of government.

Notwithstanding the increment of women representation in the country due to affirmative action⁶⁵, the reality is that the numbers still offend the spirit of women representation in the East African region, where statistics show that South Sudan stands at 25%, Burundi at 30%, Uganda at 35%, Tanzania at 38% and Rwanda leading the pack at 56%. This thus erodes the fallacy that Kenya lags behind due to its African culture, seeing that her neighbors have evidently overcome such barriers.⁶⁶

The Gender Bill⁶⁷ that was recently tabled in parliament sought to implement the two-thirds gender principle that is provided for in the constitution.⁶⁸ The Bill allowed nomination of more women to the Senate and National Assembly to meet the constitutional gender representation threshold, since the number of women in the National Assembly has not yet met the threshold of the two-thirds gender principle.

This Bill however, failed to pass as it was viewed as though it geared towards favouring the women only. Gender parity includes even men.

Women currently form 19.7 percent of membership of the National Assembly in the 11th Parliament i.e. (2013-2017, including 47 County Women Representatives. No woman was elected in the 47 Senate seats but sixteen women were nominated from party lists and two more were nominated to represent youth and persons with disability, bringing the number of nominated female senators to 18.⁶⁹

No female candidate was elected Governor in any of the 47 counties. In the 47 county assemblies, women won only 82 out of 1450 elected seats during the 2013 elections. This represented 5% of elected ward representatives. An additional 680 women

⁶³Nyokabi Kamau, 'Women and political leadership in Kenya: 10 Case Studies', (Heinrich Boll Foundation, 2010) available at <https://ke.boell.org/sites/default/files/women_in_leadership_stu_dy.pdf> accessed on 26th June 2017

⁶⁴ Constitution of Kenya 2010, Article 81 (b)

⁶⁵ Constitution of Kenya, 2010, Article 27 (6)

⁶⁶Diana Gichengo, WOMEN IN POLITICS; THE 50 YEAR JOURNEY IN KENYA.

<http://www.academia.edu/24038426/WOMEN_IN_POLITICS_THE_50_YEAR_JOURNEY_IN_KENYA> accessed on 30th June, 2017.

⁶⁷ Constitution of Kenya Amendment Bill No.4 of 2015

⁶⁸The Constitution of Kenya, 2010, Article 27 (8)

⁶⁹ Political representation under the Official Launch of the Status Report of Equality and Inclusion in Kenya-2017 as seen in the Daily Nation, Wednesday July 5th, 2017.

were nominated by political parties that had won seats in the assemblies, in order to meet the two-thirds gender rule as per Article 177 of the Constitution.⁷⁰ As a result, there are 762 women in the county assemblies, forming 34% of membership. Thus, county assemblies do meet the gender quotas set out by Article 27 and 81 of the Constitution.

The Constitution sought to mitigate historical political marginalization and discrimination against women, PWDs, and the minority communities. However, inadequate progress has been made since the Constitution was promulgated. In the current 2017 elections, more women have taken the interest to vie for the county representative, senatorial and gubernatorial seats. We even had a female presidential candidate, one Nazleen Umar who was not cleared to continue with the race.

b) Women in the Judiciary

Women's representation in the Kenyan Judiciary is among the highest in sub-Saharan Africa. In 2012, 40 out of 104 judges were women, and 187 out of 424 magistrates were women.⁷¹ In 2013 the Kenyan Judiciary's website specified that women's representation in senior judicial positions included three women in the Judicial Service Commission, two women in the Supreme Court, eight women in the Court of Appeal and thirty women in the High Court.⁷² For the first time, in 2011, Kenya began to appoint women as judges in the Muslim Kadhi Courts.⁷³

The Constitution 2010 created the Supreme Court at the apex of the Judiciary under Article 163. Among its other roles, giving Advisory Opinion is within its ambit. In Advisory Opinion No. 2 of 2012⁷⁴ brought by Attorney General (AG) regarding Article 81(b) as read with other provisions of the Constitution. The AG sought whether it required a progressive realization of the one-third gender rule or an immediate nature during the 4th March, 2013 general elections. The Supreme Court was presented with a novel opportunity to pronounce itself in advancement of gender equity in the National Assembly and the Senate. It was the argument of the AG that the Constitution was not clear on this and he interpreted it to the effect that it should be progressive.

⁷⁰ Ibid, 59.

⁷¹ Chief Justice of the Republic of Kenya, State of the Judiciary Report 2011-2012, 2012, p. 163.
<<http://www.judiciary.go.ke/portal/chief-justices-state-of-the-judiciary-report-2011-2012.html>> (Accessed 19th July 2017).

⁷² The Republic of Kenya, "The Judiciary".
<<http://www.judiciary.go.ke/portal/judges-of-the-judiciary.html>> (Accessed 19th July 2017).

⁷³ "Shari'ah Female Judges Irk Kenya Muslims", in OnIslam, 5 October 2011 http://www.mwnuk.co.uk/Shari_ah_Female_Judges_Irk_Kenya_Muslims_79_news.php (Accessed 19 July 2017). The Kadhi Courts are religious tribunals that only apply to Muslims. These courts can decide on matters of inheritance, marriage and divorce. The Kadhi is the presiding official, equivalent of a magistrate.

⁷⁴ In The Matter of the Principle of Gender Representation in the National Assembly and the Senate [2012] eKLR <<http://kenyalaw.org/caselaw/cases/view/85286>> accessed on 30th June, 2017.

The Committee of Experts (CoE) were alive to this fact, that the expedition for the home-grown constitution involved greatly the search for gender equity. Consequently, the Constitution drafters deemed it fit to abandon discriminative laws and gender neutrality nature of laws to outlaw inequality. In its role of constitution interpretation, all the Supreme Court judges found in favor of the AG's argument, with the immediate former Chief Justice dissenting.

Interrogating the Advisory Opinion, the court deviated from international instruments ratified by Kenya. Dint of Article 2(5) and (6) the advisory fatally flawed the Universal Declaration of Human Rights (UDHR) that guarantees a full range of civil political rights. It also went against the provisions of the Convention on Elimination of all forms of Discrimination against Women (CEDAW), the Protocol to the African Charter on Human Rights of Women in Africa (the Maputo Protocol) as well as the African Charter on Human and People's Rights. These ratified treaties have sufficient provisions on discrimination.

The **International Covenant on Civil and Political Rights** (ICCPR) imposes an obligation of mandatory immediate realization on civil political rights but a progressive realization for socio-economic and cultural rights. The obligation imposed by the ICCPR is unqualified and of an immediate effect and states cannot invoke a lack of resources to justify failure to protect the rights.

The CoE was also alive to this fact. The provisions of Article 21(2) by providing that social economic and cultural rights are progressive, contra differentiates the two categories of these rights, but also directs that the State ought to set standards in such realization.

The court nonetheless went on to set the date for such action by the state to be August 2015. It is my opinion that the court did not enquire what measures the state had put in place geared towards actualizing the gender rule, and in fear of causing a constitutional crisis by declaring the Parliament unconstitutionally constituted, failed to give a progressive opinion. The advisory essentially approved the disenfranchisement of the Kenyan women in political fields and is a form of discrimination dating back to independence.

Of importance, the Supreme Court as constituted lacks the gender threshold, 5 men and 2 women. FIDA lost their petition⁷⁵ challenging the names presented to the President for appointment in the first instance. However, even after opportunity presented itself for three vacancies, the old trend carried the day in spite of the fact that the Judicial Service Commission (JSC) has women seating in the commission and is chaired by a woman!

This investigation concludes that the Supreme Court has failed in fulfilling its role to advance gender equality according to Article 259, which requires that the constitution be interpreted in a way that promotes its purposes, values and principles; and permit the development of the law.

Looking at the position of the Chief Justice and Deputy Chief justice that was created by the Constitution⁷⁶, it is clear to see that women have been discriminated upon. This is because

⁷⁵ Federation of Women Lawyers Kenya (Fida-K) & 5 Others V Attorney General & Another [2011] eKLR.

⁷⁶ Article 161 (2) (a) and (b) respectively

even during applying and appointing the Chief Justice, the trend is only the males are considered and vice versa for the Deputy Chief Justice position. Be that as it may, the number of female judicial officers has increased overtime. However, despite these gains, there are still challenges to achieving women's full and equal representation in Kenya's judiciary. Women lawyers and judges point to the lower numbers of women in higher judicial offices and speak to a "glass ceiling that is preventing women from being able to move into high-ranking offices within the judiciary."⁷⁷ They also note that patriarchal attitudes, such that women are unable to serve in demanding and important offices and that leadership roles are not appropriate for women, still impede the career progression of women lawyers and judicial officers.⁷⁸

c) Domestic Violence Against Women

Domestic violence is another major challenge that negates efforts towards achieving gender equality in Kenya. It is violence between spouses, but can also happen between cohabitants or nuclear family members. Domestic violence in Kenya takes the form of physical assault, emotional abuse, and threats of violence, sexual violence and distress.

Empirical evidence from a study conducted by FIDA in 2007 identifies domination of the male in the society as the main factor as well as socialization that the man has the right to discipline his wife. This has led to widespread violence within families that turn fatal in most cases. Socialization therefore becomes one of the major challenges negating gender equality in Kenya.

There is a general failure in law to recognize offences such as marital rape. The law is there to serve the society therefore lack of recognition of such offences poses a huge challenge towards achievement of gender equality. Further to this, the male dominated parliament has been reluctant or slow to enact laws that would protect women who experience violence at home.

The laxity of law enforcement officers to apprehend perpetrators of domestic violence often dismissing victims to solve their issues within the family set up which never yield much results due to the patriarchal nature of the society.

d) Occupation of Public Office

The trend for who occupies public office in Kenya is the same as explained under women in the judiciary. Women are discriminated upon when it comes to them occupying these positions. It is not that they are less qualified but because they are not given the opportunity.

Even in the cabinet ministries, the number of women appointed to be cabinet secretaries is less and the ministries they are given seem to be very friendly and not challenging as opposed to those ones handed to their male counterparts. This though was challenged by President Uhuru Kenyatta when he appointed Rachael Omamo to be the Cabinet Secretary for Defence.

⁷⁷ "Kenya Women's Groups Want More Female Judges", in Voice of America, 20 March 2011.

<<http://www.voanews.com/content/article/157718.html>> (Accessed 19th July 2017).

⁷⁸ Ibid

An analysis of some incidences reveal the difficulties faced by women in top positions in Kenya. In the case of an accomplished civil servant lady, nominated by the President for the post of the powerful Cabinet Secretary, parliamentarians conspired and blocked her from being appointed to the top civil service job due to her tough no nonsense style of administration.⁷⁹ This character is what terrified most of the corrupt members of the parliament. It is her tough nature that worked against her, yet it is what she needed for the job. She was a victim of her own success and prospects.⁸⁰ The National Assembly rejected her nomination to be the secretary to the cabinet despite her outstanding academic and professional achievements. A man was appointed instead.

In yet another case, a lady was appointed to the position of the top most female police officer, as the Deputy Inspector General of Police. Allegations that a top official in the office of the president wanted the female officer to influence the tendering process for the purchase of police equipment such as armoured cars and bulletproof vests finally led to her untimely exit from the force.⁸¹ When the female officer declined the proposal, this led to her losing the job. Some people in high government places may have been uncomfortable with the female officer's uncompromising stand on unprofessional conduct. Those involved pressed for a 'more suitable candidate' to take over from her.⁸²

In yet another case, a female judge who held the most powerful docket in the Judiciary as the Deputy Chief Justice was reported to have brandished a gun in the face of, a woman security guard at an elitist shopping centre. The lady security guard had allegedly sought to search the Deputy Chief Justice's bag as part of routine security check of all visitors to the mall. The Deputy Chief Justice is alleged to have refused. This incident was the beginning of a series of events that finally led to the exit of the Deputy Chief Justice from the powerful office. It is worthy to note that like the Cabinet Secretary nominee and the Deputy Inspector of Police, the Deputy Chief Justice was also a strong character, firm and took a no nonsense stand on administrative matters. In contrast to the events that followed the exit of the Deputy Chief Justice, recently, a powerful male Cabinet secretary is reported to have attempted to force his way, together with his team to proceed into the domestic airport without going through a screening point. However, a tough lady security officer insisted that the Cabinet Secretary must be subjected to the security check before they could proceed. As a result, the lady security officer lost her job for humiliating the

⁷⁹ <https://www.standardmedia.co.ke/article/2000165613/why-monica-juma-s-fate-was-sealed-long-before-the-vote> Accessed on 16th July 2017

⁸⁰ Ibid

⁸¹ www.the-star.co.ke/news/2015/09/04/grace-kaindi-forced-out-over-shs12billion-supply-tenders_c1198749 Accessed on 16th July 2017

⁸² Ibid

Cabinet Secretary.⁸³The above two incidents show how the society treats the same situation differently based on gender.

IV. LEGISLATIVE FRAMEWORK FOR THE PROTECTION AGAINST GENDER DISCRIMINATION IN KENYA

Constitution 2010

1. Protection from harmful cultural practices

Article 2 (4)⁸⁴ states that,

'Any law including customary that is inconsistent with this Constitution is void to the extent of the inconsistency, and any act or omission in contravention of this Constitution is invalid.'

This provision protects women from harmful cultural practices such as dispossession of land, going on forward.

2. Citizenship

*A person is a citizen by birth if on the day of the person's birth, whether or not the person is born in Kenya, either the mother or father of the person is a citizen.*⁸⁵

This provision ensures that a Kenyan woman would be able to pass citizenship to her children regardless of whether she is or is not married to a Kenyan.

3. Women identified as a vulnerable group

*All state organs and all public officers have the duty to address the needs of vulnerable groups in the society, including women, older members of society, Persons with disabilities, children, youth, members of minority or marginalised communities and members of particular ethnic, religious or cultural communities.*⁸⁶

The Constitution has put in place measures to ensure that affirmative action is undertaken to ensure equality and freedom from discrimination.⁸⁷As a marginalized group, under Article 56, women will benefit from the State's obligation to put in place affirmative action programmes that will encourage female participation in governance, provide special opportunities in education and economic fields, access to employment and have reasonable access to water, health services and infrastructure.

4. Equality and freedom from discrimination

Article 10 deals with national values and principles of governance. It goes further to state that national values and principles of governance include human dignity, equity, social justice, inclusiveness, equality, human rights, non-discrimination, and protection of the marginalized.⁸⁸

This is echoed further in Article 27 which is central to safeguarding women's rights as it provides for equality and freedom from discrimination. Article 27 provides for;

(1) Every person is equal before the law and has the right to equal protection and equal benefit of the law.

(2) Equality includes the full and equal enjoyment of all rights and fundamental freedoms.

(3) Women and men have the right to equal treatment, including the right to equal opportunities in political, economic, cultural and social spheres.

(4) The State shall not discriminate directly or indirectly against any person on any ground, including race, sex, pregnancy, marital status, health status, ethnic or social origin, colour, age, disability, religion, conscience, belief, culture, dress, language or birth.

(5) A person shall not discriminate directly or indirectly against another person on any of the grounds specified or contemplated in clause (4).

(6) To give full effect to the realisation of the rights guaranteed under this Article, the State shall take legislative and other measures, including affirmative action programmes and policies designed to redress any disadvantage suffered by individuals or groups because of past discrimination.

(7) Any measure taken under clause (6) shall adequately provide for any benefits to be on the basis of genuine need.

(8) In addition to the measures contemplated in clause (6), the State shall take legislative and other measures to implement the principle that not more than two-thirds of the members of elective or appointive bodies shall be of the same gender.

The Sexual Offences Act⁸⁹

This legislation is an example of how law can be created and implemented while being gender sensitive and supporting gender discrimination. The language used from the definitions given, implies that both sexes can actually be raped⁹⁰ and sexually assaulted.⁹¹The provisions of section 20 shall apply *mutatis mutandis* with respect to any female person who commits an indecent act or act which causes penetration with a male person who is to her knowledge her son, father, grandson, grandfather, brother, nephew or uncle.

The Prohibition of Female Genital Mutilation Act⁹²

This Act makes it illegal to practise female circumcision, procure the services of a circumciser or send somebody out of the country to undergo FGM.⁹³ Offenders under this Act will serve up to seven years in prison and be liable for payment of fines of up to Kshs. 500,000.

Further, a person will be liable to a sentence of life imprisonment for causing a death in the process of carrying out FGM.⁹⁴ In addition, providing premises for the purposes of

⁸³ <https://www.tuko.co.ke/245136-jomo-kenyatta-airport-employee-fired-humiliating-matiangi.html> Accessed on 16th July 2017

⁸⁴ Constitution of Kenya 2010

⁸⁵ Article 14 (1) Constitution of Kenya 2010

⁸⁶ Article 21(3) Constitution of Kenya 2010

⁸⁷ Article 260 of the Constitution defines affirmative action as any measure designed to overcome or ameliorate an equity (unfairness, injustice, inequality or imbalance) or systematic denial or infringement of a right or fundamental freedom.

⁸⁸ Article 10 (2) (b) Constitution of Kenya

⁸⁹ Act No.3 of 2006

⁹⁰ Section 3 (1) of Sexual Offences Act

⁹¹ Section 5 (1) of Sexual Offences Act

⁹² Act No.32 of 2011

⁹³ Section 21 of the Prohibition of Female Genital Mutilation Act

⁹⁴ Section 19 (2) of the Prohibition of Female Genital Mutilation Act

carrying out FGM⁹⁵ or failure to report an incident of FGM knowingly are also punishable by law.⁹⁶

Protection of Victims against Domestic Violence Act⁹⁷

This legislation portrays that a law can be created while being gender sensitive and not support gender discrimination. The language used from the definitions given, implies that both sexes can actually be part of a domestic violence relationship with no description leaning towards the female sex.⁹⁸

Gender Equality With Regard To Socio-Economic Concerns

The economic perspective of gender equality in any jurisdiction should be measured in taking into account the gender gaps between men and women in accessing resources and opportunities⁹⁹. Gender parity in the economic realm in its success should go beyond mere equality slogans and measures to ensure that the most vulnerable are able to access Economic opportunities across the gender divide¹⁰⁰. Women continue to participate in labour markets on an unequal basis compared to men; in 2013, the male employment-to-population ratio was at 72.2 per cent, while the ratio for females was 47.1 per cent¹⁰¹. The rationale of gender policies and the way they are meant to serve the subjects in reshaping the policy priorities has a great significance in requirement of policy development that goes beyond the sphere of formal gender equality¹⁰². The Maputo protocol in elimination of discrimination on the economic and social welfare tasks state parties to take measures that will guarantee equal work and economic opportunities¹⁰³. This shall be inter alia promotion of equal remuneration to men and women for jobs of equal value, promoting equality of access of employment; ensuring transparency in recruitment, promotion and dismissal of women as well as introducing punitive measures for sexual harassment at workplace; guaranteeing women freedom to choose their occupation and from employer

exploitation; promoting the occupations and economic activities of women particularly in the informal sector; taking measures that will ensure the economic value of the work of women at home; to guarantee adequate and paid pre- and post-natal maternity leave in both the private and public sectors; preventing the exploitation and abuse of women in advertising and pornography¹⁰⁴.

V. ACHIEVING GENDER EQUALITY AND NON-DISCRIMINATION

Whether these measures have materialized to achieve equality and eliminate discrimination or not is a question of fact. Kenya for instance has made strides in promoting the equality in economic and social welfare. With regard to legislative measures, statutes such as the Employment Act 2007 guarantees equal access of employment for both men and women¹⁰⁵, provision of punitive measures on sexual harassment¹⁰⁶ and equal remuneration for work of equal value regardless of the gender affiliations¹⁰⁷. This includes provision of both maternity and paternity leave with pay for both men and women¹⁰⁸. The Matrimonial property Act 2014, in accordance with the Maputo protocol recognizes the contribution of women and puts an economic value and beneficial interest in work done at home with regard to matrimonial property¹⁰⁹. Other quintessential provisions in the Act are the equal status for spouses which gives married women the same rights in acquiring, administering, holding, use and control of property¹¹⁰. This is in accordance with the constitutional right to acquire and own property without any grounds contemplated within article 27(4) of the constitution¹¹¹. However, The Maputo protocol intensifies the skepticism of the equality ideal in the economic realm with provisions of the establishment and protection of women in the informal sector and sensitizing them to adhere to it. Does this provision encourage women to only venture and adhere to the informal sector? This is despite the poverty patterns due to low incomes and inferiority accorded to the informal sector particularly in Africa¹¹². Such provisions have since been transcended by the dynamics and logistics of Economic gains and impact of women with regard to gender discrimination. It is prejudice to encourage one gender to venture in a particular economic activity at the detriment of other lucrative ventures to the opposite gender, such provisions will only perpetuate stereotypical roles of women and further nurture economic dependency.

⁹⁵ Section 22 of the Prohibition of Female Genital Mutilation Act

⁹⁶ Section 24 of the Prohibition of Female Genital Mutilation Act

⁹⁷ Act. No. 2 of 2015

⁹⁸ Section 4 (1) of the Protection of Victims against Domestic Violence Act

⁹⁹ Global Gender Gap Index 2015; see also The World Economic Forum Report 2015 'The Case for Gender Equality'

<<http://reports.weforum.org/global-gender-gap-report-2015/the-case-for-gender-equality/>> accessed on 30th June 2017

¹⁰⁰ Jane Lewis, 'Work/family reconciliation, equal opportunities and social policies: the interpretation of policy trajectories at the EU level and the meaning of gender equality' 13(3) (2007) *Journal of European Public Policy*

¹⁰¹ International Labour Organization Report, 'Global Employment Trends 2014: Risk of a jobless recovery?' <http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_233953.pdf> accessed on 15th July 2017

¹⁰² Ibid note 3

¹⁰³ Protocol to the African charter on Human and People's Rights on the Rights of Women in Africa, Art 13

¹⁰⁴ Ibid

¹⁰⁵ Employment Act, 2007 s 5

¹⁰⁶ Ibid s 6

¹⁰⁷ Employment Act, 2007 s 5(5)

¹⁰⁸ Ibid s 28

¹⁰⁹ Matrimonial Property Act, 2013 s 9

¹¹⁰ Ibid s4

¹¹¹ The Constitution of Kenya 2010, Art 40

¹¹² Dan Banik, *The Legal Empowerment Agenda: Poverty, Labour and the Informal Economy in Africa* (Ashgate Publishing Ltd. Rvsvd Edition, 2013) see also; The African Development Bank, 'Recognizing Africa's Informal Sector' (27th March 2013)

With such progressive legislative measures with regard to the contemplated objectives of the Maputo protocol and CEDAW, there are doubts raised with regard to the institutional strides made. Legislation without institutional frameworks is futile¹¹³. With gender mainstreaming concerns on institutionalized programmes put in place, progress has been majorly accorded the ministry of gender and youth affairs as well as establishment of a gender commission by the National Gender and Equality Act 2011. However, even with such governmental institutional strides, the autonomy of these institutions in promoting gender equality is doubtful. The gender mainstream in various ministries, departments, national and county governments, public and private sectors has been encumbered by patriarchy and male hegemonies. The gender balance in Kenya's cabinet secretaries is a fallacy of the gender equality ideal; with a total number of twenty cabinet secretaries only five are women with only eleven women principal secretaries out of a total of forty one principal secretaries¹¹⁴. The essence of gender mainstreaming in government appointments in Kenya is therefore questionable on the independence of the gender commission and the ministry of gender which has failed to preeminently advocate for gender parity.

There has been monumental progress made as well in the institutional frameworks put in place to ensure social-economic equality in curbing poverty in women. Such programmes include the Women Enterprise Fund and Uwezo funds that provides financial credit to women as start-up capital for businesses¹¹⁵. However even in such economic solace, very few women especially in the rural and slums settlements are aware and able to access such loans let alone the institutional barriers and other frustrations that come along the funds¹¹⁶. Further, there are men who languish in poverty who also need special economic relieve in attaining economic stability¹¹⁷. The gender equality

sense in access to financial services is also discriminatory against men with a prejudicial stereotype and notion that all men are financially stable.

Key economic aspects are education with ictus being accorded to girls' education and its several aspects of development vis-a-vis the impact of gender inequality in education on economic growth. Globally, 781 million still remain illiterate of which two thirds are women. However Education from gender parity stance has been met with remarkable progress in most African countries; in Kenya, measures and programs that are intended to educate the girl child have drastically materialized. Education increases labour force participation rates and earnings as well as foster educational investment¹¹⁸. Therefore, the cost of girls' exclusion or considerable denial of equality from education hinders the productive potential of an economy and its overall development¹¹⁹. Investment of advanced education for girls globally mostly in Africa and Asia, would actually lead to attainment of 68 percent of the annual GDP¹²⁰.

In a continent that barely invests in educating the girl child especially in sub-Saharan Africa, education profoundly opens up opportunities for women to escape agricultural feminization and participate in the formal wage employment which would highly improve economic status of most women¹²¹. Measures put in place to ensure women are in labour markets and not agriculture alone through education are necessary for economic liberation and prosperity on a gender parity ideal¹²². Other than agriculture women are also forced to venture in other low productivity activities in the informal sector. This as a social perception that women can only excel in the informal sector has been an apprehension of the genesis of women as economic dependents and poverty.

The gender gap has narrowed and even worse surpassing the equality ideal in most developing countries like Kenya. With legislative measures in enactment of laws and adherence of international instruments; Kenya has been able to implement instruments such as the Maputo protocol which advocates for elimination of discrimination of women in field through promotion of literacy among women and introduction of curricula aimed at gender sensitization¹²³. This has also seen enactment of laws that ameliorate cultures and customary rules such as female genital mutilation through the Prohibition of Female Genital Mutilation Act 2015, early marriages through the Marriage Act 2014. These have been huge strides made in

¹¹³Daniel J. Curran, *Dead Laws for Dead Men: The Politics of Federal Coal Mine Health and Safety Legislation* (University of Pittsburgh pre, 1st Edn.1993)

¹¹⁴ Standard Reporter, 'List of Principal Secretaries after Cabinet reshuffle' *The Standard Newspaper* (Nairobi, 13th November 2015)

¹¹⁵ Keynote address by Commissioner Winifred Lichuma on the Gender Equality Challenges in Kenya and Africa in the Australian High commission in London on 28th June 2017 <<http://www.ngeckkenya.org/downloads/all>> accessed on 30th June 2017

¹¹⁶ Alex Njeru, 'Funds set up to help youth and women are a barrier to progress' *The Daily Nation* (Nairobi, 29th march 2016) ; see also Nancy Mulu Mwoche, 'Barriers Faced by Women Groups in Accessing Uwezo Fund in Kikuyu Constituency, Kiambu County' (MA in Arts in gender and development studies, University of Nairobi 2016)

¹¹⁷Mary Amuyunzu-Nyamongo & Paul Francis, 'Collapsing Livelihoods and the Crisis of Masculinity in Rural Kenya' (Wil source centre) <<https://www.wilsoncenter.org/sites/default/files/Mary.pdf>> accessed on 30th June 2017

¹¹⁸ Global Gender Gap Report 2013.

¹¹⁹ Ibid

¹²⁰Jad Chaaban and Wendy Cunningham, "Measuring the Economic Gain of Investing in Girls: The Girl Effect Dividend", World Bank Policy Research Working Paper, World Bank, August 2011. <<http://elibrary.worldbank.org/doi/book/10.1596/1813-9450-5753>> accessed on 30th June 2017

¹²¹ Christine Dieterich, Anni Huang, and Alun Thomas, 'Women's Opportunities and Challenges in Sub-Saharan African Job Markets' international Monetary Fund Working Paper 2016.

¹²²World Bank, World Development Report 2012

¹²³ Protocol to the African charter on Human and People's Rights on the Rights of Women in Africa, Art 13

promoting Education of the girl child. Gender based curriculum as contemplated in the Maputo protocol¹²⁴ has since partially materialized in higher learning institutions such as University of Nairobi and Riara university with introduction of courses such as Gender and The Law. However, such strides have been at the detriment of the boy child whom has since been left in the shackles of culture, society and unregulated social behaviors.

Cultural practices such as *moranism* among the Maasai community is gradually depriving young Maasai men of education while drastic measures are being taken to salvage the girl from any cultural practices. This has further led to a higher number of enrollment of girls at a 10.2 percent increase compared to boys at 6.5 percent in 2014 at the secondary education level¹²⁵. Further, Nicole (2013) contends that in the modern world, girls do better in school than boys and will get higher grades and are highly likely to complete high school at a higher rate than boys¹²⁶. The fate of recent rise of scholarships meant for women only in Kenya such as the Wangari Maathai foundation scholarship and Maasai Girls Education Fund is skeptical on whether it is a guarantee of ensuring gender equality in education while in essence forms possibilities of cultivating the risk of discriminating against men in quest for education. Such measures should be seen as the paradox of gender equality with regard to education in Kenya: this is irrespective of whether gender equality goes beyond formal equality. With all these factors constructed along the gender equality perspective in the education sector, it is a major stride that has profoundly empowered women towards Economic independence and social status yet potential Kenyan young men languish in poverty, school drop-outs, drugs and alcoholism amidst other cultural norms¹²⁷. It is time to salvage the Kenyan young man as well in the quest of gender equality vis- a-vis education which has since been misrepresented in a cloak sham of power to the woman.

Economic times have changed globally that has been characterized by the dynamism of job ethos. Jobs that have preeminently been meant for men through social construction of roles and gender are being done by women and vice versa. With Economic status analogous to social status¹²⁸, the social status of most women has been redefined on account of change in gender defined jobs. However, it is over-amplification of the gender equality ideal when women venture in the men oriented job groups without reciprocation of the same hype of men who venture in the female societal constructed careers.

¹²⁴ Ibid Art 13(1)(e)

¹²⁵ Kenya Economic Survey 2015

¹²⁶ Nicole M. Fortin , 'Leaving Boys Behind; Gender Disparities in High academic Achievement' (University of British Columbia, 2013)

; see also Julius Sigei, 'New Kenya takes shape as Women win Big in Education' *The Daily Nation* (Nairobi, 19th June 2016)

¹²⁷ Supra note 19

¹²⁸ Heather Wyatt and Warren Waynes, 'Social Class and Socioeconomic Status: Relevance and Inclusion in MPA-MPP programs' *Journal of Public Affairs Education* (17)(2)

Gender disparities in poverty are rooted in inequalities in access to economic resources. Moreover, about one in three married women even from developing countries have no control over household spending on major purchases, and about one in 10 married women is not consulted on how their own cash earnings are spent¹²⁹. In many countries, women continue to be economically dependent on their spouses amidst other financial sources such as property and land ownership where ownership is vested only on men. Only 50 percent of women are in the labour force compared to 77 percent of men around the world¹³⁰. Women are therefore less likely to be employed compared to men.

Globally, despite Men outnumbering women with 62 million in numbers, the population of women increases to 54 percent in old age compared to that of men¹³¹. This denotes that most women are usually widowed at 60 years hence intensifying questions regarding funds and pension programs that are intended to secure a livelihood for such widowed persons. The social security of women in their old age from a gender equality stance is dire globally with notions of constructed stereotypes on how women benefit from their husbands pensions¹³². According to the UN report on Progress of the World's Women 2015 Women are less likely than men to receive a pension and the retirement benefits much lower in most countries hence intensifying the risk of poverty in old age among women. Even in most developed regions like the EU, the retirement pensions for women is 37 percent lower that of men.

In most African countries the pension gap based on gender is worse with differences ranging between 50 percent with countries such as Egypt where 62 percent of men receive pension compared to 8 percent of women who receive pension¹³³. This is despite that women having a higher life expectancy rate than men. In Kenya, the general retirement pension's ideal is alarming with only 14 percent of working Kenyans under pension's schemes with an estimated less than half of the percentage being women in such saving schemes¹³⁴. This therefore has escalated pro-retirement poverty levels among women.

What needs attention is the number of programs for older persons that take into account the ageing number population percentages. This has since raised concerns regarding ageism vis-à-vis gender discrimination; it is gender inequality to allow pensions imbalances through prioritizing the social security of men as compared to that of women. What special programs have been put in place to ensure the higher percentage of women in the old age will be secured? In Kenya for instance, the Social Protection Fund for the elderly has been seen as a strategic move to alleviate old age poverty and greatly improved lives of poor

¹²⁹The World Bank, 2012, World Development Report: Gender Equality and Development

¹³⁰ The UN worlds women Report 2015 on Economic and social affairs

¹³¹ Ibid

¹³² Ibid

¹³³ Ibid

¹³⁴ Retirement Benefits Authority, 'Annual Report & Financial Statements 2015' <<http://www.rba.go.ke/index.php/en/>>

and vulnerable senior citizens¹³⁵. However, the distribution, robustness of the social protection fund is skeptical in ensuring that the poor old age Kenyans can withstand tough economic times and a high cost of living amidst other budgetary constraints¹³⁶.

with gender Equality entailing not just treating both men and women equally, it goes beyond to the rationale behind inequality and taking into account the social outplays that hinder the construction of such gender equality prima facie. Key societal aspects have been historically prudent in hindering economic independence of both men and women. Such have included marriage patterns that vary from one society to another. Worldwide Africa and Asia records unwavering numbers of early marriages for both boys and girls but with 67.5 percent of early marriage of girls¹³⁷. However, this has reduced in modern times which has allowed a greater comprehensive economic independence for women as they are able to access quality education which was a priority to boys mostly for the African communities. With the dynamic trends of marriage patterns, most women still succumb to societal pressures on marriages at 25 years compared to men at 30 years¹³⁸. Is a typical woman able to achieve financial stability at 25 years compared to a man at 30 years? The socially construed perceptions that it is a man's duty to provide is still a setback to Economic stability of women. Africa still lurks at the danger of early childhood marriages with two-fifths of women being married at 18 years¹³⁹. This translates to dire economic and social status of women in Africa regardless of international instruments and recommendations that have been ratified by majority of these states. Certain provisions of international instruments such as CEDAW under article 19 provide for elimination of discrimination in marriage on a basis of equality of men and women. This also translates to equal rights in ownership and beneficial interest in property¹⁴⁰. The Maputo protocol also places in high regard the elimination of forced marriages, equal rights marriage in separation or annulment of marriage and equitable share in matrimonial property¹⁴¹. These regional legal framework has been well embraced in the Kenyan constitution amidst other key statutes such as the Marriage Act 2014 and the Matrimonial Property Act 2013.

What measures, programs and institutions need be in place to ensure financial independence of women in Africa? Has Africa failed in the modern world to achieve gender parity on the Economic realm? Regionally, The African status quo on the rights of women has been everything to go by in defining gross

¹³⁵ Supra note 17: see also Ministry of Public Service, Youth and Gender affairs ;The National Equality Policy 2016

¹³⁶ Oscar KaiKai 'Over 800,000 Kenyans benefit from Sh80bn cash transfer fund for the elderly' *The Daily Nation*(Nairobi 25th November 2016)

¹³⁷ Supra note 32 : see also, The World Report 2016

¹³⁸ Ibid

¹³⁹ Ibid

¹⁴⁰The Convention on the Elimination of All Forms of Discrimination against Women. Art 16(1)(h)

¹⁴¹ Protocol to the African Charter on Human and People's Rights on the Rights of Women in Africa, Art 6,7

violation in both the social and economic domains. This is despite the fact that most African countries have ratified key international human rights instruments including The ICCPR¹⁴², ICESCR¹⁴³, CEDAW¹⁴⁴, Bpfa¹⁴⁵ and recently The East African Community Gender and Community Development Framework. Most women in Africa still languish in poverty and suffer from vast consequences of financial instability such as health deficiencies, birth mortalities owing to the fact that most women are unable to afford decent delivery services¹⁴⁶. This further escalates to affordability of quality products with a key focus on cosmetics, sanitation facilities and Birth control products. With the equality ideal dire the impact of health in Economic growth is substantial. Studies have shown that increase in health expectancy could raise GDP by up to 4% with more spending on health capable of significantly improving health outcomes, which in turn can contribute to reducing poverty and improving overall economic status and independence¹⁴⁷.

According to the World Health Organization report 2014, African women suffer from a wide array of health complications ranging from cardiovascular diseases, maternal, cancers and other mortality subjected diseases¹⁴⁸. With mortality of women at 72 years and men at 68 years, both men and women die from different causes; Women and girls will often be subject to constant complications related to pregnancy and childbirths, STI's and HIV¹⁴⁹. Maternal deaths though in a slight decline at 45 percent as at 2013 are still a setback in efforts meant to lower women mortality rates. This is majorly due to underdeveloped health systems, Poor access to information and education, early marriages, and lack of decision-making power among girls who are married or in relationships hence increasing their exposure to sexually transmitted infections, unwanted pregnancies and the risk of unsafe abortions¹⁵⁰. Only half of pregnant women in sub-Saharan Africa receive adequate and affordable health care during childbirth.

The whole gender equality ideal falls into place on the economic plight of women vis-à-vis that of men. Globally, most states have failed to ensure affordability of health care programs that are sui generis to the plight of women and girls. With poverty a huge shortcoming in health care, financial stability is interdependent to quality health care especially for women. It is

¹⁴²International Covenant on Civil and Political Rights

¹⁴³International Covenant on Economic, Social and Cultural Rights

¹⁴⁴The Convention on the Elimination of All Forms of Discrimination against Women

¹⁴⁵Beijing Platform for Action on women

¹⁴⁶Supra note 32

¹⁴⁷World Health Organization, Impact on Economic Growth of investing in maternal and newborn health" 2006 ; see also, David E Bloom, David Canning and Jaypee Sevilla, "The Effect of Health on Economic Growth: A Production Function Approach", World Development, Vol. 32(1), 2004.

<<http://www.ppge.ufgrs.br/giacomo/arquivos/eco02072/bloom-canning-sevilla-2004.pdf>>

¹⁴⁸World Health statistics 2014

¹⁴⁹ Ibid

¹⁵⁰ Supra note 32

inequality when a jurisdiction fails to put measures in place that are consistent to a particular gender in contrast to the other gender. Measures such as free maternal health care by the Kenyan government have been a major boost in eliminated birth related complications and financial stability to affordable health care.

Violence and prejudice against women in Africa emanates from retrogressive cultures in the name of self-determination. With regard to the 2010 UN report on violence against women in Africa, patriarchy as a result of culture treats women as subordinate to men¹⁵¹. This raises grievous questions about the fate of equality amidst other significant human rights approaches such as the right to be free from violence. This culturally constructed state has in return jeopardized the economic status quo of women with the same notion that women are subjective to men. Even in a post-modern world where most African countries have tried to improve prejudicial customary rules, a majority of women are still considered poor in Africa as opposed to men due to the subjectivity accorded to women¹⁵². This therefore outplays as the plight of women in a social set-up that treats them as secondary earners.

Gender equality in the social and economic realms has been characterized by societal perception and stereotypes in Africa worse in Kenya. In the economic ladder which begets social status, women compared to men are either inactive or circumstantially deprived and forced to take secondary positions. Stereotypes are key whereby the general perception of a woman in the economic realm globally, regionally and nationally is that of substitution of what their male counterparts are¹⁵³. Top posts in the corporate sectors, global and Local governmental and nongovernmental organizations are flanked by men and subsidiary posts accorded to women. The gender parity ideal with regard to social constructions falls into play, is it that women do not apply for the top positions and if they do is it that they are not considered? Most women do not have the incentive to start businesses which will grow into multi-billion companies as compared to their male counterparts¹⁵⁴. The gender construction ideal becomes constructed along stereotypical perceptions of capabilities of men and women.

The general atmosphere of governance and societal stereotypes is to blame for the economic and social status of women in most countries. The economic status quo of women is one that has been characterized by politics of fear and societal inferiority in the name of patriarchy that has been camouflaged as gender. Gender is itself the perpetrator of gender discrimination and a flaw of gender equality in a modern world

¹⁵¹United Nations Economic Commission for Africa, African Centre for Gender and Social Development (ACGSD) 'violence against Women in Africa; a situational analysis' 2010

¹⁵²African Development report 2015.

¹⁵³Jeanette N. Cleveland, Margaret Stockdale, Kevin R. Murphy and Barbara A. Gutek, *Women and Men in Organizations: Sex and Gender Issues at Work* (Psychology Press, 2000 1st Edition)

¹⁵⁴Phylis Makena, Simon Thiaine Kubaïson, Charles Ibuathu Njati, 'Challenges facing women entrepreneurs in accessing business finance in Kenya: Case of Ruiru Township, Kiambu County' *Journal of Business and Management* 16(4) 2014

that has carried along the historical dynamics of gender in division of roles and responsibilities. This is by large from a regional perception whereby most African men on gender account are responsible for provision to the family; a perception that has been since carried forth to exacerbate hopes of ameliorating the economic status and women.

Even in a modern society, the social construction of roles and responsibilities as gender continues to greatly impact on the social economic status of women across the globe. Our own perception and construction of gender and roles are indeed an injustice and the perpetrator of discrimination against ourselves against gender equality. In the name of women empowerment, certain television programs such as *Women and Power* from the Nation Media group¹⁵⁵ and *The Strength of a Woman* from Royal Media Services¹⁵⁶ raises questions on the authenticity and purpose of the intended empowerment. While the gist of such programs is to empower women in a male hegemony set-up, further implication would be that if a woman makes it in the society it is worthy applaud and recognition. The stereotypes of the historical inferiority of women in the domains of Development especially social and economic status will remain an obstacle to equality as long as we take as an achievement when a woman breaks from the gender norms to do the undone. Measures have been taken to ameliorate the economic status with regard to gender equality both regionally and nationally. With focus on competition and capital markets, legislative measures have been introduced majorly to ensure that both men and women compete rationally with the non-prejudiced regulatory framework. The Competition Act of Kenya 2010 through its main objectives which includes to promote the competitiveness of national undertakings in world markets¹⁵⁷. The spirit of competition has since been embraced which has cultivated innovation has since seen the rise of women in the corporate and business realm. The Standards Act cap 496 laws of Kenya has also been a great milestone in championing economic empowerment of women and consumer protection rights in Kenya. Other than improving economic status of most women, the competition ambience has created a business market that embraces quality ascertained in manufactured products.

Women in Kenya are now freely able to compete on the same ladder with their male counterparts in the industrial market realm as standards have created a competitive ambience. Incredible examples being the rise of *Keroche Breweries* founder and CEO Tabitha Karanja and the rise of *Rexe Roofing Products* by Ms. Irene Wanjiku; both fields which have been previously male dominated¹⁵⁸. Other than improving the historic economic deprivation and financial instability of women, this in return has also ensured that men do not abuse market dominance through

¹⁵⁵ NTV Kenya , 'Women and Power' <
<https://www.youtube.com/channel/UCqBJ47FJcl61fmSbcadAVg>> accessed on 30th June 2017

¹⁵⁶ Citizen TV Kenya, 'Strength of a Woman' <
<https://www.youtube.com/watch?v=ViGAZSubuJc>> accessed on 30th June 2017

¹⁵⁷ The Competition Act, s3(h)

¹⁵⁸ Karen Mbugua' A fascinating women, Words and wine' *The Star* (Nairobi, 10th May 2016)

unscrupulous ways of production of fast, unfit and health hazard products.

With the main objective of eliminating the discrimination of women in all spheres, the provisions of the Protocol whether materialized or not were meant to address the historical injustices against women. In combating discrimination state parties are tasked with the onus of including the principle of equality between men and women in the constitutions, prohibition of harmful practices that endanger the health and general well-being of women, integrating a gender perspective to policy decisions, legislation and programmes in all spheres¹⁵⁹. This shall include taking corrective and positive action in those areas where discrimination against women in law and in fact still exists and modification of social and cultural patterns and elimination of ideas based on inferiority or the superiority of either sex or on the stereotyped roles of women and men¹⁶⁰.

VI. CONCLUSION

Gender mainstreaming is a universally conventional strategy for promoting gender equality. Mainstreaming is however not an end in itself but rather a strategy, an approach, and a means to realize the goal of gender equality. It encompasses ensuring that gender perspectives and attention to the goal of gender equality are central to all activities - policy development, research, advocacy/ dialogue, legislation, resource allocation, and planning, implementation and monitoring of programmes and projects.¹⁶¹

This is to say that although we have legislated on the gender parity rule, formulated policies¹⁶² and programmes on the same, this is only but formal equality. Formal equality cannot give gains to gender equality in politics and leadership but is important for the reason of reference. Of paramount importance however is substantive equality where all key stakeholders embrace the aspect of gender equality. The Executive in all its appointments should observe the two-thirds one-third gender principle at all levels. Parliament should also be keen to legislate laws that are alive to the gender rule and also put the Executive to task in observance of the same. Gender neutral laws should be amended or abolished to be in line with the constitutional provisions of equity.

Last but not least is the Kenyan society. Our socialization passed down to generations as a male-controlled and dominated society is well engrained. However, in light of the acknowledgement of the injustices that inequality brings forth,

there has been an awakening. The authors argue that it is imperative to educate and stress on gender equality on the society for it is from it that our leadership is founded. A mind change on the empowering of women, who as we have established is the oppressed gender, is the cornerstone since men elected and appointed to be gate keepers will in turn support and enhance gender parity.

Being a signatory to voluminous international instruments and having laws and policies to the effect of promoting gender parity would not achieve much unless the same is owned and embraced by the society as a whole. Otherwise, gender equality in Kenyan politics will remain as such, a mirage. The civil society should not relent on their advocacy role; the activists and reformists should raise up to the occasion and push forward for substantive equality complimented by formal equality. It cannot be overemphasized that formal laws without substance in them cannot deal with societal construction and thus it is hard to deal with inequality.

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¹⁵⁹ Protocol to the African charter on Human and People's Rights on the Rights of Women in Africa, Art 2

¹⁶⁰ Ibid

¹⁶¹ UN WOMEN; United Nations Entity for Gender Equality and the Empowerment of Women; <<http://www.un.org/womenwatch/osagi/gendermainstreaming.htm>> accessed on 10th November, 2016.

¹⁶² The recent policy of *National Gender and Equality Policy 2016* under the Ministry of Public Service, Youth and Gender Affairs.

Study of excess acoustical parameters of dimethyl sulphoxide in 2-Propanol as binary liquid mixture at various temperatures

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Abstract- Ultrasonic velocity, density and viscosity of binary liquid mixtures of Dimethyl sulphoxide (DMSO) (0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 volume percent) in 2-Propanol have been measured at various temperatures. The acoustical parameters such as adiabatic compressibility (β), acoustic impedance (Z), free length (L_f), relaxation time (τ), free volume (V_f), available volume (V_a), internal pressure (π_i), Gibbs free energy (ΔG), Molar sound velocity or Rao's constant (R), absorption coefficient (α/l^2) and enthalpy (H) have been obtained from the experimental data of the liquid mixtures with a view to investigate the exact nature of the molecular interactions. The Excess values of adiabatic compressibility (β^E), acoustic impedance (Z^E), free length (L_f^E), free volume (V_f^E), available volume (V_a^E) and internal pressure (π_i^E) have also been calculated and found to be useful in estimating the strength of molecular interactions in the mixture.

Index Terms- Ultrasonic velocity, density, viscosity, molecular interaction, excess acoustical parameters.

I. INTRODUCTION

Ultrasonic methods find extensive applications for characterizing aspects of physicochemical behavior such as the nature of molecular interactions in pure liquids as well as liquid mixtures [1-4]. Extensive investigations in binary liquid mixtures have been carried out by different techniques [5-15]. The thermodynamic functions of binary liquid mixtures provide insight into the structure breaking and making effect of the component liquids. In the present study, derived parameters such as adiabatic compressibility (β), acoustic impedance (Z), free length (L_f), relaxation time (τ), free volume (V_f), available volume (V_a), internal pressure (π_i), Gibbs free energy (ΔG), Molar sound velocity or Rao's constant (R), absorption coefficient (α/l^2) and enthalpy (H) will be useful to know the molecular interactions of the systems. A deeper knowledge of mixing properties of binary liquid system is essential in many industrial applications such as design calculation, mass transfer, and fluid flow etc. [16].

Molecular interactions in different liquid mixtures changes depending upon the nature of solvent, the structure of molecules and the extent of solution [17].

II. EXPERIMENTAL

All the chemicals used in the present work were analytical reagent (AR) grade (99.9% pure) and were supplied by Loba chemicals, Mumbai. The liquids were thoroughly distilled to remove dissolved impurities using standard chemical procedures [18]. The chemicals were analyzed for the density measurements and the results were compared with the literature values. Ultrasonic velocities were measured with ultrasonic interferometer (model F80) supplied by Mittal enterprises, New Delhi, operating at a frequency of 2 MHz. It has an accuracy of $\pm 0.1\%$. Viscosities of pure compounds and their mixtures were determined using Ostwald's viscometer with an accuracy of $\pm 0.002\%$, calibrated with double distilled water. The densities of pure compounds and their solutions were measured accurately using 25 mL specific gravity bottles and Citizen electronic balance (the accuracy in weighing is ± 0.001 g).

III. RESULTS AND DISCUSSION

The values of ultrasonic velocity, density and viscosity of DMSO (0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 volume percent) in 2-Propanol have been measured at various temperatures and are reported in table-1. A close perusal of table-1 shows decrease in the values of ultrasonic velocity (U), density (ρ) and viscosity (η) with increase in temperature at all compositions of DMSO in 2-Propanol. The values of ultrasonic velocities and densities show increasing trend with composition of DMSO in 2-Propanol. This trend suggests that the dipole-dipole interactions are more at higher volume percent of DMSO in the binary mixture. While the viscosities decrease up to 20% of DMSO in 2-Propanol and further increases up to 100% of DMSO at all temperatures. When the temperature is increased, the ultrasonic velocity, density and viscosity decrease. This trend reveals that at higher temperature the molecular interactions between the components are low. The similar trends have been observed for DMSO in 1-Butanol by Bhosale et al. [19].

Density is measure of liquid-liquid interaction. Increase in densities with increase in composition of one of the components indicates solvent-solvent interaction while decrease in density indicates lesser solvent interactions. This may be also be assumed that solvent-solvent interaction bring about a bonding between them. So the sizes of the molecules increase and hence there will be decrease in density.

The properties such as adiabatic compressibility (β), acoustic impedance (Z), free length (L_f), relaxation time (τ), free volume (V_f), available volume (V_a), internal pressure (π_i), Gibbs free energy (ΔG), Molar sound velocity or Rao's constant (R), absorption coefficient (α/f^2) and enthalpy (H) were determined by using ultrasound velocity, density and viscosity in similar way as by Arul et al.[20].

- 1) Adiabatic Compressibility (β): The Adiabatic Compressibility is related to density and ultrasonic velocity by the relation.

$$\beta = \frac{1}{U^2 \rho}$$

- 2) Intermolecular free length (L_f) has been calculated from the relation:

$$L_f = \frac{K_T}{\sqrt{\rho U^2}}$$

Where, K_T is the temperature dependent constant having a value of 199.53×10^{-8} in MKS system.

- 3) Free volume (V_f) has been calculated from relation:

$$V_f = \left[\frac{M_{eff} U}{K\eta} \right]^{3/2}$$

Where, M_{eff} is the effective molecular weight ($M_{eff} = \sum m_i x_i$, in which m_i , x_i is the molecular weight and mole fraction of the individual constituents, respectively). K is a temperature independent constant which is equal to 4.281×10^9 in MKS system for all liquids.

- 4) The internal pressure (π_i) has been evaluated by:

$$\pi_i = bRT \left(\frac{K\eta}{U} \right)^{1/2} \left(\frac{\rho^{2/3}}{M_{eff}^{7/6}} \right)$$

Where, K is a constant, b is a factor depending on packing pattern which is 1.78, R is gas constant, T is the absolute temperature, η is the viscosity in $Nm^{-2}s$, U is the ultrasonic velocity in $m \text{ sec}^{-1}$, ρ is the density in $kg \text{ m}^{-3}$ and M_{eff} is the effective molecular weight.

- 5) Acoustic impedance (Z): The specific acoustic impedance is related to density and ultrasonic velocity by the relation.

$$Z = \rho U$$

- 6) Relaxation time (τ): Relaxation time has been calculated from viscosity coefficient, density and ultrasonic velocity of binary mixtures using the equation,

$$\tau = \frac{4\eta}{3\rho U^2}$$

- 7) Molar sound velocity or Rao's constant (R): 'R' has been evaluated by

$$R = \left[\frac{M_{eff}}{\rho} \right] U^{1/3} m^3 \left[\frac{m}{s} \right]^{1/3}$$

- 8) Available volume (V_a): Available volume has been evaluated by

$$V_a = V \left[1 - \frac{U}{U_\infty} \right]$$

Where, U_∞ = Schaff's limiting value taken as 1600 m/s for liquids [21].

- 9) Gibbs free energy has been calculated from acoustic relaxation time (τ) following Eyring rate processing theory [22].

$$\Delta G = RT \ln \left(\frac{kT\tau}{h} \right)$$

Where, R is the gas constant, k is the Boltzmann's constant ($1.23 \times 10^{-23} J.K^{-1}$), T is absolute temperature, h is Plank's constant ($6.62 \times 10^{-34} J.s$) and τ is the relaxation time.

- 10) Absorption coefficient (α/f^2) is calculated from the following equation:

$$\alpha/f^2 = \frac{8\pi^2\eta}{3\rho U^3}$$

Where, τ is the acoustical relaxation time, f is frequency and U is ultrasonic velocity.

- 11) Enthalpy (H) has been calculated from the following equation:

$$H = \pi_i \times V_m$$

Where, $V_m = \frac{M_{eff}}{\rho}$

- 12) Excess parameters (A^E) have been calculated by using relation

$$A^E = A_{exp} - A_{id}$$

Where $A_{id} = \sum_{i=0}^n A_i X_i$, A_i is any acoustical parameters and X_i is mole fraction of the liquid component.

The ultrasonic velocity, density and viscosity variations with respect to volume percentage of DMSO are shown in Figure-1, Figure-2 and Figure-3 respectively at various temperatures.

Table 2 shows the values of adiabatic compressibility (β), acoustic impedance (Z), free length (L_f), relaxation time (τ), free volume (V_f), available volume (V_a), internal pressure (π_i), Gibbs free energy (ΔG), Rao's constant (R), absorption coefficient (α/f^2) and enthalpy (H) of DMSO in 2-Propanol at various temperatures.

It may be noted that in the five different temperature, the adiabatic compressibility (β) decreases with increase in composition of DMSO in 2-Propanol indicating the possibility of stronger interaction at higher composition. It is also observed that, the interactions are more at lower temperature as compared to at higher.

Acoustic impedance (Z) increases while relaxation time (τ) decreases with increase in volume percent of DMSO in 2-Propanol. The dispersion of the ultrasonic velocity in the system should contain information about the characteristic time (τ) of relaxation processes that causes dispersion. The relaxation time which is in the order of 10^{-12} sec is due to structural relaxation process [23] and in such a situation it is suggested that the molecules get rearranged due to co-operative process [24]. The ultrasonic velocity increases with increase in composition of DMSO in 2-Propanol. This is in accordance with the view that the ultrasonic velocities increases with decrease in free length (L_f) and vice versa [25].

Rao's constant or molar sound velocity (R) is an important factor in deciding the molecular association in liquid mixtures. In the present work, Rao's constant values were found to increase with increase in volume percent of DMSO in 2-Propanol up to 50% at all temperatures and further decreases which suggest molecular association up to 50% and further depolymerization of aggregates of 2-Propanol molecules.

Internal pressure (π_i) values decreases when the composition of DMSO in 2-Propanol increases which shows the

strong interaction present at lower composition. It is also interesting to observe that the free volume (V_f) of the system increases as internal pressure decreases [26]. The Gibb's free energy (ΔG) reveals closer packing of the molecules due to the hydrogen bonding of unlike molecules in the solutions. The Gibb's free energy decreases with temperature rise suggest that less time is required for the cooperative process or the rearrangement of molecules in the solution. The values of absorption coefficient (α/f^2) decreases with rise in composition and temperature indicate that interaction decreases within the liquid molecules in the solution [27]. The variation in acoustical parameters is shown graphically by Figure-4 to Figure-14.

Table 3 shows the excess values of adiabatic compressibility (β^E), acoustic impedance (Z^E), free length (L_f^E), free volume (V_f^E), available volume and internal pressure (π_i^E).

Excess adiabatic compressibility (β^E) values are negative, it may be attributed to the existence of dispersion and dipolar interactions between the unlike molecules indicating that mixing structure are less compressible than the ideal mixture. The additional rigidity may be the reason for the negative values of excess adiabatic compressibility [28].

Excess acoustic impedance (Z^E) values are throughout negative. Negative values of Z^E in all compositions and temperatures results the possibility of the presence of weak attractive forces between the components of binary liquid mixture.

The negative values of the excess intermolecular free length (L_f^E) are observed. Similarly, excess internal pressure (π_i^E) are found to be negative suggest that weak interaction are operating in this system [29].

Excess free volume (V_f^E) values are positive indicating the existence of weak molecular interactions in the liquid mixture [30]. The variation in excess parameters is shown graphically by Figure-15 to Figure-20.

Excess adiabatic compressibility, excess acoustic impedance, excess free length and excess internal pressure showing minimum at 50% DMSO in 2-Propanol. It implies that at 50% of DMSO in 2-Propanol the molecular interaction is very weak.

Excess free volume shows maximum at around 20% and 50% DMSO and excess available volume shows maximum at 20% of DMSO and minimum at 80% of DMSO.

IV. CONCLUSION

The values of ultrasonic velocity, density, viscosity, acoustical parameters and the excess values of DMSO (0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 volume percent) in 2-Propanol at various temperatures supports for the existence of very weak interactions in the present system.

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REFERENCES

- [1] Murali Krishna P, Ranjit kumar B, Sathyanarayana B, Amara Jyothi K and Satyanarayana N, *Ind. J Pure Appl. Phys.*, 47, 576-581, (2009).
- [2] Ranjit kumar B, Satyanarayana B, Asra Banu S, Amara Jyothi K, T Savitha Jyostna and Satyanarayana N, *Ind. J Pure Appl. Phys.*, 47, 511, (2009).
- [3] Thiagarajan R and Palaniappan L, *Ind. J Pure Appl. Phys.*, 46, 852-856, (2008).
- [4] Thirumaran S and Job Sabu K, *Indian J Pure Appl. Phys.*, 47(2), 87-96, (2009).
- [5] Alka Tadvalkar, Pravina Pawar and Govind K. Bichile, *J. Chem. Pharm. Res.*, 3(3), 165-168, (2011).
- [6] Singh S, Singh R, Prasad N and Prakash S, *Ind. J Pure and Appl. Phys.* 3,156, (1977).
- [7] Ramamurthy M and Sastry O. S., *Ind. J Pure and Appl. Phys.*, 21, 579, (1983).
- [8] Flethcer A, *J Phys Chem*, 73, 2217 (1969).
- [9] Hammker R, Clegg R, Patterson P, Riddick P, Rock P, and Rock S, *J Phys Chem*, 72, 1837, (1968).
- [10] Ramasamy K and Rangnathan V, *Ind. J Pure and Appl. Phys.*, 8, 144, (1970).
- [11] Venkateswaran K, Krishnapillai M. G., Ramasamy K, *Proc. Indian Aca. Sci.*, 53, 195, (1961).
- [12] Hobbs M E and Bates W W, *J Am. Chem. Soc.*, 74, 746, (1952).
- [13] Negakuva, *J Am. Chem. Soc.*, 76, 3070, (1954).
- [14] Freedman E, *J Chem Phys*, 21, 1784, (1955).
- [15] Kannappan A N and Rajendran V, *Indian J Pure Appl. Phys.*, 30, 176, (1992).
- [16] A J Clement Lourduraj and I Johnson, *J Pure Appl. Ultrasonics*, 30, 69-73, (2008).
- [17] S Thirumaran and S Sudha, *J Chem. Pharm. Res.*, 2(1), 327, (2010).
- [18] John A. Dean, Lange, Hand Book of Chemistry, 15th Edn., Mc Graw Hill Inc; New York, 1998.
- [19] B B Bhosale and A B Nikumbh, *IJAST*, 4(3), (2014).
- [20] Arul G and Palaniappan L, *Indian J Pure Appl. Phys.*, 43, 755, (2005).
- [21] S. J. Askar Ali, *J. Chem. Pharm. Res.*, 4(1), 617-632, (2012).
- [22] Kannappan A N, Palani R., *Indian J Pure Appl. Phys.*, 45, 573-579, (2007).
- [23] Kinsler, L.E. and Rray. A.R., *Fundamentals of Acoustics* (Wiley Eastern, New Delhi). (1989).
- [24] Ali, A., Hyder, S. and Nain, A.K., *Ind. J. Phys.*, 74 B, 63 (2000).
- [25] Eyring H and Kincaid J F, *J Chem Phys.*, 6, 680, (1938).
- [26] Anbanantham, D., 1979. Ultrasonic Study of organic liquid mixtures: Hydrogen bond complexes. *J. Acoust. Soc. India*, 7: 123-127.
- [27] Ray DK, Roy RK, Roy B, Sinha TP, *J. Acoust. Soc. India*, 28, 289-291, (2000).
- [28] Amalanda Pal, Harshkumar, BK Arbad and AB Tekale, *Indian J Pure Appl. Phys.*, 41, 113, (2003).
- [29] Kannappan AN, Palani R., *Indian J Pure Appl. Phys.*, 70(B), 59, (1996).
- [30] Adgaonkar C.S & Agnihotri, *Ultrasonics*, 27, 248, (1989).

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Table 1: Ultrasonic velocity, density and viscosity of DMSO with 2-Propanol at various temperatures

Volume %of DMSO	Ultrasonic Velocity U (ms ⁻¹)	Density $\square\square$ (kg m ⁻³)	Viscosity $\square\square 10^3$ (Nm ⁻² s)	Ultrasonic Velocity U (ms ⁻¹)	Density $\square\square$ (kg m ⁻³)	Viscosity $\square\square 10^3$ (Nm ⁻² s)
	298.15K			303.15K		
0	1143.16	786.00	0.1892	1124.21	782.40	0.1605
10	1172.63	816.00	0.1665	1155.79	814.00	0.1353
20	1202.11	846.80	0.1492	1187.37	843.60	0.1260
30	1235.79	882.00	0.1520	1221.05	878.80	0.1325
40	1267.37	913.20	0.1571	1252.63	909.20	0.1385
50	1303.16	943.60	0.1536	1286.32	939.60	0.1335
60	1341.05	978.00	0.1620	1324.21	972.80	0.1447
70	1376.84	1008.40	0.1766	1360.00	1004.80	0.1553
80	1418.95	1045.20	0.1908	1402.11	1040.00	0.1657
90	1456.84	1073.20	0.1921	1437.89	1069.20	0.1661
100	1492.63	1101.20	0.1946	1473.68	1095.60	0.1693
	308.15K			313.15K		
0	1109.47	778.40	0.1307	1094.74	774.40	0.1026
10	1136.84	809.60	0.1133	1120.00	804.00	0.0876
20	1170.53	838.80	0.1039	1151.58	834.40	0.0839
30	1204.21	874.00	0.1110	1187.37	870.40	0.0929
40	1235.79	904.40	0.1159	1218.95	899.60	0.0938
50	1271.58	934.00	0.1113	1256.84	930.40	0.0911
60	1307.37	968.00	0.1234	1292.63	963.20	0.1006
70	1343.16	1000.40	0.1315	1328.42	996.40	0.1071
80	1387.37	1034.80	0.1396	1370.53	1029.60	0.1139
90	1423.16	1064.40	0.1402	1408.92	1060.00	0.1144
100	1456.84	1093.20	0.1415	1442.11	1089.20	0.1154

	318.15K		
0	1075.79	770.00	0.0740
10	1107.37	800.00	0.0653
20	1136.84	830.00	0.0620
30	1170.53	865.60	0.0691
40	1202.11	894.80	0.0716
50	1240.00	925.20	0.0683
60	1275.79	957.20	0.0740
70	1311.58	992.40	0.0800
80	1353.68	1024.80	0.0859
90	1391.58	1056.00	0.0866
100	1427.37	1083.60	0.0878

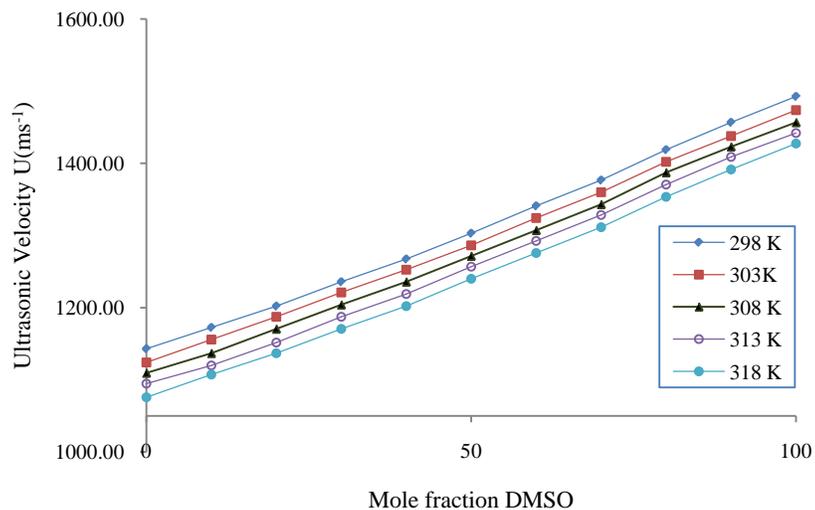


Figure-1: Ultrasonic velocity against volume % of DMSO

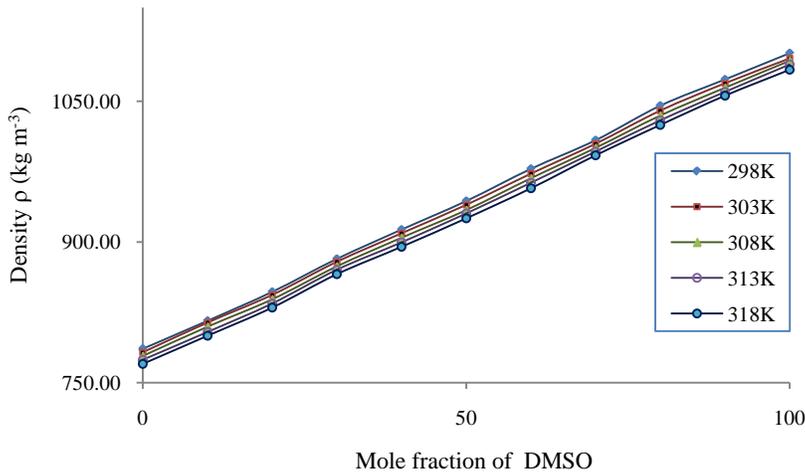


Figure-2: Density against volume % of DMSO

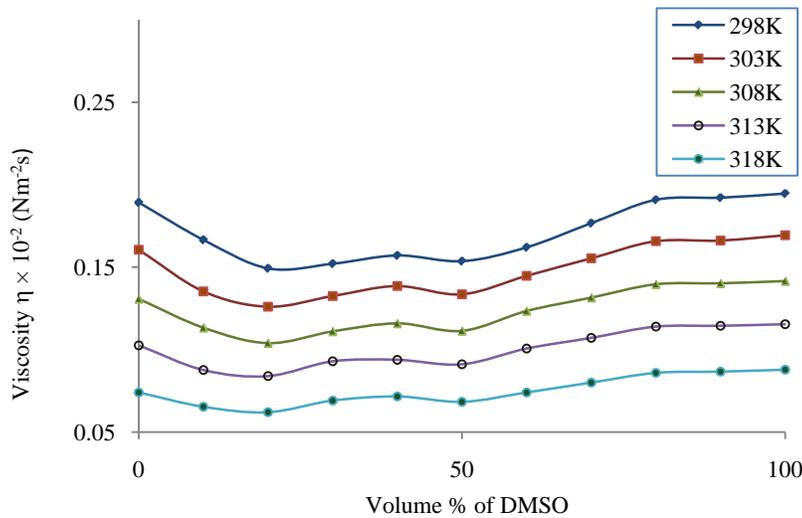


Figure-3: Viscosity against volume % of DMSO

Table 2: The values of adiabatic compressibility (β), acoustic impedance (Z), free length (L_f), relaxation time (τ), free volume (V_f), available volume (V_a), internal pressure (π_i), Gibbs free energy (ΔG), Molar sound velocity or Rao's constant (R), absorption coefficient (α/f^2) and enthalpy (H) of DMSO in 2-Propanol at various temperatures.

Volume % of DMSO	$\beta \times 10^{10} \text{ ms}^{-2} \text{ kg}^{-1}$	$Z \times 10^6 \text{ kg m}^{-2} \text{ s}^{-1}$	$L_f \times 10^{-9} \text{ m}$	$\tau \times 10^{12} \text{ sec}$	$V_f \times 10^{-6} \text{ ml}$	$V_a \times 10^{-5} \text{ m}^3 \text{ mol}^{-1}$	$\pi_i \times 10^3 \text{ Nm}^{-2}$	$\Delta G \times 10^{21} \text{ Jmol}^{-1}$	Rao's Const 'R'	$\alpha/f^2 \times 10^{-10} \text{ Npm}^{-1} \text{ s}^2$	$H \times 10^{-3} \text{ kJ mol}^{-1}$
298.15K											
0	9.736	0.899	0.642	245.60	2.4704	2.183	9.449	1.7886	799.50	4.236	722.49
10	8.912	0.957	0.614	197.85	3.3725	2.077	8.423	1.7350	819.96	3.327	654.95
20	8.172	1.018	0.588	162.57	4.4324	1.954	7.635	1.6863	835.59	2.667	600.04

30	7.424	1.090	0.560	150.46	4.7813	1.790	7.441	1.6672	843.96	2.401	585.22
40	6.818	1.157	0.537	142.80	4.9846	1.636	7.335	1.6542	851.74	2.222	577.30
50	6.240	1.230	0.514	127.80	5.6208	1.456	7.061	1.6267	857.07	1.934	554.08
60	5.686	1.312	0.490	122.81	5.6144	1.255	7.121	1.6168	854.99	1.806	552.08
70	5.231	1.388	0.470	123.18	5.2701	1.068	7.335	1.6176	851.52	1.764	561.44
80	4.752	1.483	0.448	120.89	4.9940	0.845	7.591	1.6129	839.30	1.680	566.95
90	4.390	1.563	0.431	112.45	5.1764	0.654	7.612	1.5950	828.20	1.522	556.10
100	4.076	1.644	0.415	105.76	5.2375	0.476	7.732	1.5798	810.84	1.397	548.55

303.15K

0	10.113	0.880	0.660	216.42	3.0836	2.284	8.896	1.7909	798.72	3.796	683.33
10	9.196	0.941	0.629	165.90	4.5026	2.163	7.767	1.7239	817.73	2.831	605.19
20	8.408	1.002	0.602	141.25	5.6013	2.033	7.166	1.6834	834.79	2.346	564.90
30	7.632	1.073	0.573	134.83	5.7628	1.868	7.096	1.6717	842.95	2.177	559.65
40	7.010	1.139	0.550	129.44	5.9086	1.715	7.031	1.6614	851.35	2.038	555.27
50	6.432	1.209	0.526	114.49	6.7926	1.543	6.726	1.6305	856.14	1.755	529.48
60	5.862	1.288	0.503	113.10	6.5163	1.342	6.869	1.6274	855.10	1.684	534.92
70	5.381	1.367	0.481	111.42	6.2654	1.151	7.028	1.6236	850.31	1.615	539.35
80	4.891	1.458	0.459	108.06	6.0547	0.928	7.218	1.6159	839.54	1.520	541.38
90	4.524	1.537	0.441	100.18	6.3089	0.743	7.230	1.5968	827.32	1.374	529.92
100	4.203	1.615	0.426	94.87	6.3318	0.563	7.354	1.5831	811.52	1.269	524.46

308.15K

0	10.437	0.864	0.677	181.88	4.1139	2.367	8.186	1.7801	799.30	3.233	632.04
10	9.557	0.920	0.647	144.38	5.7300	2.267	7.260	1.7210	817.47	2.504	568.66
20	8.701	0.982	0.618	120.54	7.3176	2.127	6.639	1.6747	835.27	2.031	526.21
30	7.890	1.052	0.588	116.77	7.3556	1.961	6.628	1.6666	843.27	1.912	525.31
40	7.240	1.118	0.564	111.89	7.5574	1.806	6.563	1.6556	851.57	1.785	520.80
50	6.622	1.188	0.539	98.27	8.7631	1.625	6.258	1.6224	857.50	1.524	495.30
60	6.044	1.266	0.515	99.44	8.1107	1.431	6.472	1.6254	855.24	1.500	506.23

70	5.541	1.344	0.493	97.15	7.8869	1.237	6.599	1.6195	850.12	1.426	508.42
80	5.021	1.436	0.469	93.45	7.7025	1.001	6.750	1.6095	840.49	1.328	508.67
90	4.639	1.515	0.451	86.71	8.0084	0.814	6.768	1.5903	828.03	1.201	498.21
100	4.310	1.593	0.435	81.32	8.1450	0.639	6.864	1.5739	810.19	1.101	490.54

Table 2: continued....

Volume % of DMSO	$\square \times 10^{10}$ $\text{ms}^2 \text{kg}^{-1}$	$Z \times 10^6$ $\text{kg m}^{-2} \text{s}^{-1}$	$L_f \times 10^{-9}$ m	$\square \times 10^{12}$ sec	$V_f \times 10^{-6}$ ml	$V_a \times 10^{-5}$ $\text{m}^3 \text{mol}^{-1}$	$\pi_i \times 10^3$ Nm^{-2}	$\square \text{G} \times 10^{21}$ Jmol^{-1}	Rao's Const 'R'	$\square \square / \int$ $\times 10^{-10}$ $\text{Npm}^{-1} \text{s}^2$	H $\times 10^{-3}$ kJ mol^{-1}
313.15K											
0	10.775	0.848	0.694	147.400	5.7975	2.451	7.394	1.7585	799.86	2.655	573.87
10	9.915	0.900	0.665	115.811	8.2381	2.365	6.508	1.6957	818.84	2.039	513.15
20	9.037	0.961	0.635	101.097	9.8329	2.232	6.095	1.6603	834.69	1.731	485.36
30	8.149	1.033	0.603	100.940	9.3966	2.051	6.193	1.6599	842.23	1.676	492.56
40	7.481	1.097	0.578	93.566	10.1570	1.899	6.025	1.6401	851.57	1.514	480.31
50	6.804	1.169	0.551	82.647	11.6149	1.703	5.777	1.6078	856.81	1.297	458.69
60	6.213	1.245	0.527	83.344	10.8205	1.509	5.958	1.6100	855.61	1.271	467.97
70	5.687	1.324	0.504	81.213	10.5433	1.312	6.074	1.6033	849.82	1.206	469.54
80	5.171	1.411	0.480	78.527	10.2534	1.086	6.217	1.5945	840.85	1.130	470.62
90	4.752	1.493	0.461	73.125	10.6972	0.883	6.229	1.5760	828.43	1.023	460.30
100	4.415	1.571	0.444	67.927	10.8918	0.708	6.316	1.5568	810.42	0.929	453.03
318.15K											
0	11.222	0.828	0.714	110.72	9.2201	2.5572	6.412	1.7150	799.76	2.029	500.44
10	10.194	0.886	0.681	88.75	12.5767	2.4389	5.725	1.6565	819.51	1.580	453.47
20	9.322	0.944	0.651	77.06	15.1671	2.3158	5.343	1.6192	834.95	1.337	427.43
30	8.432	1.013	0.619	77.68	14.3185	2.1449	5.451	1.6213	842.14	1.309	435.55
40	7.734	1.076	0.593	73.83	14.8930	1.9911	5.373	1.6079	851.32	1.211	430.16
50	7.029	1.147	0.565	64.01	17.5060	1.7945	5.104	1.5701	856.85	1.018	407.07
60	6.419	1.221	0.540	63.33	16.7913	1.5999	5.210	1.5673	856.33	0.979	411.38

70	5.858	1.302	0.516	62.48	15.9996	1.3979	5.359	1.5637	848.84	0.939	415.55
80	5.325	1.387	0.492	60.99	15.3507	1.1700	5.507	1.5573	840.70	0.888	418.50
90	4.890	1.470	0.471	56.46	15.9324	0.9658	5.529	1.5369	827.78	0.800	409.96
100	4.530	1.547	0.454	53.03	16.1611	0.7779	5.606	1.5203	811.82	0.733	404.23

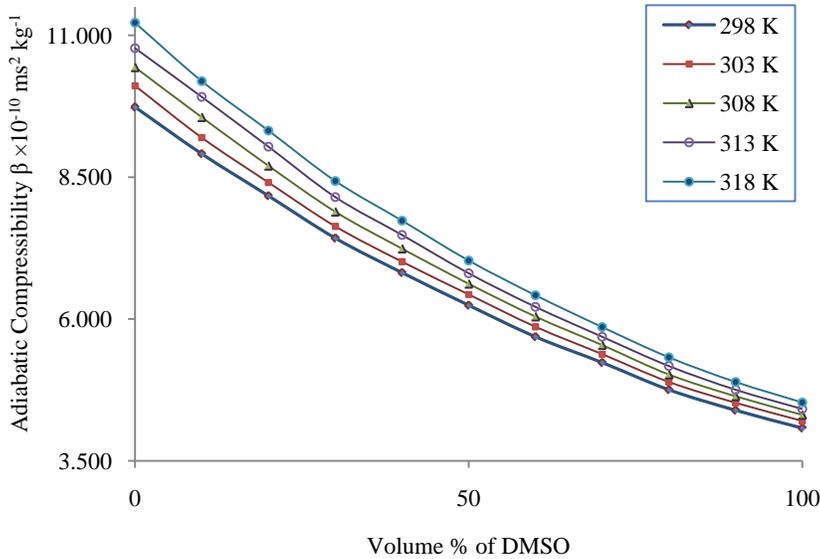


Figure-4: Adiabatic compressibility against volume % of DMSO

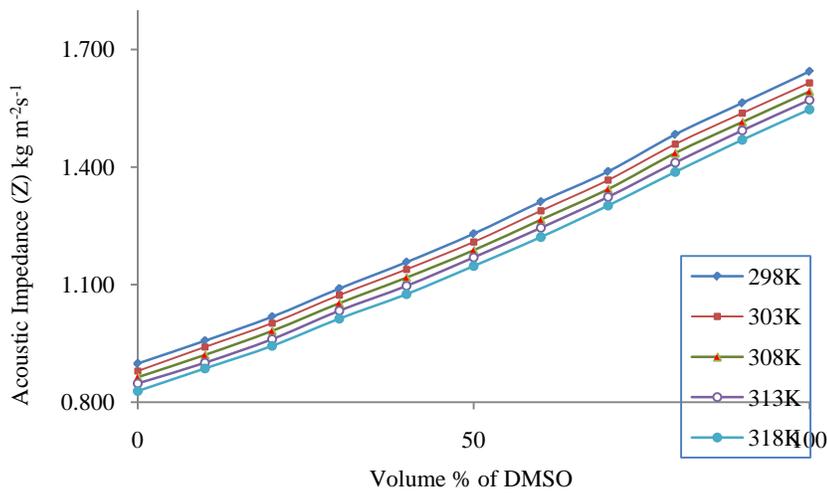


Figure-5: Acoustic impedance against volume % of DMSO

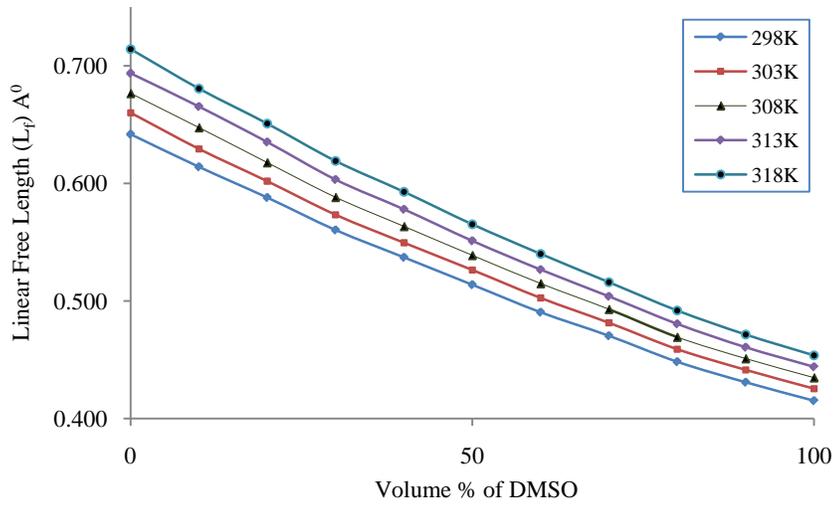


Figure-6: Linear free length against volume % of DMSO

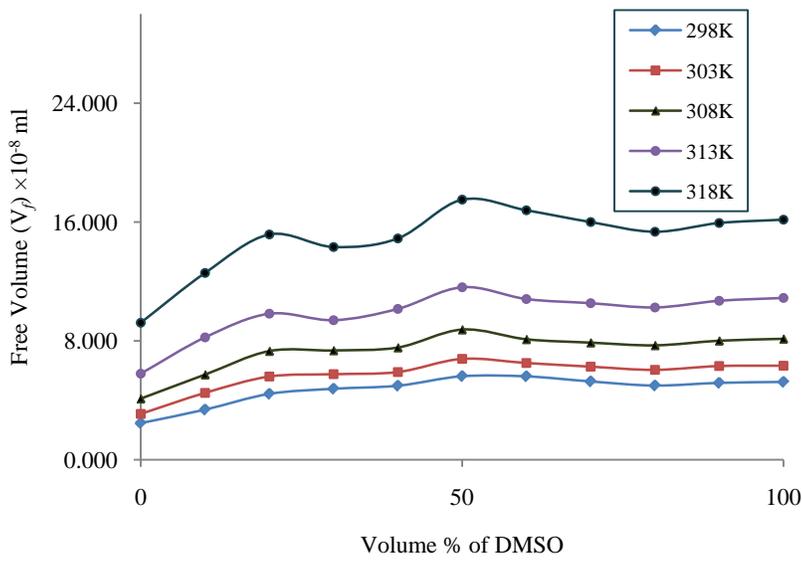


Figure-7: Free volume against volume % of DMSO

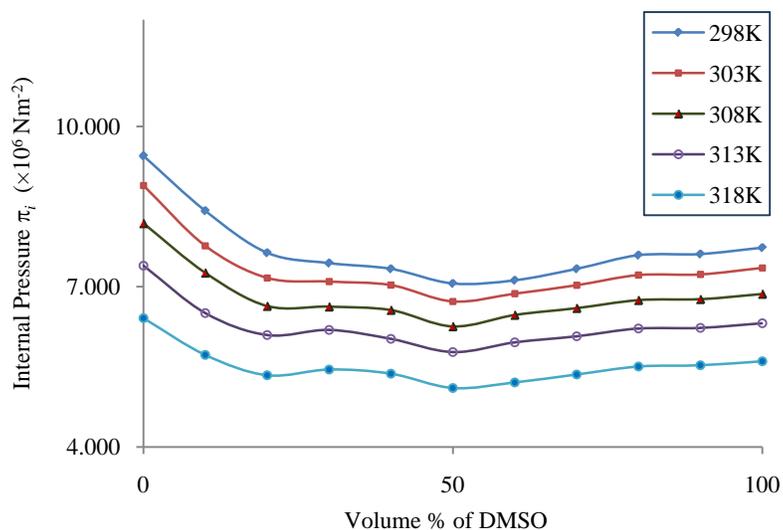


Figure-8: Internal pressure against volume % of DMSO

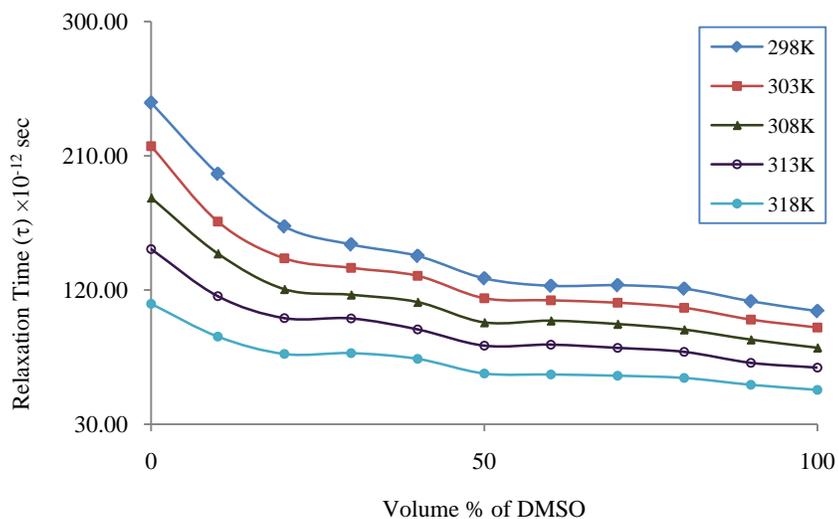


Figure-9: Relaxation time against volume % of DMSO

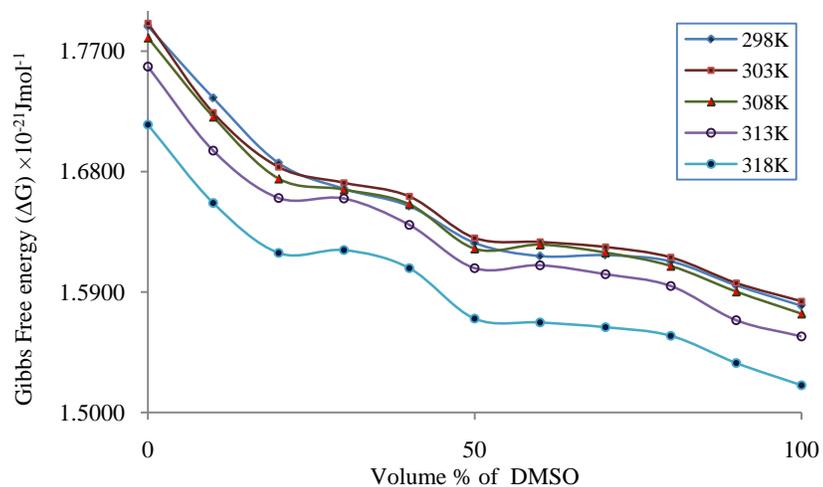


Figure-10: Gibbs free energy against volume % of DMSO

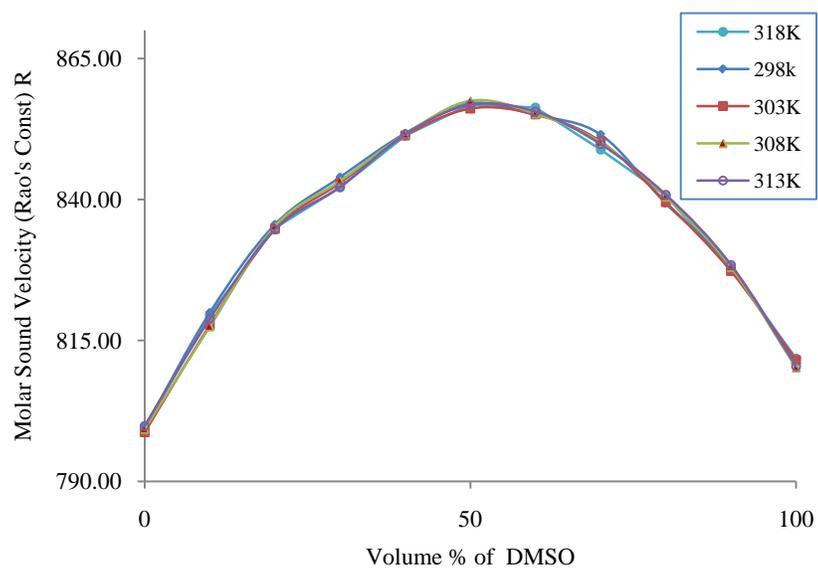


Figure-11: Molar sound Velocity against volume % of DMSO

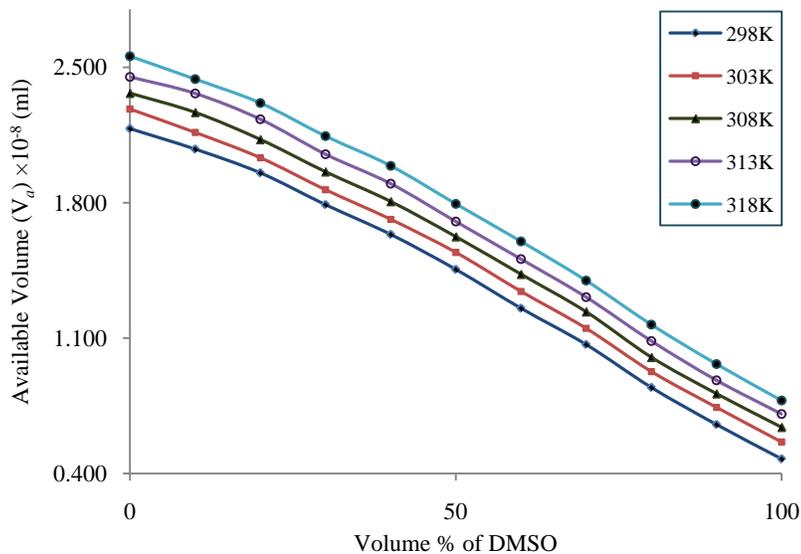


Figure-12: Available volume against volume % of DMSO

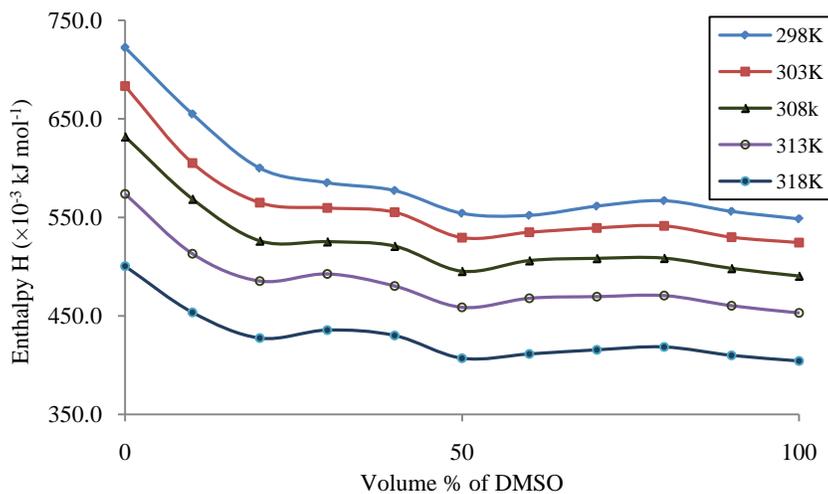


Figure-13: Enthalpy against volume % of DMSO

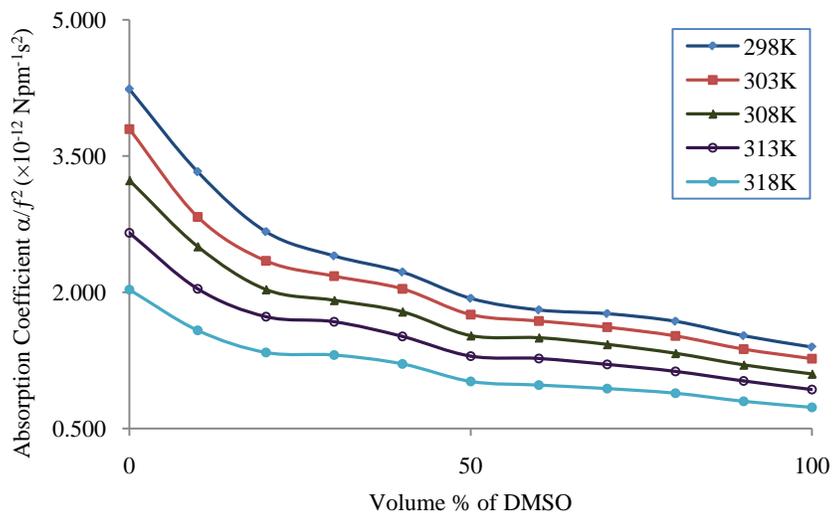


Figure-14: Absorption coefficient against volume % of DMSO

Table 3: The Excess values of adiabatic compressibility (β^E), acoustic impedance (Z^E), free length (L_f^E), free volume (V_f^E), available volume (V_a^E) and internal pressure (π_i^E).

Volume % of DMSO	$\beta^E \times 10^{-10}$ $\text{ms}^2 \text{kg}^{-1}$	$Z^E \times 10^6$ $\text{kg m}^{-2} \text{s}^{-1}$	$L_f^E \times 10^{-9}$ m	$V_f^E \times 10^{-6}$ ml	$V_a^E \times 10^{-6}$ ml	$\pi_i^E \times 10^3$ Nm^{-2}
298.15K						
0	0.000	0.000	0.000	0.000	0.000	0.000
10	-0.449	-0.043	-0.019	0.548	0.025	-1.066
20	-0.787	-0.078	-0.034	1.267	0.038	-1.861
30	-1.102	-0.098	-0.048	1.290	0.017	-2.026
40	-1.238	-0.116	-0.055	1.184	0.013	-2.062
50	-1.303	-0.124	-0.059	1.527	-0.009	-2.219
60	-1.297	-0.116	-0.060	1.246	-0.040	-1.989
70	-1.133	-0.106	-0.054	0.648	-0.046	-1.544
80	-0.929	-0.070	-0.045	0.141	-0.073	-0.988
90	-0.532	-0.040	-0.026	0.117	-0.053	-0.589
100	0.000	0.000	0.000	0.000	0.000	0.000
303.15K						
0	-0.0001	-0.0004	0.0000	0.000	0.000	0.000
10	-0.5204	-0.0382	-0.0209	1.000	0.009	-1.171
20	-0.8852	-0.0720	-0.0368	1.696	0.015	-1.785
30	-1.2055	-0.0905	-0.0513	1.473	-0.008	-1.833
40	-1.3349	-0.1094	-0.0585	1.253	-0.011	-1.838
50	-1.3761	-0.1187	-0.0619	1.793	-0.022	-2.039
60	-1.3598	-0.1119	-0.0625	1.194	-0.053	-1.742
70	-1.1973	-0.0996	-0.0564	0.647	-0.060	-1.375
80	-0.9765	-0.0663	-0.0470	0.166	-0.086	-0.912
90	-0.5563	-0.0371	-0.0276	0.182	-0.056	-0.554
100	-0.0002	-0.0004	-0.0005	0.000	0.000	0.000

308.15K						
0	-0.0002	-0.0004	-0.0004	0.000	0.000	0.000
10	-0.4629	-0.0416	-0.0192	1.089	0.029	-0.972
20	-0.8751	-0.0738	-0.0364	2.172	0.024	-1.612
30	-1.2103	-0.0921	-0.0512	1.728	-0.001	-1.613
40	-1.3470	-0.1108	-0.0586	1.474	-0.005	-1.631
50	-1.4088	-0.1191	-0.0627	2.250	-0.027	-1.850
60	-1.3791	-0.1134	-0.0627	1.198	-0.050	-1.504
70	-1.2166	-0.1008	-0.0566	0.608	-0.059	-1.196
80	-1.0035	-0.0669	-0.0477	0.093	-0.094	-0.804
90	-0.5739	-0.0376	-0.0280	0.109	-0.064	-0.479
100	0.0000	-0.0004	-0.0002	0.000	0.000	0.000

Table 3: continued....

Volume % of DMSO	$\square^E \times 10^{-10}$ ms² kg⁻¹	$Z^E \times 10^6$ kg m⁻²s⁻¹	$L_f^E \times 10^{-9}$ m	$V_f^E \times 10^{-6}$ ml	$V_a^E \times 10^{-6}$ ml	$\pi_i^E \times 10^3$ Nm⁻²
313.15K						
0	-0.0001	-0.0002	-0.0004	0.000	0.000	0.000
10	-0.4208	-0.0443	-0.0175	1.763	0.043	-0.937
20	-0.8332	-0.0764	-0.0345	2.709	0.044	-1.378
30	-1.2238	-0.0918	-0.0511	1.656	0.005	-1.280
40	-1.3563	-0.1117	-0.0581	1.833	0.004	-1.417
50	-1.4544	-0.1164	-0.0637	2.746	-0.031	-1.598
60	-1.4149	-0.1124	-0.0634	1.447	-0.052	-1.310
70	-1.2520	-0.0989	-0.0574	0.710	-0.062	-1.042
80	-1.0106	-0.0693	-0.0473	0.010	-0.086	-0.694
90	-0.5918	-0.0367	-0.0283	0.098	-0.068	-0.419

100	-0.0004	-0.0003	0.0001	0.000	0.000	0.000
318.15K						
0	-0.0004	0.0004	0.0001	0.000	0.000	0.000
10	-0.5641	-0.0380	-0.0216	2.403	0.012	-0.746
20	-0.9432	-0.0720	-0.0375	4.085	0.025	-1.165
30	-1.3084	-0.0896	-0.0532	2.375	-0.002	-1.071
40	-1.4421	-0.1096	-0.0604	2.142	-0.002	-1.135
50	-1.5363	-0.1150	-0.0659	4.004	-0.035	-1.359
60	-1.4841	-0.1123	-0.0653	2.602	-0.053	-1.172
70	-1.3205	-0.0967	-0.0595	1.192	-0.064	-0.904
80	-1.0574	-0.0688	-0.0488	0.002	-0.085	-0.591
90	-0.6141	-0.0364	-0.0291	0.129	-0.062	-0.352
100	-0.0004	-0.0003	-0.0003	0.000	0.000	0.000

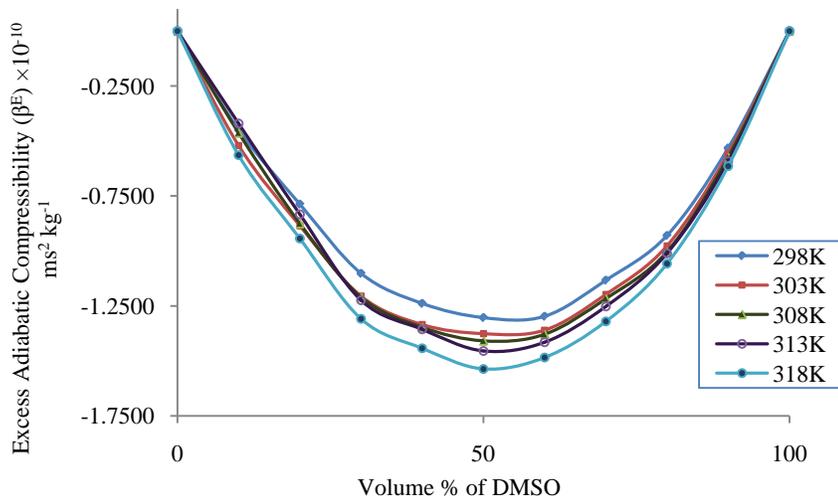


Figure-15: Excess adiabatic compressibility against volume % of DMSO

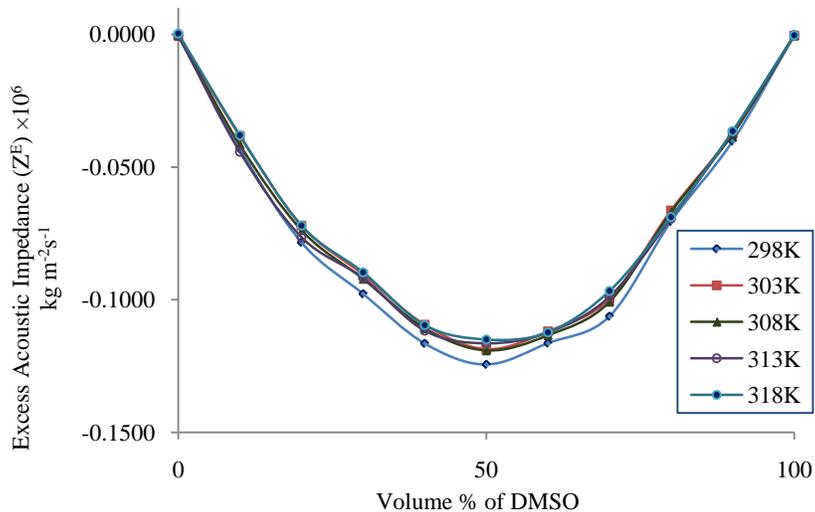


Figure-16: Excess Acoustic impedance against volume % of DMSO

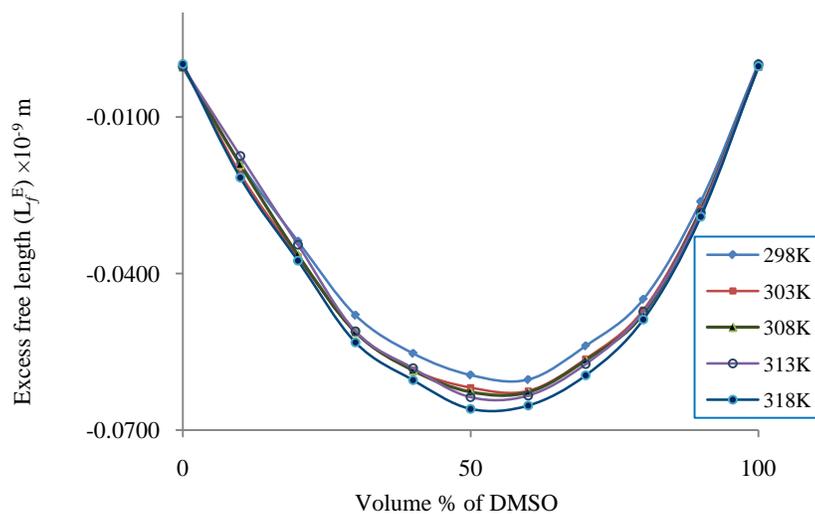


Figure-17: Excess free length against volume % of DMSO

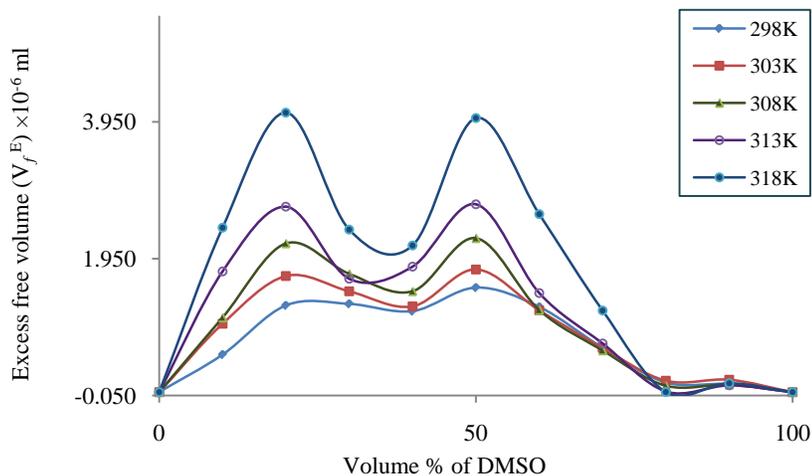


Figure-18: Excess free volume against volume % of DMSO

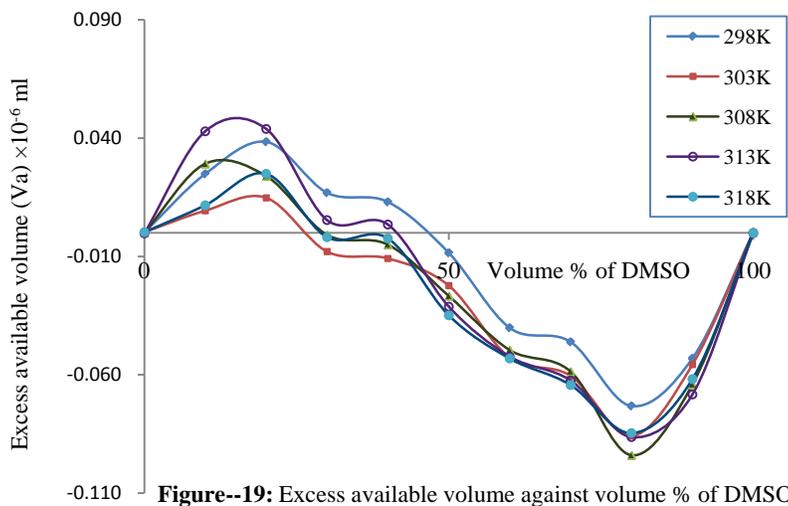


Figure-19: Excess available volume against volume % of DMSO

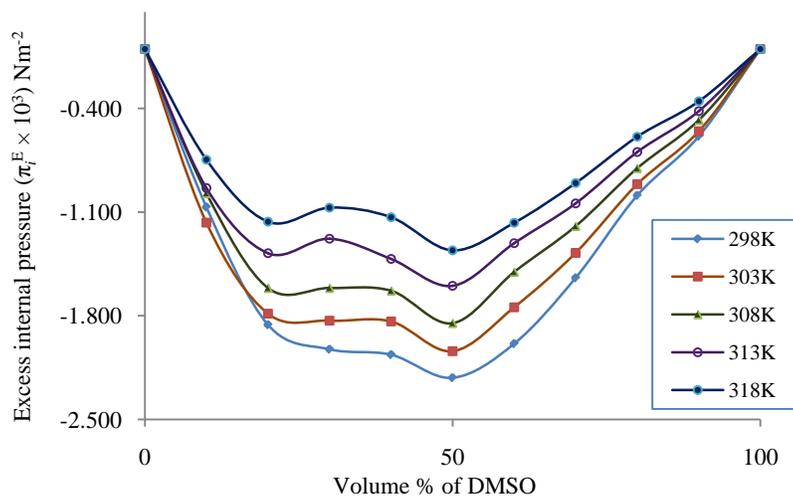


Figure-20: Excess internal pressure against volume % of DMSO

Content Based Image Retrieval Using Color and Texture Feature with Distance Matrices

Manisha Rajput

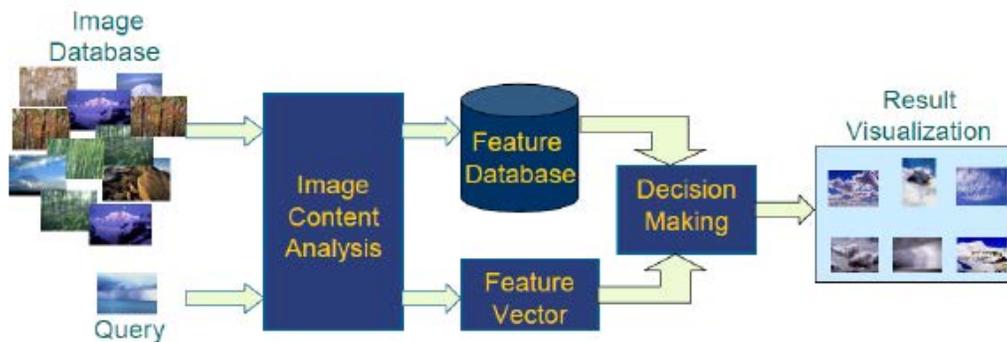
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Abstract: Content based image retrieval is the task of retrieving the images from the large collection of database on the basis of their own visual content. In this paper, first I presented overview of geometric and statistical distance metrics used in CBIR along with the comparative analysis of these measures on color and texture features. Color features extracted by computing color histograms in HSV space and texture features by wavelet decompositions. Geometrical distances such as Euclidean, standard Euclidean statistical distance metrics such as spearman, minkowski, Mahalanobis were analyzed for feature similarity. Correlation and relative deviation is also found in it. I gave certain conclusions on the performance of all these distance metrics in terms of Precision and Recall graphs.

Keywords: CBIR, texture distance metrics, Euclidean, Mahalanobis, minkowski, spearman, correlation, deviation

1. INTRODUCTION

Content based image retrieval: Content-based image retrieval (CBIR), also known as query by image content (QBIC) and content-based visual information retrieval (CBVIR) is the application of computer vision techniques to the image retrieval problem, that is, the problem of searching for digital images in large databases. "Content-based" means that the search will analyze the actual contents of the image rather than the metadata such as keywords, tags, and/or descriptions associated with the image. The term 'content' in this context might refer to colors, shapes, textures, or any other information that can be derived from the image itself. CBIR is desirable because most web based image search engines rely purely on metadata and this produces a lot of garbage in the results.



Schematic Overview of the System

Image features categorized as low-level visual features, scale, rotation and translational invariant features and high-level semantic features. Low-level features include color, texture and shape. For general CBIR applications, color features are most important and are the intensity values of a pixel obtained in any color plane representation of an image. Color features obtained with the help of histograms, correlogram and color sets. Texture features capture the granularity and repetitive patterns of image surfaces and play an important role in image retrieval. Texture analysis is widely used in interpretation and classification of terrain images, radiographic and microscopic cell images. To some extent, performance of CBIR decided by the correct usage of distance metrics. Similarity measurement in CBIR can be rank based or distance based. Dissimilarity measures used in CBIR broadly classified as geometric measures and statistical measures. Dissimilarity measures for interval data are Minkowski distances. Similarity measures for interval data are Cosine and Pearson correlation distance metrics. Manpreet Singh, Sumit Chopra, Jagdeep Kaur.

2. LITERATURE SURVEY

Texture based image retrieval is done by Gabor filters represented in [7]. Gabor filters are a group of wavelets. For a given image $I(x, y)$ with size $P \times Q$, its discrete Gabor wavelet transform is given by a convolution:

$$G_{mn}(x, y) = \sum_s \sum_t I(x-s, y-t) \psi_{mn}^*(s, t)$$

where, s and t are the filter mask size variables, and ψ_{mn}^* is the complex conjugate of ψ_{mn} . Color based image retrieval is done by color histogram color moments and hshvistogram. Minkowski distance metric at different levels presented in [3]. These metrics are preferred whenever each dimension holds equal importance in retrieval process. Minkowski metric used for feature vector comparison by An et al [4]. Manhattan distance or City block distance or Minkowski L1 depends on the rotation of the coordinate system, rather its translation L1 metric Minkowski distance to compare LBP histograms of query and database images [5]. Similarity of color histograms using L1 metric which is also known as city block metric proposed by Swain et al. Similarity of color histograms using L2 metric also known as Euclidean proposed in [2]. It was used for feature vector comparison. Minkowski L1, L2, Mahalanobis distance measures for shape databases evaluated in [6]. In this paper I presented image retrieval task based on HSV color histogram features and Gabor filter based texture features for analyzing the performance of standard geometrical, statistical and cumulative distance measures consisting Euclidean, Manhattan, Spearman, Mahalanobis distances.

3. PROPOSED SYSTEM

Experimentation is done in Matlab to analyze the effect of distance metrics on different types of images.

1. Image database is loaded into Matlab workspace.
2. Query Image is selected from the database.
3. Color feature extraction is done by computing color histograms for query and database images in HSV Color space.
4. Using Gabor filters, texture features extracted.
5. Distance metrics were applied for feature similarity measurement.
6. Performance measures, precision (P) and recall (R) evaluated for the retrieved images.
7. Comparative analysis is done for image retrieval based on effect of similarity measures for color and texture features.

Image Dataset: 1000 images from 10 different categories where 100 images correspond to each category.



Feature Extraction: Concatenate the features to form 190-dimensional feature vectors.

Features	Description	Dimensions
Color histogram	HSV space is chosen, each H, S, V component is uniformly quantized into 8, 2 and 2 bins respectively	32
Color auto-correlogram	The image is quantized into $4 \times 4 \times 4 = 64$ colors in the RGB space	64
Color moments	The first two moments (mean and standard deviation) from the R, G, B color channels are extracted	6
Gabor wavelet	Gabor wavelet filters spanning four scales: 0.05, 0.1, 0.2, 0.4 and six orientations: $\theta_0 = 0, \theta_{n+1} = \theta_n + \frac{6}{\pi}$ are applied to the image. The mean and standard deviation of the Gabor wavelet coefficients are used to form the feature vector	48
Wavelet moments	Applying the wavelet transform to the image with a 3-level decomposition, the mean and the standard deviation of the transform coefficients are used to form the feature vector	40

Image Similarity: There are many ways to define similarity. Similarity regarding color distribution, shapes, textures etc. Since the dataset is constructed from a combination of these features we need to define some similarity metrics to take advantage of it.

Euclidean Distance:

Euclidean distance is also called as L2 distance. If $u=(x1, y1)$ and $v=(x2, y2)$ are two points, then the Euclidean Distance between u and v is given as:

$$\sqrt{\sum_{i=1}^N (X_i - Y_i)^2}$$

Standard Euclidean distance:

$$d = \sqrt{\sum \left(\frac{1}{s_i^2}\right) (x_i - y_i)^2}$$

Manhattan Distance:

It is also called the L1 distance. If $u=(x1, y1)$ and $v=(x2, y2)$ are two points. Formula is given below:

$$\sum_{i=1}^N \frac{|X_i - Y_i|}{(1 + X_i + Y_i)}$$

Spearman Similarity Measure:

If image intensities do not contain ties when they are ordered from the smallest to the largest, then by replacing the intensities with their ranks and calculating the Pearson correlation coefficient between the ranks in two images, Spearman rank correlation will be obtained. Spearman Rank Correlation measures the correlation between two sequences of values.

Mahalanobis Distance:

$$D_M(x) = \sqrt{(x - \mu)^T S^{-1} (x - \mu)}$$

Correlation Similarity Measure:-

In this case, similarity between two items i and j is measured by computing the *Pearson r* correlation $cor_{i,j}$. To make the correlation computation accurate we must first isolate the co-rated cases (i.e., cases where the users rated both i and j).

Relative Deviation Similarity Measure:-

The relative standard deviation (RSD) is useful for comparing the uncertainty between different measurements of varying absolute magnitude. The RSD is calculated from the standard deviation, s , and is commonly expressed as parts per thousand (ppt) or percentage (%):

$$RSD = \left(\frac{s}{x}\right) * 1000 \text{ ppt } \%$$

The %-RSD is also called the "coefficient of variance" or CV

Confusion matrix is used to compare the performance of the CBIR system using different distance metrics. To evaluate the overall performance of the CBIR system and compare the different distance metrics for retrieval accuracy, confusion matrix is calculated. A confusion matrix represents the actual classifications compared with the number of correct and incorrect prediction. The confusion matrix is n -by- n matrix, where n is the number of classes from the dataset. Each row represents the number of instances in actual class. Each column represents the number of instances in predicted class [9].

The other two are common evaluation methods namely recall (or sensitivity) and precision (or specificity). Recall measures the ability of the system to retrieve all models that are relevant, while precision measures the ability of the system to retrieve only models that are relevant. The precision and recall rates are computed by the following equations:

$$\text{Precision} = \frac{TP}{TP + FP}$$

$$\text{Recall} = \frac{TP}{TP + FN}$$

4. EXPERIMENTS & RESULTS

I used WANG database for comparing CBIR system consisting ten different groups of images including Africa, flowers, dinosaurs, monuments, elephants, horses, beach, food, busses and mountains. We presented the comparative analysis of what distance metric performed well for a particular type of query for its color and texture features.

1. In first case I have used Euclidean as our Similarity metrics, following results are shown:-

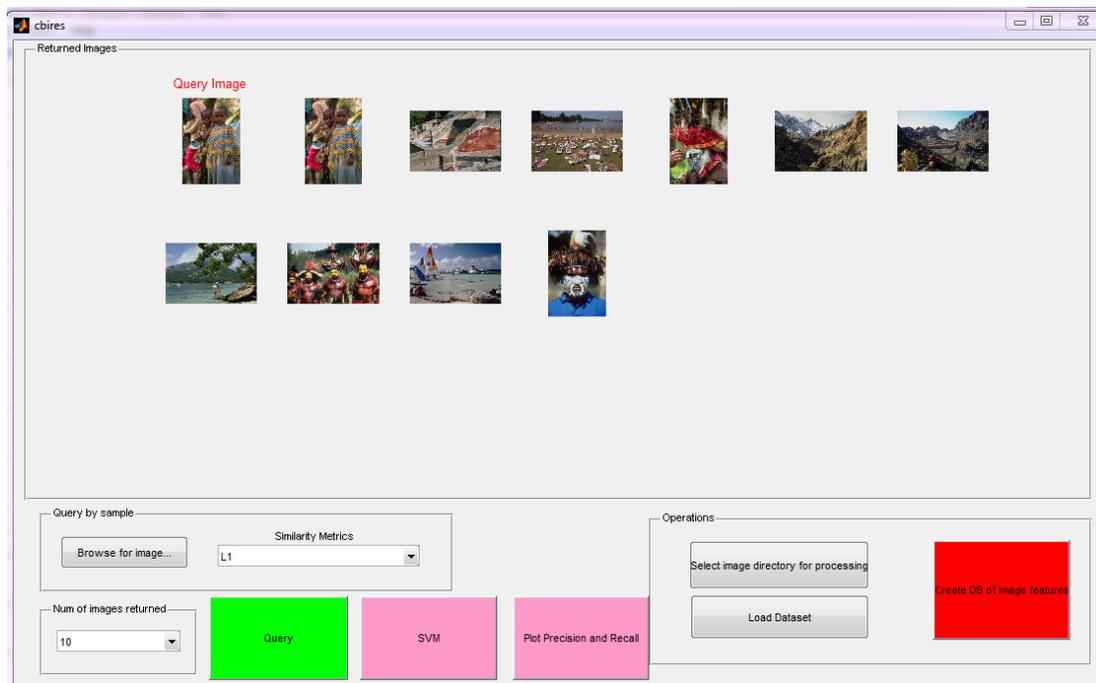


Fig 1 Retrieved images from database using L1 Similarity measure

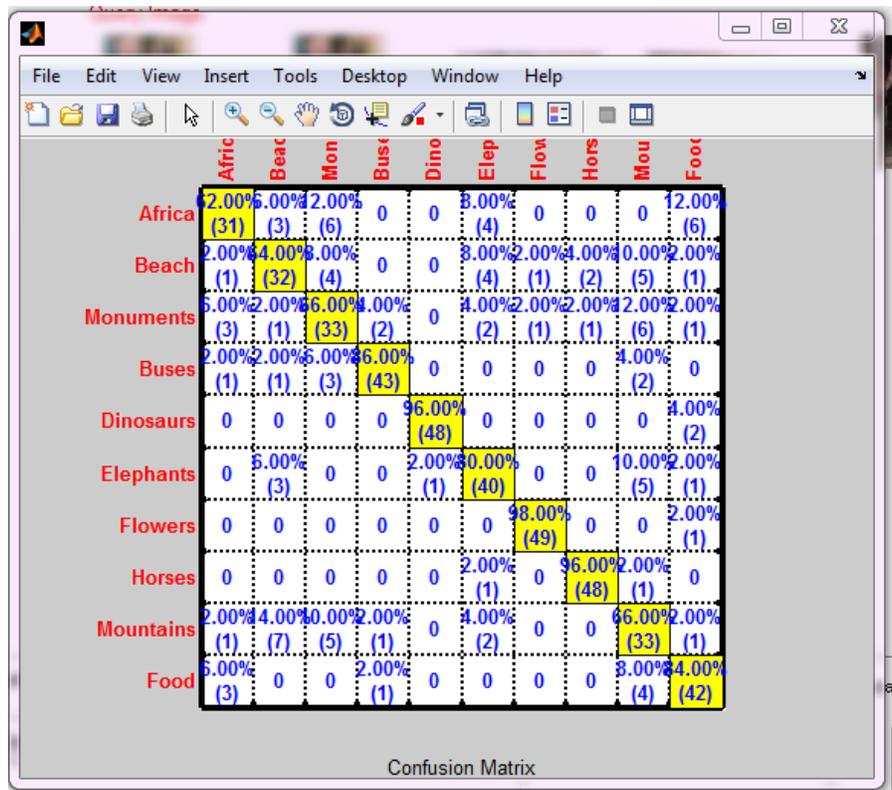


Fig 2 Confusion Matrix of L1 Similarity Measure

2. In second case I have used L2 distance as our Similarity metrics, results are shown below:-

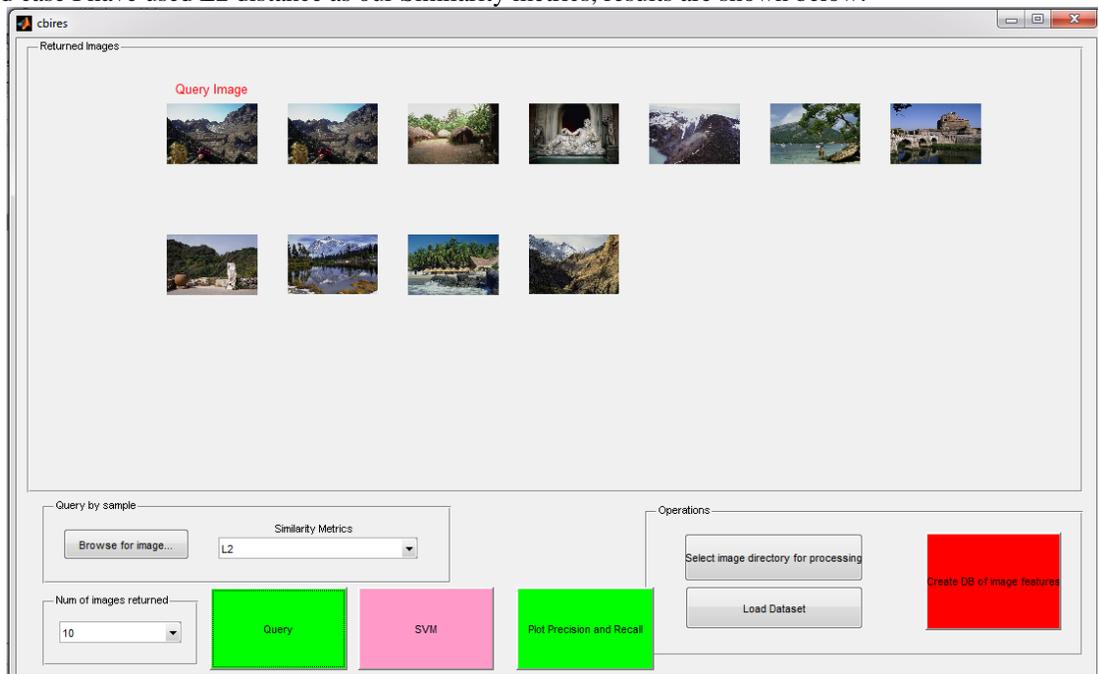


Fig 3 Retrieved images from database using L2 Similarity measure

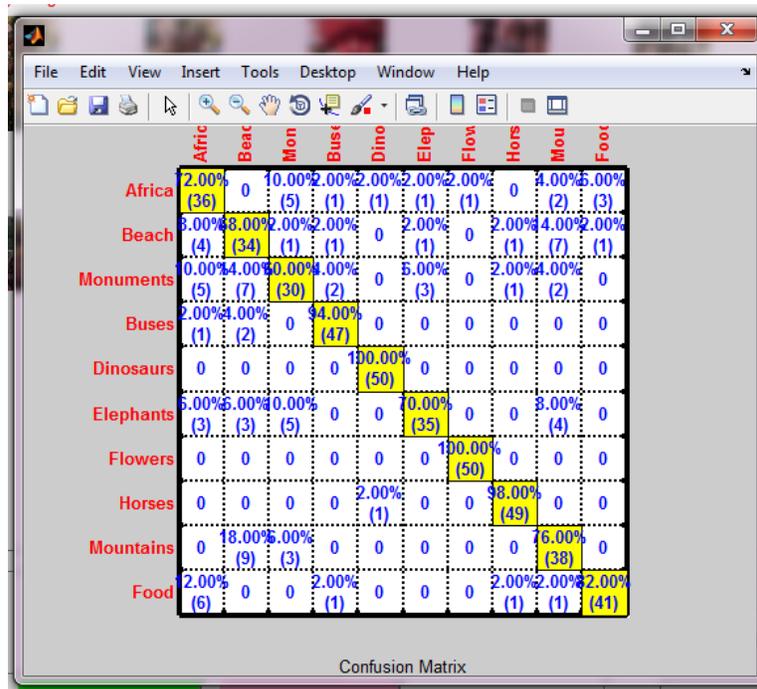


Fig 4 confusion matrix of L2 similarity measure

3. In third case I standardized L1 have used distance as our Similarity metrics, results are shown below:-

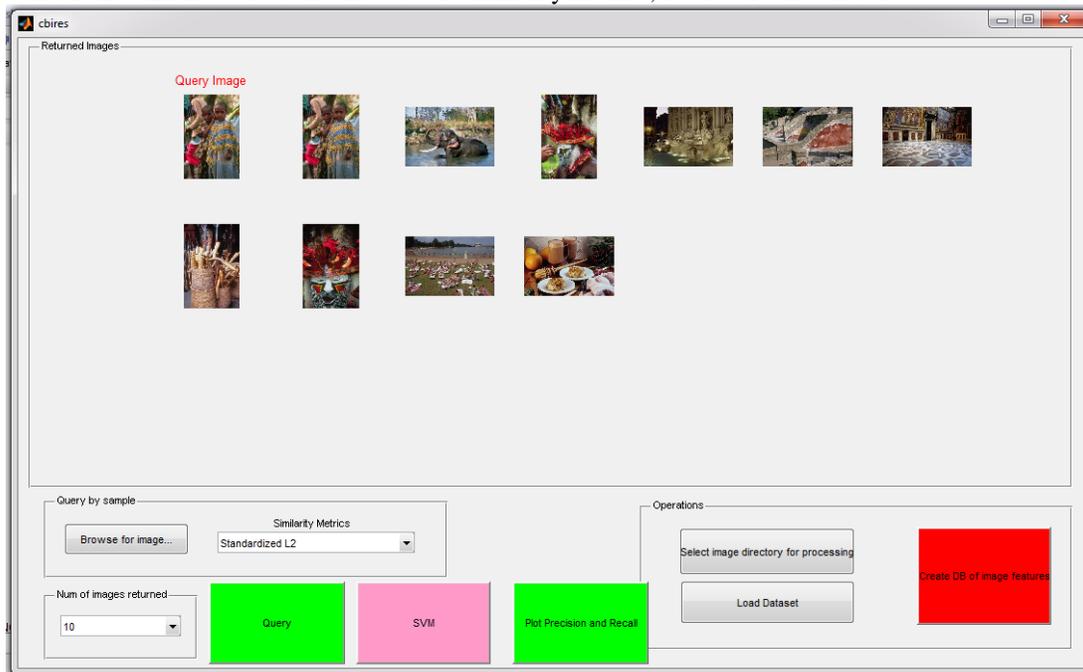


Fig 5 Retrieved images from database using standardized Similarity measure

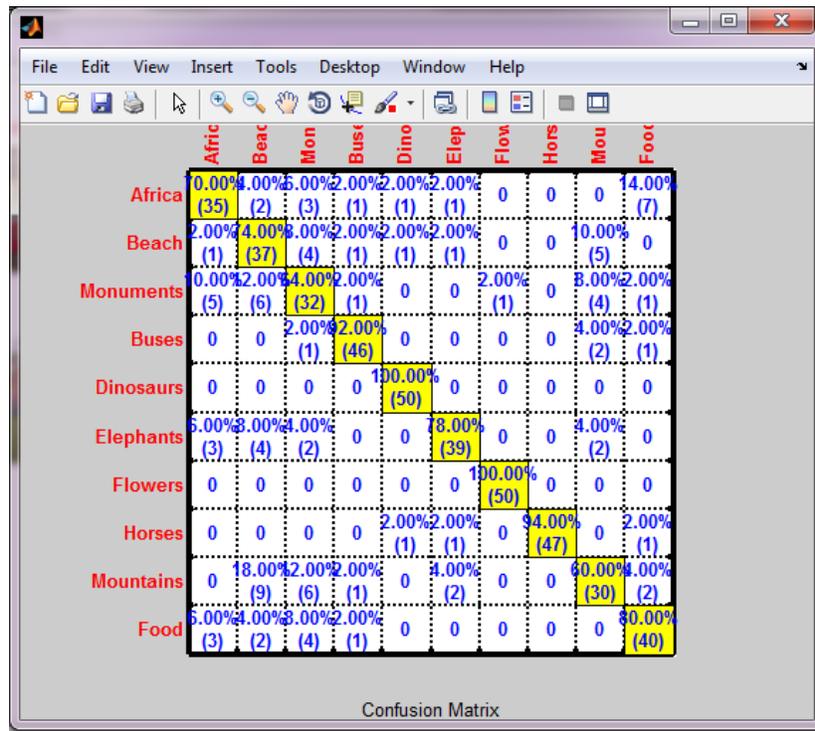


Fig 6 confusion matrix of standardized similarity measure

2. In fourth case, I have used Relative Deviation distance as our Similarity metrics, results are shown below:-

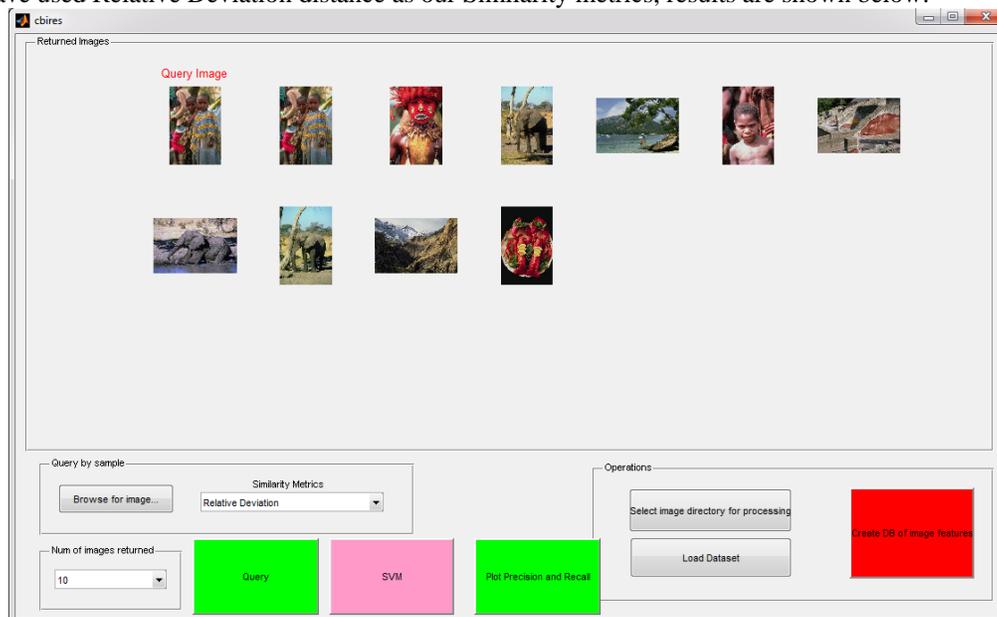


Fig 7 Retrieved images from database using Relative Deviation Similarity measure

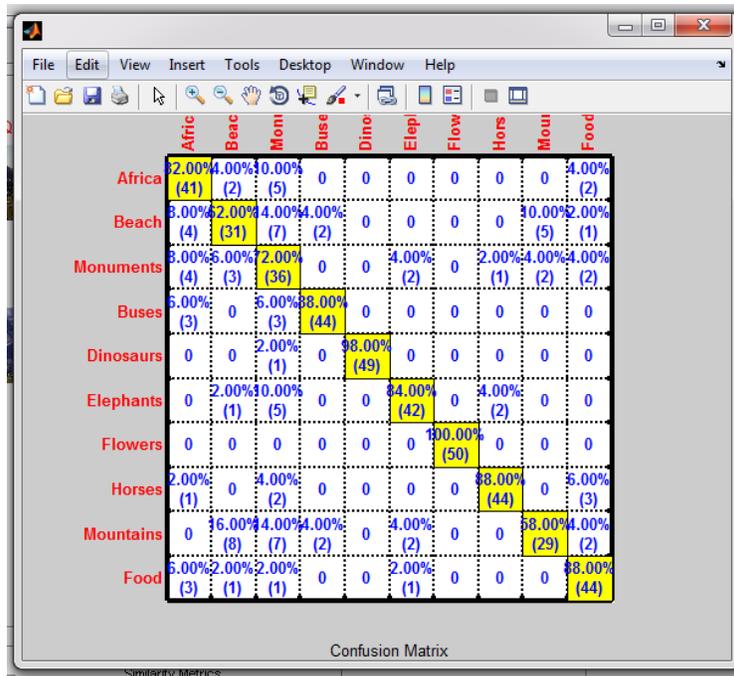


Fig 8 confusion matrix of Relative Deviation Similarity Measure

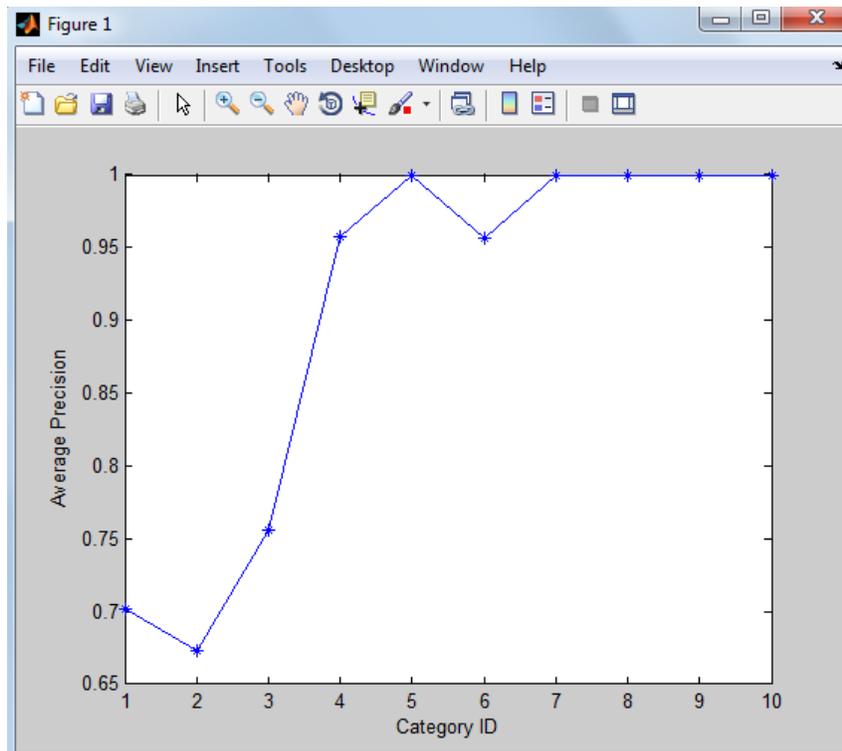


Fig 9 Precision Graph of Relative Deviation Similarity Measure

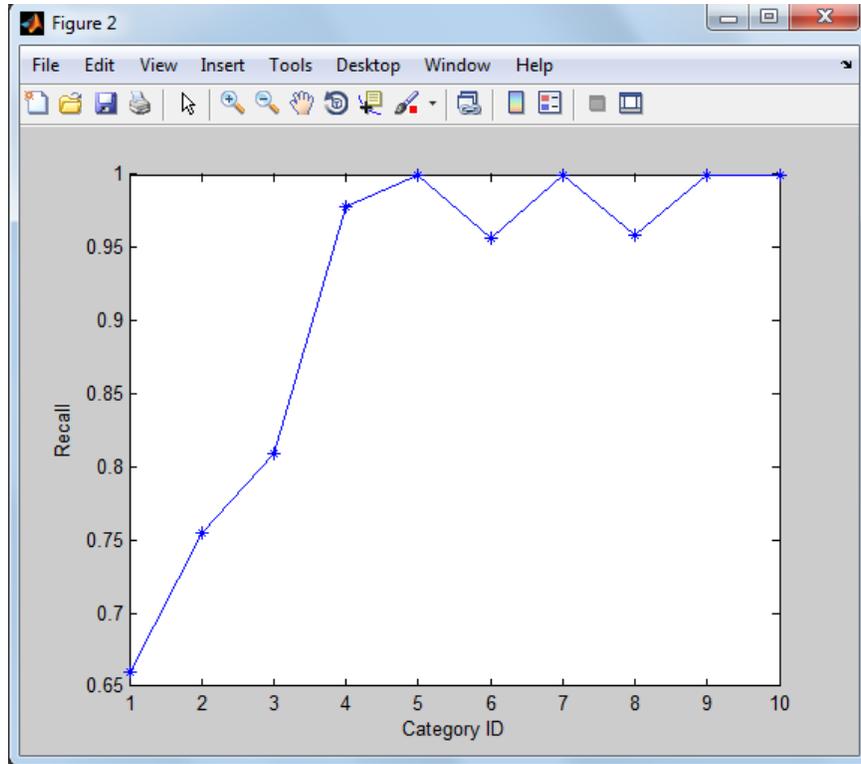


Fig 10 Recall Graph of Relative Deviation Similarity Measure

5. In fifth case I have used correlation distance as our Similarity metrics, results are shown below:-

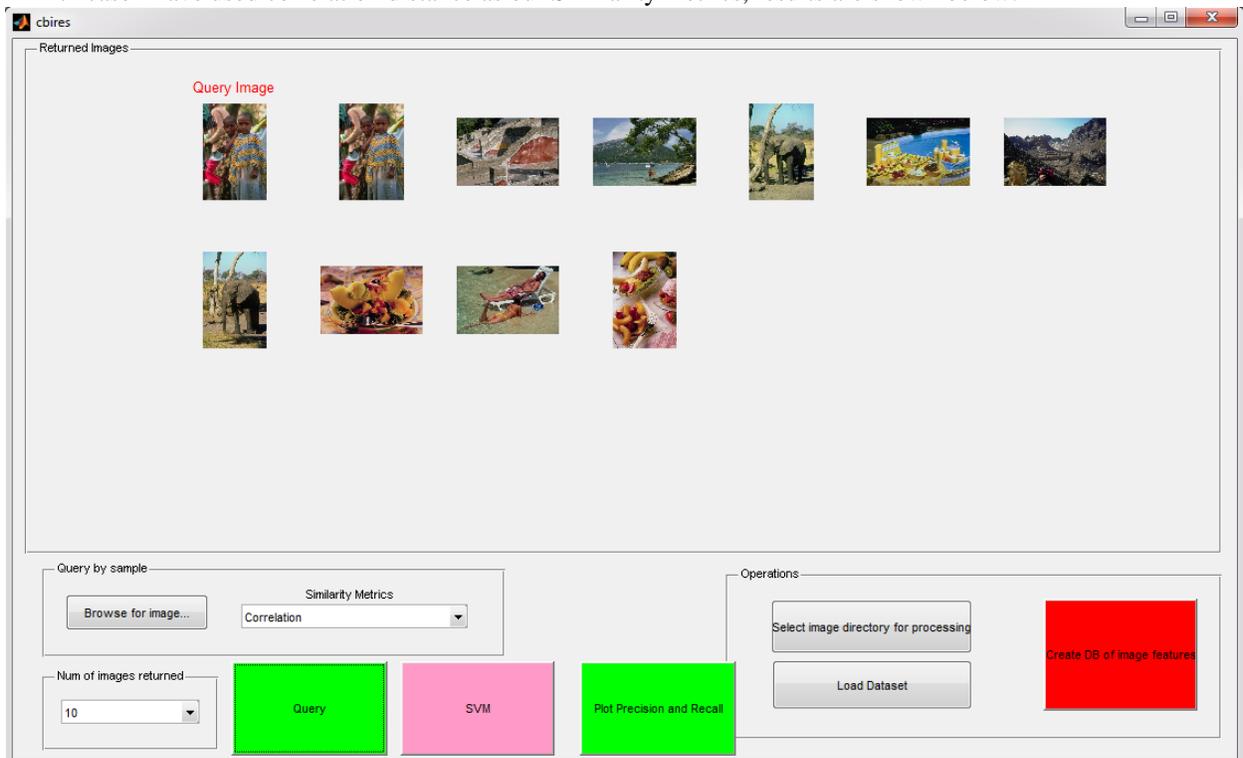


Fig 11 Retrieved images from database using Correlation Similarity measure

	Africa	Beach	Monum	Buses	Dinosa	Elephai	Flower	Horses	Mounta	Food
Africa	78.00% (156.2095)	0	8.00% (16.0215)	0	2.00% (4.0054)	6.00% (12.0161)	0	0	4.00% (8.0107)	2.00% (4.0054)
Beach	4.00% (8.0107)	74.00% (148.1987)	4.00% (8.0107)	2.00% (4.0054)	0	0	0	0	14.00% (28.0376)	2.00% (4.0054)
Monuments	8.00% (16.0215)	8.00% (16.0215)	70.00% (140.188)	2.00% (4.0054)	0	2.00% (4.0054)	0	2.00% (4.0054)	6.00% (12.0161)	2.00% (4.0054)
Buses	4.00% (8.0107)	4.00% (8.0107)	2.00% (4.0054)	84.00% (168.2256)	0	0	0	0	6.00% (12.0161)	0
Dinosaurs	0	0	0	0	96.00% (192.2578)	0	0	0	4.00% (8.0107)	0
Elephants	6.00% (12.0161)	2.00% (4.0054)	4.00% (8.0107)	0	0	78.00% (156.2095)	0	2.00% (4.0054)	8.00% (16.0215)	0
Flowers	0	0	0	0	0	0	100.00% (200.2686)	0	0	0
Horses	0	0	0	0	0	2.00% (4.0054)	0	94.00% (188.2524)	4.00% (8.0107)	0
Mountains	0	16.00% (32.043)	10.00% (20.0269)	2.00% (4.0054)	0	0	0	0	72.00% (144.1934)	0
Food	10.00% (20.0269)	2.00% (4.0054)	2.00% (4.0054)	2.00% (4.0054)	2.00% (4.0054)	0	0	0	0	82.00% (164.2202)

Confusion Matrix

Fig 12 Confusion Matrix of Correlation Similarity Measure

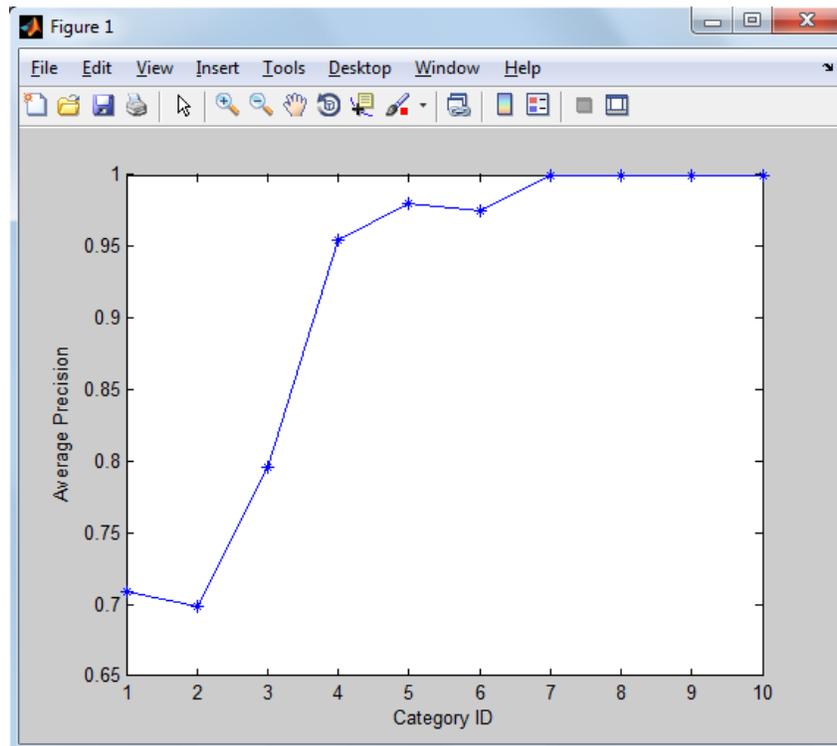


Fig 13 Precision Graph of Correlation Similarity Measure

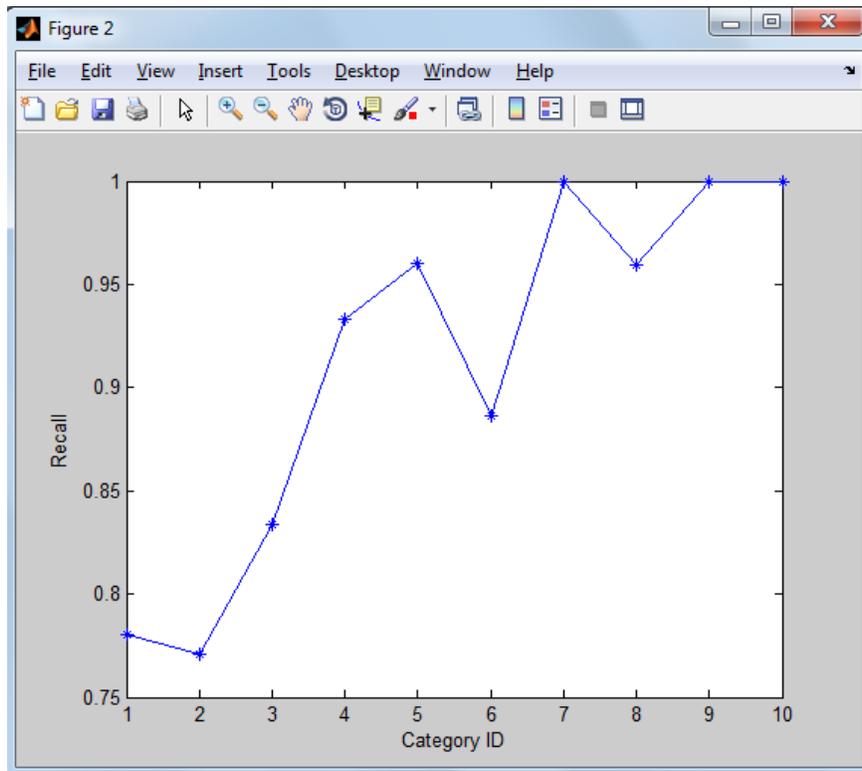


Fig 14 Recall Graph of Correlation Similarity Measure

5. Conclusion

In this paper, an algorithm has been proposed to retrieve image from database which are matched with query image. I have used eight distances L1,L2, Standardized L1,normalized L2, minkowski, spearman, Correlation and Relative Deviation as our similarity metrics. The performance of the system is shown in the form of Confusion matrix and recall and precision graphs.

References:

1. Neha "Content Based Image Retrieval :A Review" ,(IJSETR), Volume 3, Issue 5, May2014
2. Mrs. P. Nalini, Dr. B. L. Malleswari, (EEECOS)-2016 "An Empirical Study and Comparative Analysis of Content Based Image Retrieval (CBIR) Techniques with Various Similarity Measures",
3. Long, Fuhui, Hongjiang Zhang, and David Dagan Feng." *Fundamentals of content-based imageretrieval.*" *Multimedia Information Retrieval and Management.* Springer Berlin Heidelberg, 2003. 1-26.
4. YoungeunAn, Muhammad Riaz, and Jongan Park. Cbir based on adaptive segmentation of hsv color space. In *Computer Modelling and Simulation (UKSim), 2010 12th International Conference on*, pages 248–251. IEEE, 2010.
5. ValteriTakala, TimoAhonen, and MattiPietik'ainen. Block-based methods for image retrieval using local binary patterns. In *Image analysis*, pages 882–891.Springer, 2005.
6. Zhang, Dengsheng, and Guojun Lu. "Evaluation of similarity measurement for image retrieval." *Neural Networks and Signal Processing, 2003. Proceedings of the 2003 International Conference on.* Vol. 2. IEEE, 2003.
7. "Dengsheng Zhang, Aylwin Wong, Maria Indrawan"Content-Based Image Retrieval Using Gabor Texture Features", Guojun LuGippsland School of Computing and Information TechnologyMonash University, Churchill, Victoria, 3842, Australia
8. T.KrishnaMohana, V.Lalitha, L.Kusuma, N.Rahul, M.Mohan"Various Distance Metric Methods for Query Based Image Retrieval", Department of Electronics & Communications Engineering ,JNTUK, LIET Jonnada, Indi
9. Manpreet Singh, Sumit Chopra, Jagdeep Kaur, "An Efficient Content Based Image Retrieval System Using Soft Computing Technique" *IJCSMC, Vol. 4, Issue. 5, May 2015, pg.148 – 157*

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Antibacterial activity of aqueous methanolic extract of leaf and fruit extract of *Santalum album*

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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. In the present study we were investigated the antibacterial activity of leaf and fruit extract of *Santalum album*. The antimicrobial activity of aqueous extract leaf and fruit of *Santalum album* was performed against gram negative and gram positive bacteria.

Index Terms- Antibacterial activity, *Santalum album*, leaves and fruits.

I. INTRODUCTION

Santalum album is a native of the highlands of southern India mainly Coorg, Chennai and Mysore. It generally occurs at altitudes of 2000-3000 feet. The tree attains the height of 60-65 feet. *Santalum* thrives well-drained loamy soil preferably on slopes of hills exposed to the sun. It requires a minimum of 20-25 inches rainfall per year. The finest wood grows in driest region particularly on red or stony ground while on rocky ground the tree often remains small but gives the highest yield of oil. Trees more than 30 years old may have circumference from 18 to 38 inches. The bark and sapwood are odourless and the roots and heartwood contains the essential oil. [1]

Antimicrobials of plant origin have enormous therapeutic potential. They are effective in the treatment of infectious diseases while simultaneously mitigating many of the side effects that are often associated with synthetic antimicrobials. All medicinal, plant contains certain active constituent, it responsible to some pharmacological activity. The medicinal actions of plants are unique to a particular plant species or group, consistent with the concept that the combination of secondary products in a particular plant is taxonomically distinct [2]. The present study aims to assess the antibacterial activity of leaf and fruit extract of *Santalum album*.

II. MATERIAL AND METHODS

Selection of plant material

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.). Mostly extract of leaf and fruit has been used in the study.

Preparation of the plant extract

The Fresh and disease free leaves and fruit of plant were washed and dried under shade. Then the samples were ground

separately using mortar and pestle. 100% aqueous extract of plant leaves and fruit were prepared by using distilled water.

Antibacterial assay

The following bacterial strains were used in this study viz., Gram negative (*E. coli*, *P. aeruginosa*, *P. putida*, *Proteus vulgaris*) and gram positive (*S. mutanc*, *S.aureus*, *E. ficalis*, *M. luteus*). Disc diffusion assay method was carried out by using standard protocol.

III. RESULTS AND DISCUSSION

The antimicrobial activity of the leaf and fruit extract was estimated using disc methods against Gram negative (*E. coli*, *P. aeruginosa*, *P. putida*, *Proteus vulgaris*) and gram positive (*S. mutanc*, *S.aureus*, *E. ficalis*, *M. luteus*). The methanol crude extracts of *Santalum album* and its fractions revealed comparatively small antibacterial potential against gram-positive and gram negative bacteria at the concentrations of 25%, 50%, 75% and 100% with their respective zone of inhibition of 10 -18 mm (Table 1 and 2).

Maximum zone of inhibition was observed in 25% and 50% methanol extract of *Santalum album* leaf extract against in *S. aureus*.

Many plants produce chemicals which inactivate bacterial infections. The results showed that leaf have more antibacterial activity than fruit so that we can use *S. album* leaf extract against those microbes. [3-6]

Table 1- Antibacterial activity of leaf extract of *Santalum album*

Gram negative bacterial strains	Zone of inhibition (mm)			
	25%	50%	75%	100%
<i>E. coli</i>	10	11	11	12
<i>P. aeruginosa</i>	11	11	13	15
<i>P. putida</i>	11	12	13	14
<i>Proteus vulgaris</i>	11	12	13	14
Gram positive bacterial strains				

<i>S. mutanc</i>	10	11	12	12
<i>S. aureus</i>	18	18	10	10
<i>E. ficalis</i>	11	12	14	12
<i>M. luteus</i>	11	12	13	16

Table 2 - Antibacterial activity of fruit extract of *Santalum album*

Gram negative bacterial strains	Zone of inhibition (mm)			
	25%	50%	75%	100%
<i>E. coli</i>	10	10	11	11
<i>P. aeruginosa</i>	11	12	10	10
<i>P. putida</i>	0	11	12	12
<i>Proteus vulgaris</i>	0	12	12	13
Gram positive bacterial strains				
<i>S. mutanc</i>	11	12	12	13
<i>S. aureus</i>	12	14	12	12
<i>E. ficalis</i>	11	10	14	10
<i>M. luteus</i>	12	14	15	16

IV. CONCLUSION

The present antimicrobial study of extract of *Santalum album* that the aqueous methanolic extract of leaf shows highest activity against the employed bacteria. Possibilities for future

studies may include testing different parts of *S. album* for antimicrobial activity. Comparing data from studies of other *Santalum spp.* may be helpful in determining similar medicinal properties of plant extracts. These properties may have economic benefits involving *S. album* in cultivation.

REFERENCES

- [1] Kirtikar, K. R. and Basu. *Santalum album* Indian Medicinal Plants. 3 (II): 2184-88.
- [2] Bakkiyaraj, S. and Pandiyaraj, S. 2011. Evaluation of potential antimicrobial activity of some medicinal plants against common food-borne pathogenic Microorganism. *International Journal of Pharma and Bio Sciences*, 2(2):484-491.
- [3] Barile, E., Bonanomi, G., Antignani, V., Zolfaghari, B., Ebrahim Sajjadi S., Scala, F. and Lanzotti, V. 2007. Phytochemical screening and antimicrobial assessment of *Abutilon mauritianum*, *bacopamonifera* and *Datura Stramonium*. *Phytochemistry*, 68:596-603.
- [4] Akharaiyi, F. C. 2011. Antibacterial phytochemical and antioxidant activities of *Datura metal*. *International Journal of Pharmacology Technology Research*, 3(1):478-483.
- [5] Giriram Kumar, Indira A. Jeyraaj, Jeyaraaj, R., Loganathan, P. 2006. Antimicrobial activity of aqueous extract of leaf and stem extract of *Santalum album*. *Ancient Science of Life*, XXV(3&4):6-9.
- [6] Sreedevi, R. and Damodharam, T. 2015. Phytochemical and Antibacterial Activities of *Santalum Album*. *Int. J. Pharm. Sci. Rev. Res.*, 33(1):280-283.

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Impact of Terrorism on International Peace and Security in the Age of Technological Advancement

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Abstract - Efforts geared at repositioning the international system to ensure peaceful coexistence among states have greatly been undermined by terrorist activities across the globe. Thus, while commerce and technology have brought the planet together in ways unimaginable, advances in communication, transportation and weaponry by nations now give room for unavoidable avenue for terrorist exploitation. This paper examined the impact of international terrorism in the international system. The paper utilized data drawn from the secondary sources which were analyzed within the context of Frustration/Aggression theory. The article revealed that frustration on the part of the terrorists about their perceived plights especially the United States support for Israel against the Palestinians is responsible for the prolonged terrorist attacks against the United States of America and Israel. Similarly, the article also found out that military interventionist foreign policies by the major powers aggravate and intensify terrorist attacks across the globe. Consequently, the article recommended among others, that Palestinians should be provided with some reliefs from their current stateless condition; efforts should be intensified in improving living conditions in less prosperous countries by providing disadvantaged people with employment and other opportunities for a better life as this will help to deter some potential terrorists.

Index Terms - International terrorism, interventionist foreign policy, frustration aggression, international peace, security.

I. INTRODUCTION

The present day international system has come to become more unified with evidence of interconnection everywhere. Commerce and technology have brought the planet together in ways previously unimaginable. The internet has penetrated into remote corners of the planet, and new discoveries in digital and optical technology now seem to drive human beings even closer together. Advances in communication, transportation and weaponry by nations now give room for unavoidable avenue for terrorist exploitation. Thus, while international relations seek to unify states by way of bringing them together as a unified whole, terrorism on the other hand is at odds with civilization march toward globalization. It aims at breaking the international system apart into smaller autonomous units. Barber (1992) captured this phenomenon vividly when he noted that the planet is falling precipitantly apart and coming reluctantly together at the very same moment. This division he labels as Jihad which means the internal struggle against evil or the external struggle against the

perceived enemies of Islam. Rourke (2008) observed that the global changes that have given move to a rapid increase in the number of international nongovernmental organizations have also expanded the number of transnational terrorist groups that are organized and operate internationally and that commit transnational terrorism. More so, modern technology has increased the power of weapons available to terrorists. Explosives have become more deadly with an increasing danger of terrorists obtaining the material and means to launch a biological, chemical or radiological attack. Again, increased urbanization has brought people together so that they are easier targets, especially when gathered in such high profile places as skyscrapers, sports stadium, market places, churches, mosques, etc.

Similarly, modern communication has also affected the international system adversely and made terrorism more efficacious as terrorists use the modern day advancement in technology to create pressure on governments to negotiate with terrorists and accede to their every demand. Terrorism now affects the international system negatively as terrorist groups now destroy lives and property of citizens within and across national boundaries. It is against this background that this chapter seeks to explore the concept of terrorism and its impact on the international system.

II. STATEMENT OF THE PROBLEM

Observably, the persistence of terrorist activities across the globe has led to an increased thought as to what to do to stem the tide of terrorist activities across the world. The present day international system has intensified efforts at bringing together countries of the globe with evidence of interconnectivity. But while the international system through the internet and technology penetrates into the remote corners of the globe with new discoveries, terrorists now exploit advances in communication, transportation and weaponry by nation. Accordingly, while international relations seek to unify states by way of bringing them together as a unified whole, terrorism on the other hand is at odds with this civilization march toward globalization.

This situation therefore raises concern and pertinent question: Are advances in modern technology which is a fall out of globalization responsible for the rising spate of modern day international terrorism?

Flowing from this problem, the following questions become pertinent:

- (i) What factors account for terrorist activities in the globe?

- (ii) To what extent has modern technology served as a boost to global terrorism?
- (iii) In what ways can terrorism be eradicated to ensure international peace and security?

Objectives of the Study

- (i) To find out the factors that account for terrorist activities across the globe.
- (ii) To examine the extent to which modern technology has served as a boost to global terrorism.
- (iii) To recommend ways of eradicating terrorism to ensure international peace and security.

Theoretical Framework

This paper is guided and analyzed within the framework of the frustration and aggression theory. Originally developed by Dollard and his research associates in the 1930s and later expanded and modified by scholars like Yale and Berkowitz, frustration and aggression theory states that aggression is always the result of frustration. An individual whose basic desires are thwarted and who consequently experience profound sense of dissatisfaction and anger is likely to react to his condition by directing aggressive behavior at what is perceived as being responsible for thwarting those desires, or at a substitute. Thus, according to Gurr (1970), "relative deprivation is a perception of thwarting circumstance". This is to say that when a man is deprived of his desire, he feels thwarted or frustrated because he has been deprived the right of possession.

The tenets and basic assumptions of the frustration/aggression theory are that:

- i. Aggression is always the result of frustration.
- ii. The greater the perceived importance of the desire, the more vigorous the aggressive response.
- iii. The greater the discrepancy between what men seek and what seems attainable, the greater their anger and their propensity towards violent reactions.
- iv. Emphasizes on relative deprivation gap between expectations and capabilities.

In analyzing the subject matter within the context of the theory, terrorists' activities seen as aggression springs from denial or deprivation seen as frustration. Without the perceived United States domination of the Arab world mostly the Palestine, there would not have been terrorist attacks on the West. Thus the continued attacks by terrorist organizations against the United States of America and her citizens on one hand and Israel and her citizens on the other hand stem from the perceived deprivation of Palestinians from their homeland. The gap between this expectation and realization brings in frustration which gingers aggressive dispossession towards the United States of America and her allies by terrorists. Against this background, terrorism is seen as an effective tool by terrorist to rid themselves and others of what they consider as oppression and an only way for an oppressed group to prevail against a heavily armed government.

What is Terrorism?

Terrorism is difficult to define. In other words, there is no commonly accepted definition of the concept. Terrorism is tied to human behavior. Thus for Griset (2008), human behavior has

always been hard to predict, control and comprehend. Relatively rare behavior like terrorism is even harder to understand. This is so because the adversarial and political postures embedded in the practice of terrorism make it unlikely that a universally accepted definition or a widely shared strategy for controlling it will soon emerge. Terrorism is an ideological and political concept (Griset, 2008:3). The meaning given to the concept is part of a person's or nation's philosophy. Thus, the determination of the right definition of terrorism is subjective and not likely to be reached by consensus. Therefore, if you disagree with my position, you are a terrorist; if you agree with my position, you are not a terrorist (Cooper, 2001). Yet the cliché that "one man's terrorist is another man's freedom fighter" provides little help in achieving definitional precision. Repressive regimes call those who struggle against them terrorist, but those who commit violence to topple those same regimes call themselves freedom fighters (Hoffman, 2006). Let us now look at a few of these definitions: for Lacqueur (2001:79) terrorism is "the use of covert violence by a group for political ends. Hoffman (2006:41) defined the concept as the "deliberate creation and exploitation of fear through violence or threat of violence in the pursuit of political change". For Stern (2003:xx), it is "an act or threat of violence against noncombatants with the objectives of exacting revenge, intimidation or otherwise influencing an audience".

Some definitions specifically include religious motivations, others include hate, millenarian and apocalyptic groups. Not everyone agrees that people who employ terrorist tactics on behalf of animals or the environment are terrorists. Several definitions refer only to non-state actors, whereas others include state sponsored terrorism (Mahan and Griset, 2008). Kydd and Walter (2011:394) defined terrorism "as the use of violence against civilians by non-state actors to attain political goal, Rourke (200:316) while recognizing the lack of consensus in the definition of terrorism, defined the concept as:

Violence carried out by individuals, nongovernmental organizations, or covert government agents or units; that specifically target civilians; uses clandestine attack methods such as car bombs and hijacked airliners and attempt to influence politics.

This definition stresses that terrorism focuses on harming some people in order to create fear in others by targeting civilians and facilities or systems, such as transportation on which civilians rely. The objective of terrorist is not just killing and wounding people and destroying physical material. Instead the true target is the emotions of those who see or read about the act of violence and become afraid or dominated.

On his part, de Mesquita (2003) defined it as any act of violence undertaken for the purpose of altering government's political policies or acts that target those who do not actually have the personal authority to alter or entries governmental authorities. By this definition, it is evident that terrorism encompasses all violent acts that are not motivated by the injury the specific individuals actually victimized by the act but rather are designed to influence the behavior of others, particularly policymakers.

Collapsing all the definitions into one whole, we adopt, Cooper's definition as "the international generation of massive fear by human beings for the purpose of securing or maintaining control over other human beings (Cooper 2001:883). For the

purpose of this article, we adopt Cooper's definition as our working definition although like him, we recognize that no single definition will ever be satisfactory to everyone.

History of Terrorism

Terrorism dates back to history. The Jewish Zealots of the first century, also known as the Sicarii, constituted one of the earliest large scale terrorist organizations. Their goal was to prevent Roman rule over Judaea (now Israel). They died for their efforts in a mass suicide at Masada in 20 AD but not before they had incited an insurrection of the populace against the Roman occupation of Judaea. This was followed by Gunpowder plot by Guy Fawkes in Great Britain in the 17th century. Although the Gunpowder or Papacy plot was foiled, Fawkes and his associates justified their actions in terms of religion (Griset 2008:36). It was termed the "holy terror".

Religious motives are often cited as a justification for much of contemporary terrorism. Many terrorist groups of today such as Al-Qaida, Taliban, ISIS, Alshabab, and others, all draw their motives from religion. For example Doran (2002) argued that Osama bin Laden's primary motive on 9/11 terrorist attacks was to overthrow the pro-US governments of some Arab and Muslim nations, including Saudi Arabia, Egypt and Pakistan. Religious and political motivations are often difficult to separate.

The 18th century challenged the divine rights of kings, arguing against a society of privilege and in favour of a political system that recognized the equality of men. Terrorists of the 18th and 19th centuries fought against a system that conferred amazing riches on a few and subjected all others to hard work and deprivation. Thus, not only have hereditary rulers and their representatives been targeted for assassination by terrorists who reject the existing governments but in addition revolutionary governments have themselves turned on their citizens, launching terrorist attacks of breath-taking cruelty and slaughtering untold members of civilians. It was through the state sponsored terrorism that in July 14, 1789, a French mob attacked the Bastille prison in Paris, massacring the soldiers stationed there. The rioters later walked through the streets carrying the heads of the prison commandant and several of the guards on pike. The mob was supported by a group of radical revolutionaries, who soon gained control of the government. In October of the same year, the radicals forced King Louis XVI and the Royal family to move from Versailles to Paris; later the king unsuccessfully tried to flee. He ultimately was tried by the revolutionary Court and in January 21, 1793, was executed (Mahan and Griset, 2008:48).

Like modern terrorists, the French revolutionaries took advantage of technological advances. Joseph Guillotine's invention of a new execution technology served in no little measure as it was a perfect fit for France's ruthless state sponsored terrorism. This was followed by the White terror with victims of the reign of terror attacking the former terrorists. The Russian terrorist group known as the Narodnaya Volya which existed from 1878 to 1881 was also another terrorist group in the history of terrorism. The group, a secret society of about 500 members targeted only high profile officials. This group was different from the state-sponsored terrorists in the French revolution that jailed and killed thousands of their countrymen. As reported by Lacqueur (1977) if ten or fifteen pillars of the establishment were killed at the same time, the government

would panic and would lose its freedom. At the same time, the masses would wake up". Thus, the Narodnaya Volya counted on the toppling of tsar's regime as a result of their assassinations. This method of terrorism came in the wake of the land distribution which was at the heart of the struggle in Russia in 1861. Tsar Alexander II abolished serfdom and lifted strict controls over freedom of speech and assembly. These progressive actions were influenced by the ideas of the European Enlightenment, but they proved to be tsar's undoing and led eventually to his assassination (Lacqueur, 1977:34).

Part of the history of terrorism could be discovered from the adoption of nationalism, and the desire for independence from colonial rulers were at the heart of the social, economic, political and religious struggles as in India. India under British rule since 1857 adopted isolated instances of terrorism from the beginning of British colonialism. This massive nonviolent resistance to colonial rule led the British to withdraw from India in 1947 and India became independent. Also, Algeria through its National Liberation Front (FLN) attacked the French colonial rule by attacking military installations, police installations and public utilities in 1954. This was inspired by Frantz Fanon's *Wretched of the Earth*. Other countries which also achieved their freedom through terrorism took their inspiration from the writings of Germany's Karl Marx, Russia's Vladimir Lenin and China's Mao Zedong. These writings were carefully studied by Fidel Castro who launched the Cuban Revolution of 1959.

Although many argue that terrorism has increased as technology has advanced, the fact remains that terrorists have always had weapons, transportation, and communication – no matter how rudimentary. Thus, from the sword of the Zealots Sicarii to the dagger of the Assassins to silk scarf noose of the thugs, terrorists have used whatever technology was available to them. Contributing in this direction, Rapoport (1984:659) argued that "the critical variable cannot be technology; rather the purpose and organizations of particular groups and the vulnerabilities of particular societies to them are decisive factors". That way, understanding the culture, religion, politics, economics and ideology of a country and its people is the best way to comprehend the phenomena of terrorism.

Weapons and Tactics of Terrorism

Notwithstanding, modern terrorism has advanced with the advancement in science and technology. Enders and Savders (2005) observed that there are new, more terrible threats—radiological terrorism, and nuclear, biological and chemical (NBC) terrorism. Terrorists now attack with radiological, biological, or chemical weapons using "ships, trucks, airplanes or other means" than by weapons of mass destruction from another country using its military missiles or bombers. Major weapons of terrorism include:

i. Conventional Weapons Terrorism

This involves the use of bombs, guns and other conventional weapons. As reported by Rourke (2008:319): During 2006, for example, bombs were used in 59% of the terrorist attacks, and firearms were used in another 19%. Kidnapping (17%) were also common, with a few cases of arson, hijackings, and assassinations. Even the attacks on the World Trade Centre and Pentagon in 2001, as horrific as they were,

would fall under the category of conventional weapons terrorist attacks.

ii. Radiological Terrorism

This involves spewing radioactivity into the surrounding air and water which would result in increased levels of radiation causing future cancers, pregnancy complications, and other medical risks. It is also potential for economic damage, since a radiological attack could render parts of a city or an important facility unsafe, perhaps for years (Rourke, 2008).

iii. Chemical and Biological Terrorism

This weapon of terrorism came to the limelight after the 9/11 attacks. This is the spreading of anthrax that would leave millions dead.

Similarly, terrorist tactics across the globe include, children at war, assassination, hijacking, kidnapping and hostage taking, bombing, suicide terrorism including female suicide bombers, etc. These tactics will be discussed seriatim:

(i) Children at War

Records show that at the beginning of the 21st century, an estimated 300,000 children, some as young as 7 years old, are being used as combatants, sometimes after being kidnapped. They are exploited by both established governments and rebel movements in scores of armed conflicts around the world; such children are trained in violent tactics (Human Rights Watch, 2006). Young combatants participate in all aspects of contemporary political strife. They wield AK 47s and M-16s on the front lines of political strife, serve as human mine detectors, participate in suicide missions, carry supplies and act as spies, or lookouts. Physically vulnerable and intimidate, they make obedient soldiers. They are scattered across the globe-in Afghanistan, Angola, Congo, Cuba, Eritrea, Rwanda, Iraq, Iran, Somalia, Uganda, etc.

ii. Assassinations

Assassinations have always been a basic tactic of terrorists. It involves taking the lives of public figures who they christen as their enemy in order to achieve their objective. Many public officials including Israeli Prime Minister Yitzhak Rabin have been killed through this tactic. As a tactic of war, a single strategic fatality can have an impact that makes an assassination a compelling choice for a strike against an enemy (Mahan and Grisct, 2008).

iii. Hijacking

This involves taking over a vehicle on the public thoroughfare and turning it into a terrorist weapon. It includes car theft at knife point or gun point as well as terrorists' target of autos, buses, trains, ships, military vehicles, aircrafts or even spacecraft depending on their technical resources and development.

iv. Kidnapping and Hostage taking

Kidnapping and hostage taking involve seizing, detaining or threatening to kill or injure someone. The victim is held to compel a third party to act or abstain from acting as a condition for the release of the seized person. This tactic has continued unabated and remains a common known tactic of terrorism

across the globe. In kidnapping, terrorists confine their victims in secret locations and make ransom demands, threatening to kill if these demands are not met. Hostage takers openly confront the police or military, in known locations with the objective often being to make demands with full media coverage.

v. Bombing

This is the detonation of deadly explosives. Explosives are considered as conventional tools of warfare. The history of terrorist bombing begins with dynamite, black powder and Molotov cocktails. The objectives of bombing remain the same regardless of the technology employed to a blow up a notable target and gain attention for a cause, slow down the opposition, get rid of political adversaries and destroy property. Some bombings intend to achieve all these goals, whereas others are meant simply to gain attention.

vi. Suicide Terrorism

This has become a serious tactical concern in transnational terror. This is a process in which the perpetrators intend to take numbers of other innocent victims with them in death. It is seen as a form of martyrdom. According to Mahan and Grisct (2008:142):

In most religious traditions, martyrdom is regarded not only as a testimony to the degree of one's commitment but also as a performance of a religious act, specifically as act of self sacrifice.

However, suicide bombing has its root in secular ideologies as well. Many suicide bombers of contemporary terrorist attacks are females. Female suicide terrorists are said to be the ultimate asymmetrical weapons (Zedalis, 2004). There is often more shock value if the suicide bomber is a woman thus attracting attention and precipitating widespread fear. Women provide a tactical advantage as they significantly increase the number of combatants available to a terrorist group.

Strategies of Terrorism

Minst and Snyder (2011) provide five principal strategies in terrorist campaigns. These include attrition, intimidation, provocation, spoiling and outbidding. In attrition strategy, terrorists seek to persuade the enemy that the terrorists are strong enough to impose considerable costs if the enemy continues a particular policy. Intimidation is a strategy of trying to convince the population that the terrorists are strong enough to punish disobedience and that the government is too weak to stop them, so that people behave as the terrorists wish. Provocation strategy attempts to induce the enemy to respond to terrorism with indiscriminate violence, which radicalizes the population and moves them to support the terrorists. Spoilers strategy is an effort to persuade the enemy that moderates on the terrorists side are weak an untrustworthy, thus undermining attempts to reach a peace settlement. Groups engaged in outbidding use violence to convince the public that the terrorists have greater resolve to fight the enemy than rival groups and therefore are worthy of support.

The Goals of Terrorism

Although the ultimate goals of terrorists have varied over time, Minst and Snyder (2008) have identified five enduring

important goals of terrorism. These include; regime change, territorial change, policy change, social control and status quo maintenance. Let's take a look at them one after the other;

- i. **Regime Change:** in most cases, terrorist objective is to overthrow a government and replace it with the government led by the terrorists or at least one more to their liking. The Taliban in Afghanistan, the Al-Qaida, Alshabab, among others fit into this category as terrorist groups whose basic objective is to establish Islamic states in the Middle East.
- ii. **Territorial Change:** This involves taking territory away from a state either to establish a new state as the Tamil Tigers seek to do in Tamil areas of Sri Lanka or join another state as Lashkar-e Tayyiba would like to do by incorporating India Kashmir into Pakistan.
- iii. **Policy Change:** This is a broader category of lesser demands, such as Al-Qaida's demand that the United States drops its support for Israel.
- iv. **Status quo maintenance:** This is the support of an existing regime or a territorial arrangement against political groups that seek to change it. An example of this is the protestant paramilitary groups in Northern Ireland which support the maintenance of the territorial status quo of that country as British territory as against the Irish Republican Army (IRA) demands that the territory be transferred to Ireland, (Minst and Snyder, 2011:394).

Causes of Terrorism

Terrorism has long existed even though it came to the front burner of international agenda in the wake of September 11 2001 attacks on the United States of America. Understanding its causes is vital to combating it. That being the case, it is instructive to argue that political violence is in part a product of unequal global distribution of wealth. According to Rourke (2008:321) "Globalization has brought the wealth gap into sharper focus and has also created a sense of cultural dislocation with its impact... connection between poverty and violence". The second factor is the overwhelming view among Muslims that the United States favours Israel. This factor points to the presence of U.S. forces in the Middle East, particularly U.S. support to authoritarian regimes in Saudi Arabia and elsewhere. This accounts for the psychological drives of terrorists blowing themselves to pieces attacking Israelis and others.

Terrorism is usually not the irrational acts of crazed fanatics; it is usually carried out by those who consider it a necessary, legitimate and effective tool to rid themselves and others of what they consider as oppression. It is seen as the only way for an oppressed group to prevail against a heavily armed government (Rourke, 2008:322). Modern conditions make terrorist operations possible. Technology has increased the power of weapons available to terrorists. Explosives have become more deadly, huge airliners can be made into piloted missiles, and there is an increasing danger of terrorists obtaining the material and means to launch biological, chemical or radiological attack. Again, increased urbanization has brought people together so that they are easier targets, especially when gathered in such high profile places as skyscrapers, sports stadium, churches, mosques,

market places, etc. Another major cause of terrorism is modern communications which have made terrorism more efficacious because the goal of the terrorist is not to kill or injure, but to gain attention for a cause or to create widespread anxiety that will in turn, create pressure on governments to negotiate with them and accede to their demand. Without the media to transmit the news of their act, their goal will not be accomplished.

III. CONCLUSION

This article set out to discuss international terrorism and the extent to which it has affected the peaceful coexistence of states. It has been discovered that while international relations was trying to unify states with one another, terrorism on its part is tearing the international system apart. Terrorist now avail themselves of the bountiful and rapid increase in weapons and explosive devices to launch deadly attacks on governments and their innocent citizens.

Accordingly, the article discussed the definition of terrorism, history of terrorism and took a glimpse at terrorism and terrorist attacks around the globe. Other areas of concern and discussion in this chapter included weapons and tactics of terrorism, strategies of terrorism, goals of terrorism, causes of terrorism and lastly ways of combating terrorism. The article is of the opinion that countering or combating terrorism does not only rely on military actions alone, but requires and consists mostly in understanding the root causes behind terrorism. Accordingly, counter terrorism measures should include attempts to improve the living condition in less prosperous countries, adopting a policy a military restraint rather than interventionist foreign policy by the Major Powers abroad and reduction of inhuman treatment meted on prisoners in US detention facilities in Guantanamo Bay in Cuba and US run prison in Iraq, among others.

IV. RECOMMENDATIONS

A major concern about terrorism lies on how to combat it. Countering terrorism does not only require military action alone, it consists mostly in understanding the root causes behind terrorism. This is so because many of the most spectacular terrorist incidents, especially those involving Americans and Israelis, have been carried out by Palestinians or groups sympathetic to the Palestinians. Therefore providing Palestinians with some relief from their currently stateless condition might well deprive terrorist organizations of an important source of volunteers for their plans and projects. Accordingly, the article recommend as follows:

- (i) Palestinians should be provided with some reliefs from their currently stateless condition which has deprived them of their homeland and their well deserved right to independence
- (ii) Conventional military attacks against states that support terrorism such as the one that was staged by the United States against Libya in 1986 can aggravate the casualty rate. US bombs in Libya killed innocent civilians. According to Wilkinson (1984:44) "such attacks would substitute the greater

evil of full scale war, with all its attendant death devastation and dangers of escalation, for the lesser evil of terrorism”.

- (iii) Poverty and injustice contribute to terrorism; as a result counterterrorism measures should include attempts to improve living conditions in less prosperous countries. Providing disadvantaged people with employment and other opportunities for a better life can help to deter some potential terrorists.
- (iv) Since no international criminal code, international police force capable of combating terrorism, or international court with jurisdiction over acts of terrorism exists, the United Nations should engage more in collaborative counterterrorism activities primarily by passing laws against terrorism and entering into cooperative agreements with one another. Similarly, the UN should intensify efforts in the maintenance of international peace, security, promoting human rights and helping member states resolve political, cultural and economic problems. Developed countries of the world especially the United States should curtail their military exercise overseas.
- (v) Adopting a policy of military restraint rather than interventionist foreign policy by the major powers of the world will help in no little way in reducing the menace of terrorist attacks.
- (vi) Torture and sadistic treatment of prisoners around the world like the US run prison in Iraq, the US detention facility at Guantanamo Bay in Cuba where prisoners are housed for prolonged periods without access to lawyers, without formal charges and with few human rights should stop. Such inhuman treatment coupled with excessive force, civil disability and the loss of internationally guaranteed rights, and indefinite detention are central means by which the wars on both terror and crime breed and are executed. Even in prison, prisoners should enjoy their fundamental human rights, at least to a certain level.

- Gurr, T. R. (1970). *Why Men Rebel*. Princeton: Princeton University Press.
- Hoffman, B. (2006). *Inside Terrorism*, New York: Columbia University Press.
- Human Rights Watch (2006). *Children's Right - Child Soldiers*. New York: HRW.
- Kydd, A. H. and Walter, B. F. (2006). The Strategies of Terrorism. *International Security*, 31(1): 49-80.
- Lacqueur, W. (2001). *A History of Terrorism*. New Jersey: Transaction Publishers.
- Lopez, G. A. and Stohl, M. S. (1989). *International Relations: Contemporary Theory and Practice*. Washington DC.: CQ Press.
- Mahan. S. and Griset, P. L. (2008). *Terrorism in Perspective*. Los Angeles: Sage Publications.
- Minst, K. A. and Snyder, J. L. (2011). *Essential Readings in World Politics*. London: W. W. Norton and Company.
- Rapoport, D. C. (1984). Fear and Trembling: Terrorism in Three Religious Traditions. *American Political Science Review*, 78(3): 658-677.
- Ray, J. L. (1992). *Global Politics*. Boston: Houghton Mifflin Company.
- Rourke, J. T. (2008). *International Politics on the World Stage*. Boston: McGraw Hill.
- Stern, J. (2003). *The Ultimate Organizations in Terror in the Name of God: Why Religious Militants Kill*. New York: Harper Collins.
- Terrorism Research Centre (2006). *Terrorism Group Profiles*, November 6.
- Wilkinson, P. (1984). State Sponsored International Terrorism: The Problem of Response. *World Today*, 298.
- Zedalis, D. (2004). *Female Suicide Bombers*. Carlisle: All Strategic Studies Institute.

V. REFERENCES

- Barber, R. R. (1992). Jihad vs McWorld. *Atlantic Monthly*, 269(3): 53-65.
- Cooper, H. H. A. (2001). Terrorism: The Problem of Definition Revisited. *American Behavioural Scientists*, 44(6): 881-893.
- De Mesquita, B. B. (2003). *Principles of International Politics: People's Power, Preferences and Perceptions*. Washington DC.: CQ Press.
- Doran, M. (2002). Somebody Else's Civil War. *Foreign Affairs*, 8 (3): 22-42.
- Enders, W. and Sandler, T. (2005). After 9/11: Is it all Different Now? *Journal of Conflict Resolution*, 49(2): 259-277.

Identify the constructs of a Journal – Essentially a journal consists of five major sections. The number of pages may vary depending upon the topic of research work but generally comprises up to 5 to 7 pages. These are:

- 1) Abstract
- 2) Introduction
- 3) Research Elaborations
- 4) Results or Finding
- 5) Conclusions

In Introduction you can mention the introduction about your research.

IDENTIFY, RESEARCH AND COLLECT IDEA

It's the foremost preliminary step for proceeding with any research work writing. While doing this go through a complete thought process of your Journal subject and research for its viability by following means:

- 1) Read already published work in the same field.
- 2) Goggling on the topic of your research work.
- 3) Attend conferences, workshops and symposiums on the same fields or on related counterparts.
- 4) Understand the scientific terms and jargon related to your research work.

WRITE DOWN YOUR STUDIES AND FINDINGS

Now it is the time to articulate the research work with ideas gathered in above steps by adopting any of below suitable approaches:

A. Bits and Pieces together

In this approach combine all your researched information in form of a journal or research paper. In this researcher can take the reference of already accomplished work as a starting building block of its paper.

Jump Start

This approach works the best in guidance of fellow researchers. In this the authors continuously receives or asks inputs from their fellows. It enriches the information pool of your paper with expert comments or up gradations. And the researcher feels confident about their work and takes a jump to start the paper writing.

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There are numbers of software available which can mimic the process involved in your research work and can produce the possible result. One of such type of software is Matlab. You can readily find Mfiles related to your research work on internet or in some cases these can require few modifications. Once these Mfiles are uploaded in software, you can get the simulated results of your paper and it eases the process of paper writing.

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CONCLUSION

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

APPENDIX

Appendixes, if needed, appear before the acknowledgment.

ACKNOWLEDGMENT

The preferred spelling of the word "acknowledgment" in American English is without an "e" after the "g." Use the singular heading even if you have many acknowledgments.

REFERENCES

- [1] G. O. Young, "Synthetic structure of industrial plastics (Book style with paper title and editor)," in *Plastics*, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.
- [2] W.-K. Chen, *Linear Networks and Systems* (Book style). Belmont, CA: Wadsworth, 1993, pp. 123–135.
- [3] H. Poor, *An Introduction to Signal Detection and Estimation*. New York: Springer-Verlag, 1985, ch. 4.
- [4] B. Smith, "An approach to graphs of linear forms (Unpublished work style)," unpublished.
- [5] E. H. Miller, "A note on reflector arrays (Periodical style—Accepted for publication)," *IEEE Trans. Antennas Propagat.*, to be published.
- [6] J. Wang, "Fundamentals of erbium-doped fiber amplifiers arrays (Periodical style—Submitted for publication)," *IEEE J. Quantum Electron.*, submitted for publication.

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Economic & Environmental Analysis of Remote diesel generator with photo-voltaic cogeneration

Shamal Mithil kalambe

Abstract - The burning of depleting fossil fuels for power generation has detrimental impact on human life and climate. In view of this, Renewable energy sources are being increasingly exploited to meet the energy needs. In order to handle intermittent nature of renewable energy source, hybrid energy systems can be applied instead of standalone system. These systems use different energy generators in combination, by this maintaining a stable energy supply in times of shortages by one of the energy resources.

This paper discusses the design, simulation, systematic techno-economic and environmental analysis of autonomous hybrid systems i.e. PV-Diesel energy system with battery storage for rural electrification is suitable to achieve both ecological and socio-economic objectives, since Hybrid systems are an environmental sound technology.

MATLAB Simulink is used for Simulation performed for three cases: 1) diesel only; 2) diesel-battery; and 3) PV with diesel-battery using a one-year time period. The results of the simulations are used to perform an economic analysis and predict the environmental impacts of integrating a PV array into diesel-electric power systems for remote villages. The economic part of the model calculates the fuel consumed, the kilowatt-hours obtained per gallon of fuel supplied, and the total cost of fuel. The environmental part of the model calculates the CO₂, particulate matter (PM), and the NO_x emitted to the atmosphere. The investigation also examines the effect of PV/battery penetration on COE, operational hours of diesel gensets. In this study exhibits that the operational hours of diesel generators decrease with increase in PV capacity.

Keywords: Diesel Generator, Battery, Simulation, Hybrid Energy System, Matlab Simulink, PV, bidirectional inverter, Environmental impact

1. INTRODUCTION

Electrification of isolated or remote areas has been a subject of consideration ever since electricity started to affect human activities. In these areas the geographic adverse conditions and/or the increased cost to expand the utility grid usually lead to the

implementation of autonomous power energy systems [1–3]. In previous decades the relatively low cost of operation and maintenance (O&M) of a diesel generator (DG) based mainly on the low prices of fuel, along with the high initial cost for PV generators (PVGs) and the required power electronics, resulted in extended use of DGs to supply power to meet load demand in remote areas [4–7]. The conducted steady and systematic Research and Development (R&D) of PVs and their related Balance of System (BOS) have caused a significant decline in the associated prices. On the other hand, the constant increases in energy demand and the related utilization of natural resources have caused enormous increase in fuel prices. These factors have made the renewable energy sources (RES) a viable supplement and perhaps a main alternative to be used in remote areas where the cost of O&M and the fuel cost of DGs are relatively high [8].

The advantages *wrt* Implementing PVs in an autonomous system are several [9], but there is a real disadvantage concerning limited system reliability when there is no solar irradiation for a longer period than the one being considered by the designer for storage capacity of the system. In such a case, the energy stored in the battery bank due to economic reasons cannot meet fully the load requirements [10]. On the contrary, the non constant yearly energy production of the PVG may lead to over design and thus to a more expensive PVG with relatively greater battery storage capacity in order to meet the load requirements. The unnecessarily larger size of PVGs and ratings of the needed inverter can be avoided by using a combination of a conventional energy source to supply power, especially when the peak load demand is much higher than the capacity of the PVG. In such cases the use of a DG to supply the required load power, while it simultaneously charges the battery, results in providing the necessary reliability and cost effectiveness characterizing the overall hybrid power system (HPS) [11].

This paper presents three competing power systems, with equal capacity, serving the same load, which were proposed, developed and tested for their reliability, efficiency and cost effectiveness. These three investigated systems were: 1) a DG one, 2) a DG-battery one, and 3) a PV with DG-battery one. The operating requirements and associated costs of the examined three power systems (PSs) were used to perform the desired economic analysis.

2. LOAD ESTIMATION AND MATEROLOGICAL DATA

The meteorological Annual and other data wrt a site i.e. Town *Gilibili*, Ballarpur, Dist. Chandrapur, State. Maharashtra, India at Latitude -19.96, Longitude -79.30 is obtained from website [w7]. Daily and Annual Load Demand Estimated by interviewing number of villagers using Energy Need Assessment Questionnaires.

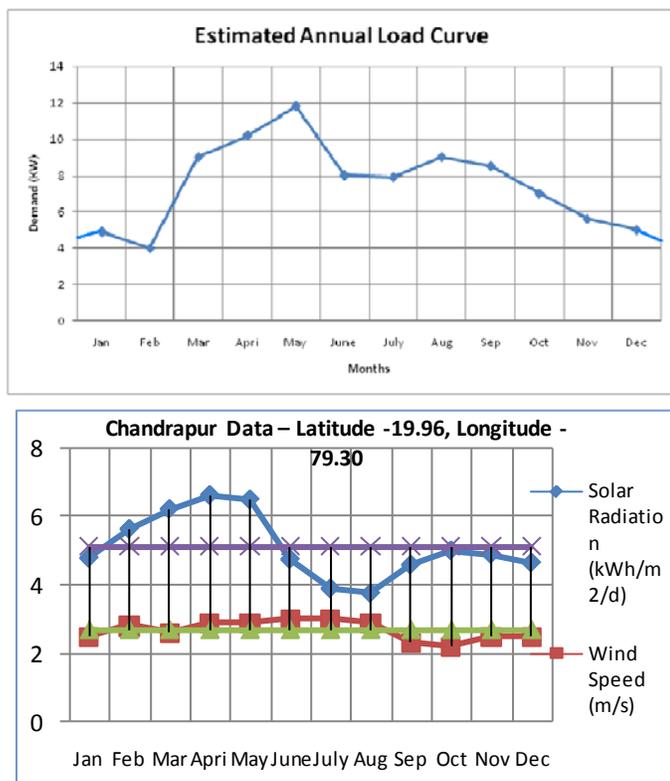


Fig.(a) Load curve & (b)Metrological data for location

3. MATLAB / SIMULINK SOFTWARE

MATLAB is powerful in matrix or vector programming; it is also a brilliant tool in working with matrix for numerical and engineering applications. It has the ability to be programmed to solve several

tasks at one time using the idea of matrix. In MATLAB, there are toolboxes of special collections of functions and scripts. Script is a program without input and output, which is actually a collection of MATLAB statement in one file. Function block accepts variable inputs and allows variable outputs [9].SIMULINK has a wide selection of dynamic systems for modeling, analyzing and simulating. It also offers a graphical user interface for creating block diagram models. A system is configured in terms of block diagram representation from a library of standard components. In the middle of a simulation, algorithms and parameters can still be changed to get intuitive results, thus providing the user with a ready access learning tool for simulating many of the operational problems found in the real world. It also provides immediate access to the mathematical, graphical, and programming capabilities of MATLAB [13]

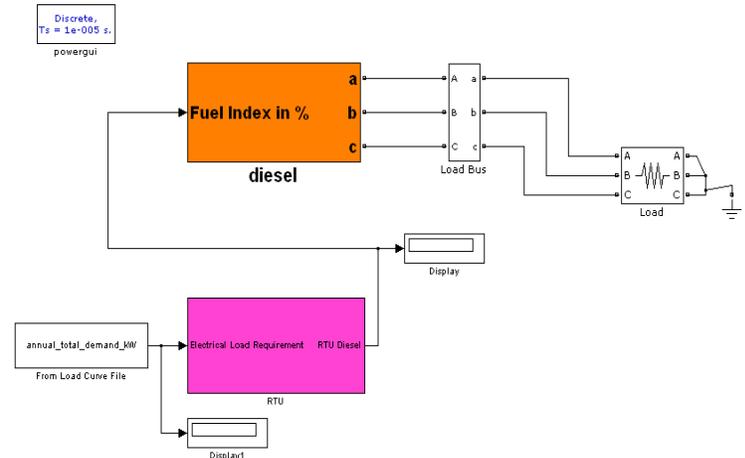


Fig. (a) Diesel Generator only Simulation Circuit

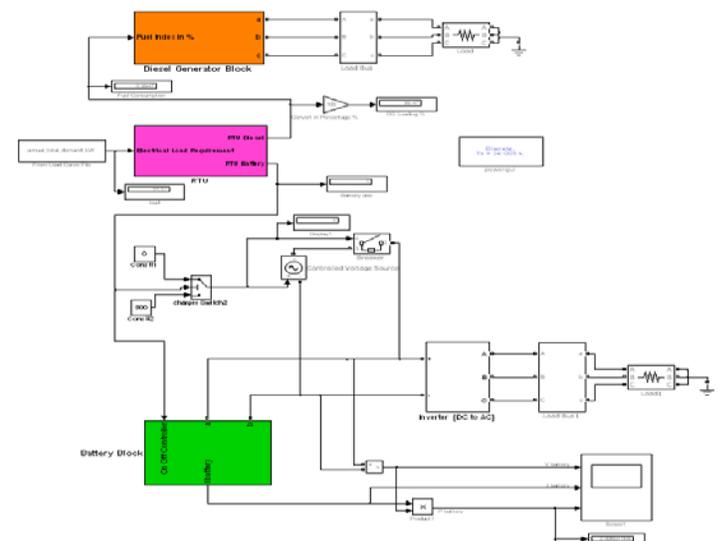


Fig.(b) Matlab simulation of Diesel + Battery Circuit

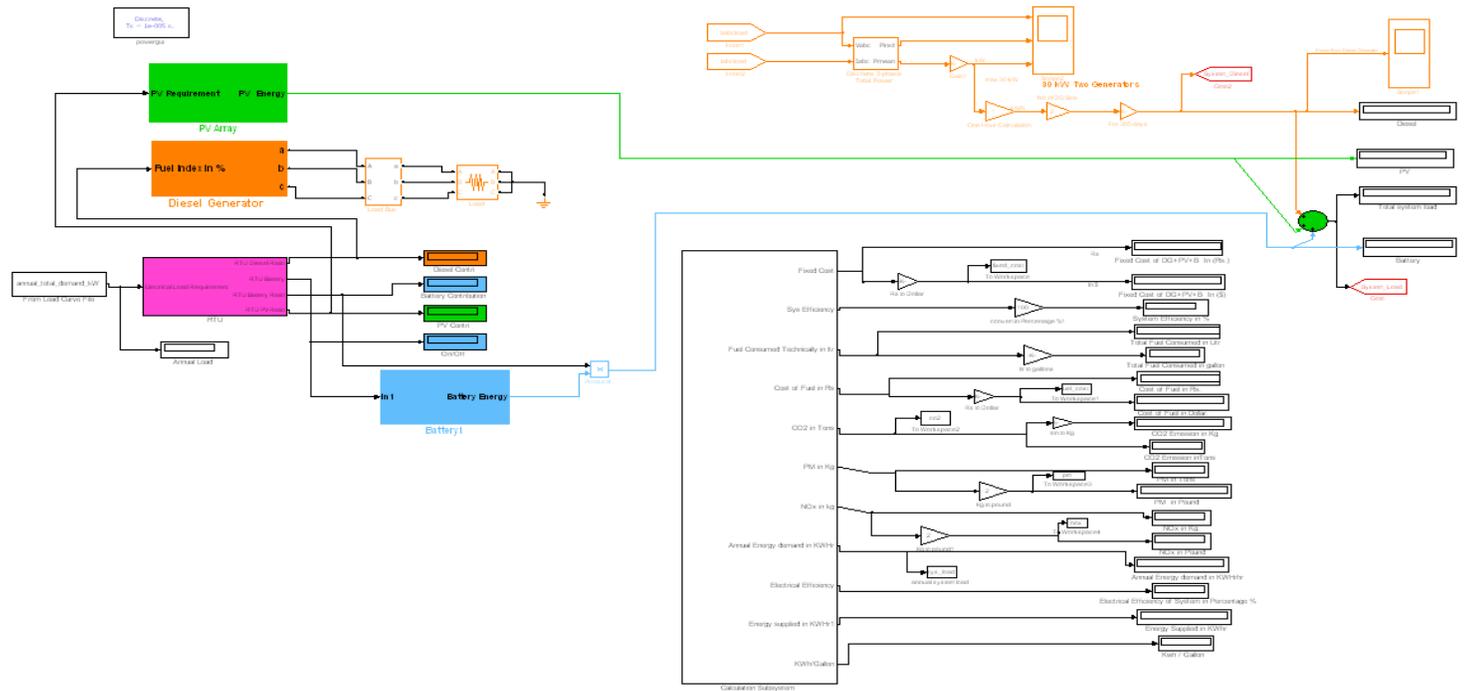


Fig. Matlab Simulation Model of 3 different model (a) Diesel Only (b) Diesel + Battery (c) PV + Diesel + Battery

4. OVERVIEW OF AUTONOMOUS POWERS OPERATION

4.1 PV Array Modeling

PV arrays are built up with combined series/parallel combinations of PV solar cells, which are usually represented by a simplified equivalent circuit model such as given in Fig. 1 and by equation(1).

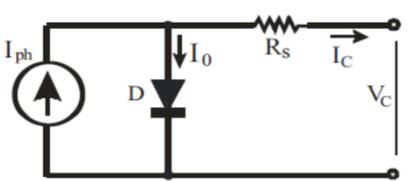


Fig.1. Simplified equivalent circuit of Photovoltaic Cell

$$V_c = \frac{AkT_c}{e} \ln \left(\frac{I_{ph} + I_0 - I_c}{I_0} \right) - R_s I_c \quad (1)$$

Where,
 e: electron charge (1.602×10^{-19} C), k: Boltzmann constant (1.38×10^{-23} J/oK), I_c : cell output current, I_{ph} : photocurrent, function of irradiation level and junction temperature (5 A), I_0 : reverse saturation current of diode (0.0002 A), R_s : series resistance of cell (0.001 Ω), T_c : reference cell operating temperature (20 $^\circ$ C), V_c : cell output voltage, V.

Energy production by the PV

Typical and mostly used integration of global irradiation is the monthly daily mean irradiation, $(G_d)_m$, given by [12]

$$(G_d)_m = \frac{1}{(m_2 - m_1)} \sum_{N=m_1}^{m_2} G_d$$

Where, G_d in W/m^2 is the daily global irradiation, m_1 is the first day of the examined month, and m_2 is the last day of the examined month. Cell temperature T_c in $^\circ$ C is another parameter which alters the performance of a PVG. An increase of T_c causes associated increase of the PVG's current, but also associated noticeable decrease in PVG's voltage and power. If the meteorological station provides only the ambient temperature and the global solar irradiation, then the cell temperature can be approximated by [13].

Cell temperature T_c in $^\circ$ C is another parameter which alters the performance of a PVG. An increase of T_c causes associated increase of the PVG's current, but also associated noticeable decrease in PVG's voltage and power. If the meteorological station provides only the ambient temperature and the global solar irradiation, then the cell temperature can be approximated by [13].

$$T_c = T_a + 0.02G \tag{3}$$

where, T_a is the ambient temperature. When the ambient temperature and irradiation levels change, the cell operating temperature also changes, resulting in a new output voltage and a new photocurrent value. The solar cell operating temperature varies as a function of solar irradiation level and ambient temperature. The variable ambient temperature T_a affects the cell output voltage and cell photo current. Furthermore, if the wind speed u in m/s is given at the actual site, then T_c can be better approximated by [14]:

$$T_c = 3.12 + 0.899T_a + 0.025G - 1.3u \tag{4}$$

If G and T_c are known, then [15-16]:

$$P(G, T_c) = P_{STC} \frac{ISC(G, T_c)V_{oc}(G, T_c)}{ISC_{STC} V_{ocSTC}} \tag{5}$$

Where, $P(G, T_c)$, $ISC(G, T_c)$ and $V_{oc}(G, T_c)$ are the power, the short-circuit current and the open-circuit voltage of the PV module at (G, T_c) conditions, respectively; production by the PVG The energy being produced by the PVG is proportional to the global irradiation. It is also related to the temperature of the cell and the air mass.

Simulation of PV Array

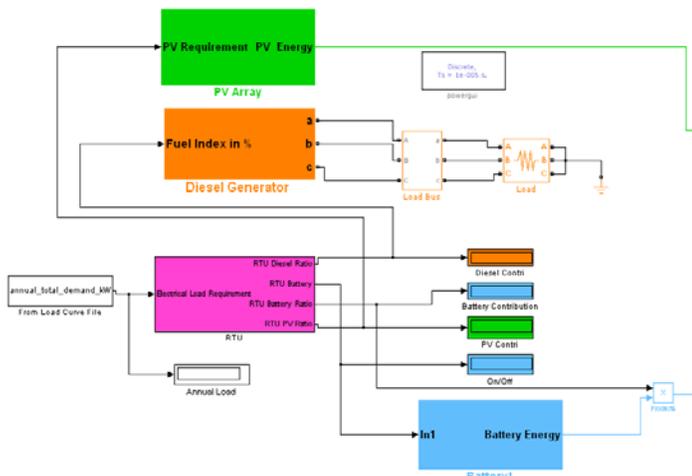


Fig.(d) PV+ diesel+ Battery Matlab simulation model

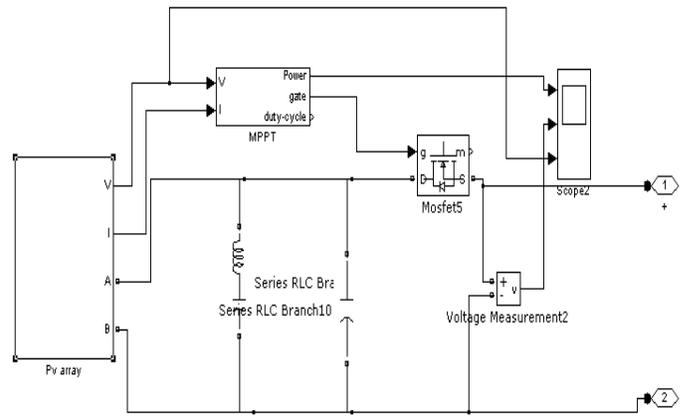


Fig. (e) PV Array Simulation

4.2. Energy production by the Diesel Generator

The power which may be supplied to an autonomous system by the DG is equal to the total load demand. If not given by the manufacturer of the DG, the fuel consumption (FC) vs the supplied load (SL) curve should be established as follows

$$FC = a \times SL + b \tag{6}$$

The coefficients a and b can be calculated using the least square method for a number of experimental measurements as follows.

$$a = \frac{N \sum (SL_i \times FC_i) - \sum SL_i \sum FC_i}{N \sum SL_i^2 - (\sum SL_i)^2} \tag{7}$$

$$b = \frac{\sum FC_i - a \sum SL_i}{N} \tag{8}$$

where, i is the examined measurement (i.e. 1, 2, ..., N), SL_i is the load being supplied and FC_i is the fuel being consumed by the DG when it supplies load SL_i . The above mentioned curve is of significant importance for the economic assessment of every PS for possible use. Similarly, the efficiency η_{DG} of the DG is strongly dependent on the load it supplies and is given by,

$$\eta_{DG} = \frac{P_{out}}{P_{in}} = \frac{SL}{MCV \times FC} \tag{9}$$

$$\eta_{DG} = \frac{P_{out}}{P_{in}} = \frac{SL}{MCV (a \times SL + b)} \tag{10}$$

If the load to be supplied is less than 30% of the DG rating capacity, the DG operation should be prevented

not only due to its low performance, but mainly due to the damage the machine may suffer, which will limit its useful life [19]. In such a case, either the load should be supplied by the battery or the charger itself should have enough rated power to charge the battery (without causing damage to it) and the total load being served should be rated close to 70-80% of the DG nominal power output [19].

4.3 Battery bank

A mathematical model of battery bank storage is necessary to predict the state of charge (SOC) of battery at each hour of simulation period. It is difficult to predict the exact SOC of battery for uncontrolled charge /discharge cycles in standalone systems. Load will not be satisfied when the power generated by PV system is insufficient and storage is depleted and its state of charge has fallen below a predetermined minimum value. Energy is stored in battery bank when power generated by PV system exceeds the load. On the contrary, energy is taken from the battery bank when power generated is less than the load demand. The SOC of battery bank at any time t_1 depends upon state of charge in the previous moment t_0 and the sequence of generated power and load demand levels in the time interval $t_1 - t_0$. System controller (not shown in block diagram) starts/stops charging batteries when SOC of battery bank reaches to its predefined minimum/maximum charge quantity. System controller disconnects the load when SOC falls below a minimum charge quantity. The SOC of battery bank storage at any hour t can be obtained by monitoring the charge/discharge energy to/ from the battery as given by following expressions:

$$E_{\text{batt}}(t) = \min [\text{ChargeLim}, (E_l(t)/\eta_{\text{inv}} - E_g(t)) / \eta_{\text{batt}}] \quad (11)$$

$$E_{\text{batt,in}}(t) = \min [\text{ChargeLim}, (E_g(t) - E_l(t)/\eta_{\text{inv}}) \eta_{\text{batt}}] \quad (12)$$

$$E_b(t) = E_b(t-1) (1-\delta) - E_{\text{batt}}(t) + E_{\text{batt,in}}(t) \quad (13)$$

Where, $E_b(t)$ and $E_b(t-1)$ are SOC of battery at the time t and $(t-1)$ respectively; δ is the hourly self discharge rate of bank taken as 0.009 for this study; $E_{\text{batt,in}}(t)$ and $E_{\text{batt}}(t)$ are the charge and discharge quantities of battery storage; $E_l(t)$ is load demand; $E_g(t)$ is the total energy produced by both PV at time t ; η_{inv} and η_{batt} are the efficiency of inverter and charge/discharge efficiency of battery storage respectively; ChargeLim is the maximum allowable

charge/discharge energy to/from the battery, assumed to be equal to 10/20 percentage of total battery bank storage capacity. In this paper, the charge/ discharge efficiency of battery is assumed to be the same and equal to the round trip efficiency of battery storage.

The battery bank combined with the inverter's output power should support as much of the load demand as possible in order to avoid frequent (unnecessary) use of the DG. When designing a hybrid PV-DG system the selection of the battery is a significant factor, since its capacity determines not only the energy it can supply but also the peak load that can be served by the battery-inverter sub-system (due to the voltage drop of the battery, which is a function of the supplied load and at the same time is the input voltage of the inverter). In general the capacity of battery is calculated as follows [17].

$$E_{\text{batt}} = \frac{E_{L\text{-BAT}} d}{\eta_{\text{inv}} V_s \eta_c \eta_t \text{DOD} \eta_{\text{bat}}} \quad (14)$$

where, E_{batt} is the required battery capacity in Ah, $E_{L\text{-BAT}}$ is the daily supplied energy to the load by the battery in Ah/d, d is the number of days the battery can supply the load, η_{inv} is the efficiency of the inverter, V_s is the system voltage on the DC side in V, η_c is the cable efficiency, η_t is the temperature efficiency, DOD is the used depth of discharge, and η_{bat} is the efficiency of the battery.

4.4 Bidirectional Inverter (Inverter-Charger)

The inverter nominal output power specifies the peak load that can be supplied. In a hybrid PV-DG power system an inverter with nominal power output less than the peak load demand can be used when the peak load is directly supplied by the DG. In most cases, when the base load and the peak load of the PS do not have significant fluctuations, it is preferable to implement an inverter that can supply the peak load, which results in a PS fully controlled by the inverter, and thus decreasing significantly the other related time intervals (eg DG startup period etc) where no load can be served. When the DG is in operation the bidirectional inverter becomes a charger of the battery and all the load is supplied by the DG.

5. ECONOMICAL CRITERIA

The economic analysis part of the simulation model involves calculation of the simple payback time (SPBT) for the PV module and calculation of energy payback time (EPBT) for the PV array. In most of the remote villages, battery banks are used as back-up sources for power. Therefore, the PV with diesel-battery system is compared to the diesel-battery system in the analysis of SPBT. The SPBT is given as:

$$SPBT = \frac{\text{Excess Cost of PV system}}{\text{Rate of saving}} \quad (15)$$

Economics plays an integral role in both, in simulation process wherein it operates the system so as to minimize the total life cycle cost, and in its optimization process, wherein it searches for system configuration with the lowest total life cycle cost. The life cycle cost calculation includes the initial cost of construction, component replacement, maintenance and fuel cost and miscellaneous cost such as emission /penalty cost resulting from pollutant emission / load unmet. In this study, the life cycle cost (LCC) calculation is done only for those system configurations that satisfy customer desired reliability criteria. Therefore, initially the unit sizing program is run to get these combinations, and thereafter the program is extended to evaluate the LCC of such combinations. The LCC of system without any other miscellaneous cost is calculated as [17]:

$$LCC = \frac{ACC}{CRF} \quad (16)$$

$$ACC=CC+OMC+RC+FC \quad (17)$$

Where, ACC is the annual cost of configuration, CRF is the capital recovery factor, ACC is the sum of annual capital costs (CC), operation & maintenance (OMC), replacement cost (RC), and fuel cost (FC) of all system components. The annual cost can be found by multiplying the initial cost by the capital recovery factor (CRF). Where i is the annual interest rate, n is the life of the system. Following expressions are used for the calculation of annual fuel cost(FC) and replacement cost (RC) in equation.

6. POLLUTANT EMISSION COST

When the fuel combustion takes place in diesel generator, numbers of emission (gases) are produced. Percentage of carbon dioxide (CO₂) is largest amongst these emissions. Due to this reason the amount of carbon dioxide production only is considered to find emission cost in this study. The CO₂ emission cost is calculated on the basis of price of tradable renewable certificate using following equations:

$$CO_2\text{weight} = (C\text{content.PDG}) / 1016.04 \quad (20)$$

$$CO_2\text{tax} = (PTRC / C\text{content}) * 1016.04 \quad (21)$$

$$E_c = CO_2\text{weight} * CO_2\text{tax} \quad (22)$$

Where, E_c is the cost of emission, $C\text{content}$ is the carbon content taken as 0.6078 Kg per KWh, $PTRC$ is the price of tradable renewable certificate (US\$/KWh). $CO_2\text{weight}$ is taken in tons, and CO_2 tax has been calculated in terms of US dollars per ton. Finally this cost of emission is also added in the annual cost to the customer (ACC) to calculate LCC of system.

7. SIMULATIONS AND RESULTS

After performing the simulations for the three cases, it was observed that case 3 provided superior results in terms of fuel consumption for the diesel generator and the greenhouse emissions. It was observed that the diesel generator operates most efficiently for case 3, while the diesel-battery system in case 2 has the highest kilowatt-hours per gallon. In case 1, the entire load was supplied without the PV array and the battery bank, leaving the load to be supplied by the diesel generator. Since the diesel generator operates with the lowest load for the diesel-only system, it is the least efficient system and has the lowest kilowatt-hours per gallon. In case 2, when the battery bank is discharged, the diesel generator is used to charge the battery bank, so eventually, the entire load is supplied with the help of the diesel generator. In case 3, part of the load was supplied using the PV array. As a result, there is substantial saving in the fuel consumption by the diesel generator due to use of the battery bank and the PV array with the diesel-only system.

The study exhibits that for a given hybrid configuration, the number of operational hours of diesel generators decreases with increase in PV capacity. It has been found that the for a given PV–diesel hybrid system, the decrease in diesel run time is further enhanced by inclusion of battery storage. The percentage fuel savings by using hybrid PV–diesel–battery system (60 KW diesel system, 1 h storage, 22% PV penetration) is 22% as compared to diesel-only situation. The percentage decrease in carbon emissions by using the above hybrid system has been found to be 21% as compared to the diesel-only scenario. More importantly, with the use of the above hybrid system, about 17615 Kgs/year of carbon emissions can be avoided entering into the local atmosphere. The hybrid PV–battery–diesel configuration (by virtue of a high degree of flexibility)

offers several advantages such as: diesel efficiency can be maximized; diesel maintenance can be minimized; and a reduction in the capacities of diesel and battery (while matching the peak loads) can occur. The present investigation shows that the potential of renewable energy option of solar energy cannot be overlooked. A fraction of Gilbili energy demand may be harnessed by deployment of PV systems. The observations of this study can be employed as a benchmark in designing/sizing of hybrid PV–diesel–battery systems for other locations having similar climatic and load conditions. Over dependence on fossil fuels is alarming. Hence, investments in solar energy are imperative to mitigate energy crisis in foreseeable future. System Cost can vary as per selection of equipments, transportation, installation, etc.

Sr.No.	Parameter	Diesel Only	Diesel – Battery System	PV with Diesel-Battery System
1.	System Cost (\$)	\$ 71363.6	\$ 120261.8	\$ 171802.72
2.	System Cost (Rs)	Rs. 3925000	Rs. 6614400	Rs. 9449150
3.	System Mechanical Efficiency (%)	26.22 %	29.9 %	29.9 %
4.	KWhr / Gallon (KWhr)	10.61	12.1	12.1
5.	Fuel Consumed (Gallons)	8409.22	7322.36	6584
6.	Fuel Consumed (Liters)	31828.9	27715.16	24921.086
7.	Total cost of Fuel (\$)	28935.38	25195.6	22655.5
8.	Total cost of Fuel (Rs.)	1591445.48	1385758.4	1246054.26
9.	CO2 Emitted (Kg)	81163.72	70673.6	63548.77
10.	CO2 Emitted (tons)	81.16	70.67	63.55
11.	PM Emitted (tons)	36.12	31.46	28.28
12.	PM Emitted (pounds)	72.24	62.9	56.55
13.	NOx Emitted (pounds)	3462.6	3015	2711
14.	NOx Emitted (Kg)	1731.3	1508	1356
15.	Annual Energy demand (KWhr)	89221	89221	89221
16.	Annual Energy Supplied	101516	100186	89530
17.	Electrical Efficiency of DEG (%)	87.89	89.06	90.03

Table : Comparison of Results of all 3 PMS cases

The preliminary results reported here demonstrate that the integration of a PV array into a diesel-battery stand-alone hybrid power system reduces the operating costs and the greenhouse gases and

8. Conclusion

particulate matter emitted to the atmosphere. The Simulink model can be used to study the performance of any PV with diesel-battery hybrid power system if the operating characteristics of the power system are known. With few modifications, the model can be extended to incorporate other renewable energy sources. The incorporation of additional renewable sources of energy, such as wind turbines in this system, could

further reduce fuel consumption. The dynamic performance and the control system strategy of the power system can also be incorporated into the model.

Although there is a significant capital investment to purchase a PV system for this application, the PV system may have acceptable 16 to 20-yr LCCs for many remote locations. Furthermore, over its life cycle, the PV hybrid power system will consume less fuel and emit less CO₂, NO_x and PM than the diesel-only system. If the external costs associated with these emissions are taken into account, the PV system discounted payback period will further decrease. Hybrid energy systems, which result in more economical and efficient generation of electrical energy, would not only enhance the capability of automated and precision generation systems, but would also help to extend the life of nonrenewable energy sources.

References

1. Leake E. Weldemariam, "GENSET-SOLAR-WIND HYBRID POWER SYSTEM OF OFF-GRID POWER STATION FOR RURAL APPLICATIONS", TUDelft The Netherlands, Sustainable Off-grid Power station for Rural Applications, July 2010,100-254.
2. Ahmad Agus Setiawan, Yu Zhao, Chem. V. Nayar, "Design, economic analysis and environmental considerations of mini-grid hybrid power system with reverse osmosis desalination plant for remote areas", www.elsevier.com/locate/renene, Renewable Energy 34 (2009) 374–383.
3. Ajai Gupta, R.P. Saini, M.P. Sharma, Roorkee, India, "Steady-state modeling of hybrid energy system for off grid electrification of cluster of villages", Renewable Energy, www.elsevier.com/locate/renene, 35 (2010) 520–535.
4. ARE - shining a Light for a progress, "Hybrid power systems based on renewable energies- A suitable and cost-competitive solution for rural electrification", www.ruralelec.org/fileadmin/DATA/Documents/06_Publications/Position_papers/ARE-WG_Technological_Solutions_-_Brochure_Hybrid_Systems.pdf, Ed.: ARE-Alliance for Rural Electrification, 2008.
5. Timur Gul, D. Abmann, "Integrated Analysis of Hybrid Systems for Rural Electrification in Developing Countries", Stockholm 2004, ISSN 1651-064X,1-124.
6. Dumitru Cristian Dragoş, Gligor Adrian : "Software Development for analysis of solar-wind hybrid systems supplying local distribution network.", 2ND INTERNATIONAL CONFERENCE ON MODERN POWER SYSTEMS MPS ,pp.220-223,2008
7. Juhari.Ab.Rzak "Optimization of PV-Wind-Hydro-Diesel Hybrid systems by minimizing excess capacity "European Journal of scientific Research Vol 25 2009. pp-663-667.
8. M.A. Elhadidy, S.M. Shaahid, "Performance evaluation of hybrid (wind/solar/diesel) power systems Renewable Energy, 26 (2002) 401–413.
9. H. Dagdougui, R. Minciardi , A. Ouammi, M. Robba, R. Sacile, "Modelling and control of a hybrid renewable energy System to supply demand of a green-building," International Environmental Modelling and Software Society (iEMSs),2010, pp.-1-8.
10. Ashok, S., "Optimised model for community-based hybrid energy system", Renewable Energy, 32, 1155–1164, 2007.
11. Dorin Bica, Cristian Dragos Dumitru,Adrian Gligor, Adrian-Vasile Duka, "Isolated hybrid solar- wind- hydro renewable energy system" , university of Tg.Mures,Romania,2009.
12. Cristian Dragoş Dumitru, Adrian Gligor " MODELING AND SIMULATION OF RENEWABLE HYBRID POWER SYSTEM USING MATLAB/SIMULINK ENVIRONMENT" , Scientific Bulletin of the „Petru Maior” University of Târgu Mureş Vol. 7 (XXIV), no. 2, 2010, ISSN 1841-9267
13. S.M. Shaahid , I. El-Amin, "Techno-economic evaluation of off-grid hybrid photovoltaic–diesel– Battery power systems for rural electrification in Saudi Arabia—A way forward for sustainable development" , Renewable and Sustainable Energy Reviews 13 (2009) 625–633.
14. M. Sylos Labini, et. al.,"A Study for Optimizing the Management Strategies of a Hybrid Photovoltaic-Diesel Power Generation System" , ENEA (National Agency of Alternative Energy), University of Bari (Italy), 2006, p.p.- 1-7
15. Wenxia Pan, Wenzhong Gao, Eduard Muljadi, Senior Member, IEEE "The Dynamic Performance and Effect of Hybrid Renewable Power System with Diesel/Wind/PV/Battery",pp.1-5.
16. Suryoatmojo, " Optimal Design of wind-pv-diesel-battery using genetic algorithm" , IEEJ trans., pp. 413-423.
17. J S Buckeridge,2 PhD, MIPENZ, MNZIS, MRSNZ, FAustIMM, FGS, "Design considerations for a sustainable hybrid energy system", The Institution of Professional Engineers New Zealand
18. Sachin Jain and Vivek Agarwal, Senior Member, IEEE , "An Integrated Hybrid Power Supply for Distributed Generation Applications Fed by Nonconventional Energy Sources", IEEE TRANSACTIONS ON ENERGY CONVERSION, VOL. 23, NO. 2, JUNE 2008
19. Teng-Fa Tsao,chen "Dynamic Modeling and Simulation of Hybrid Power Systems Based on \ Renewable Energy", International Conference on Energy and Environment Technology, 2009
20. M. Ibrahim: "Decentralized Hybrid Renewable Energy Systems", ISET, 2002, Kassel, Germany
21. R. Saiju, O. Omari, E. Ortjohann: "A Simulation Model for Expandable Hybrid Power System"s, Kasseler Symposium, 2002, Kassel, Germany
22. Qader Mahmoud Salah Ismail : "Simulation of a Hybrid Power System Consisting of Wind Turbine, PV, Storage Battery and Diesel Generator with Compensation Network: Design, Optimization and Economical Evaluation" ,2008, Nablus, Palestine

Websites –

- W1. Websites. <http://www.worldometers.info/>
- W2. "Global Energy Crisis," at

<http://www.whywehateoilcompanies.com/uncategorized/global-energy-crisis/>. & “The shock around the corner”, Energy Shock, Business Today, August 2011.

W3. IPCC (Intergovernmental Panel on Climate Change). 2007. Climate Change 2007: Synthesis Report http://www.ipcc.ch/publications_and_data/publications_and_data_technical_papers.shtml [Core Writing Team, Pachauri, R.K and Reisinger, A.(eds.)]. IPCC: Geneva, Switzerland.

W4. José L. Bernal-Agustín, Rodolfo Dufo-López and David M. Rivas-Ascaso , “*Design of Isolated Hybrid Systems Minimizing Costs and Pollutant Emissions*”, Renewable Energy (<http://www.sciencedirect.com/science/journal/09601481>), 2005,pp.-1-5.

W5. www.nrel.gov

W6. <http://eosweb.larc.nasa.gov/sse/RETScreen/>

W7. www.ireda.org

W8. www.homerenergy.com

The Effect of Dividend Policy on Corporate Profitability: An Empirical Study on Beverage, Food and Tobacco Industry in Sri Lanka

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Abstract- The purpose of the study is to examine the relationship between dividend pay-out and corporate profitability. The study conducted as a panel sectional survey and exploited the sample frame of the Beverage, Food & Tobacco (BFT) industry in Sri Lanka. 10 companies were taken from the listed companies in Colombo Stock Exchange (CSE) under the Beverage, Food & Tobacco (BFT) industry in Sri Lanka. Secondary data for the period of 2012 to 2015 was used for this study based on financial statement. The objective of this study is to find out the impact of dividend payout on corporate profitability in Sri Lanka. The dividend policy measured using the dividend payout ratio, while return on equity (ROE) used as a measure of profitability. The study concluded that there is a positive significant relationship between dividend policy and the profitability in Beverage, Food & Tobacco (BFT) industry in Sri Lanka. The time horizon for this study is limited when compared with other studies.

Index Terms- Beverage, Food & Tobacco, Corporate Profitability, Dividend Policy, Sri Lanka

I. INTRODUCTION

Dividend policy refers to the payout policy that a firm follows in determining the size and pattern of cash distributions to shareholders over time. The Board of Directors (BOD) of the company frames dividend policy in order to make decisions of how much earnings distributed among the shareholders as the reward for making investment and taking risk in certain company and how much retained within the company as retained earnings. Dividend policy is an essential area of research in corporate finance. Under real world conditions, determining an appropriate payout policy often involves a difficult choice because of the need to balance many potentially conflicting forces. According to conventional wisdom, paying dividend affects both shareholders wealth and the firm's ability to retain earnings to exploit growth opportunities. Because investment, financing, and dividend decisions are interrelated (Pruitt & Gitman, 1991), management cannot consider dividend policy in isolation from these other decisions. In addition may investors view dividend policy as important because the supply cash to firm with the expectation of eventually receiving cash in return (Baker, 1944)

The dividend policy remains as an unsettled puzzling topic in the finance literature. Notwithstanding, several theories and models have been developed regarding the dividend policy, the corporate dividend policy is still an unsolved and controversial concern in the corporate finance field thus still open for debate. Black, (1976) expressed, "The harder we look at the dividend picture, the more it seems like a puzzle, with pieces that just don't fit together". Even after three decades, the circumstance remains much more similar today.

Dividend or profit allocation decision is one of the four decision areas in finance. Dividend decisions are important because they determine what funds flow to investors and what funds are retained by the firm for investment (Ross et al., 2002).

The effect of dividend policy on the corporate profitability is a significant problem in corporate industry. Therefore, the main idea of this study is to examine the relationship between dividends policy and the corporate profitability. In other hand, the issue of concern is how the corporate profitability affects dividend policy of selected Beverage Food and Tobacco (BFT) industry in Sri Lanka.

In the present, Dividend policy is one of the significant parts of firm policies viewed as an interesting topic. Dividend policy decisions affect the business valuation. Cash dividend takes a distinctive position among the shareholders' perspective. On the other hand, the main problem is implementing a policy of divided payout. Dividend policies determined by some factors. Those are nature of industry, capital requirement, cash flow requirement, corporate governance, business cycle, government policies & taxation. Dividend payouts determine by principles and guidelines that the company practices and decide to make dividend payments to shareholders.

II. LITERATURE REVIEW

Dividend Payout

Miller & Modigliani, (1961) stated theory for dividend payout on capital structure. They made a comprehensive argument for irrelevancy. They state that, given the investment decision of the firm, the dividend payout ratio is more detail. It does not affect the wealth of share holders.

The use of cash dividends as signed by managers mostly debated in the finance literature. Miller & Modigliani noted that the effect of a firm's dividend policy on the current price of its

shares is a matter of considerable significance, not only to the corporate officials, who must set the policy, but also to investors organizing portfolios and to economists seeking to acknowledge and appraise the functioning of the capital markets. Further, they establish that in a perfect capital market optimal investment decisions by a firm are independent of how such decisions financed.

Black & Scholes(1974) stated that increase in dividend might have no definite effect on share price. They further emphasize temporary changes in share price may occur due to the change in dividend policy. According to Gitman, increased dividends generally increase share price, this may not always be the case; if a firm overall performance is questionable, then raising dividends may not encourage investors.

Oyejide, (1976)states that a significant part of returns investors can realize from putting money into stocks comes from dividends paid by companies. The amount of money a company pays in form of dividends varies significantly from one business to the other. Companies use dividend policy to determine how much they will distribute. There is a connection between dividend policy and retention policy.

Corporate profitability has long regarded as the primary indicator of a firm's capacity to pay dividends. Lintner, 1956 indicate that the current year's earnings and previous year's dividends influence the dividend payment pattern of a firm.

Profitability

The decision to pay dividends starts with profits. Therefore, it is logical to consider profitability as a threshold factor, and the level of profitability as one of the most important factors that may influence firms' dividend decisions. The theory suggests that dividends usually paid out of the annual profits, which represents the ability of the firm to pay dividends. Thus, firms incurring losses are unlikely to pay dividends. In his classic study, Lintner, (1956) found that a firm's net earnings are the critical factor of dividend changes. Furthermore, several studies have documented a positive relationship between profitability and dividend payouts

Sheridan & Roberto ascertains that firms with high profit rates all factors held constant would maintain relatively lower debt ratio since they are able to generate such funds from internal sources.

The pecking order hypothesis suggests that firms finance investments first with the internal finance, and if external financing is necessary, firms prefer to issue debt before issuing equity to reduce the costs of information asymmetry and other transactions cost (Myers & Majluf, 1984). This financing hierarchy thesis might also have an effect on the dividend decision. That is, taking into account the costs of issuing debt and equity financing, less profitable firms will not find it optimal to pay dividends, *ceteris paribus*. On the other hand, highly profitable firms are able to pay more dividends and to generate internal funds (retained earnings) to finance investments. Therefore, the pecking order hypothesis may provide an explanation for the relationship between profitability and dividends.

Fama & French, (2002) used the expected profitability of assets in place for testing the pecking order hypothesis. They

interpreted their results of the positive relationship between profitability and dividends as consistent with the pecking order hypothesis.

Myers, (1984) ascertains that a negative relationship between debt and profitability exist on the basis that successful companies do not need to depend on so much external funding but rather they should instead rely on their internal reserves accumulated from past profits. Titman & Wessels, (1988) and Barton, et al., (1989) agree that firms with high profit rates all factors held constant would maintain relatively lower debt ratio since they are able to generate such funds from internal sources.

Financial researchers who analyzed the dividend policy empirically articulated different views about the relationship between dividend policy and corporate profitability.

Harmoniously, (Carrol, 1995) using quarterly data of 854 firms over the 1975-1984 periods found a significant positive relationship between earnings forecast revisions and dividend changes. More specifically, his results suggested that dividend increases followed by an increase in future earnings and dividend decreases were followed by a decline in future earnings. Nissim & Ziv, (2001) found a positive association between current dividend changes and future earnings changes considering a particular model of earnings expectations.

In this concern, this research tries to clarify the relationship between dividend policy and corporate profitability for the listed Beverage Food and Tobacco (BFT) industry in Sri Lanka.

III. METHODOLOGY

There are significant literatures, which investigate the relationships between dividend policy & corporate profitability, across a number of different stock markets and over a range of different time horizons. Following methodological approach proposed to use in this study in establishing the relationship between dividend policies on the corporate profitability and Beverage, Food and Tobacco (BFT) industry in the emerging Sri Lanka Stock Market (Colombo Stock Exchange).

IV. CONCEPTUAL FRAMEWORK

Based on this research study the following conceptualization model formulated. Purpose of this study is seeking the impact of corporate profitability on the dividend payout in this dynamic economy. Therefore, conceptualization of this problem received considerable attention, since the output will depend on the derived concept.



Operationalization Framework

CONCEPT	VARIABLE	MEASUREMENT
Corporate Profitability (IV)	Return on Equity	$\frac{\text{Profit after tax}}{\text{shareholders' equity}}$
Dividend Payout (DV)	Dividend Payout	$\frac{\text{Dividend per share}}{\text{Earnings per share}}$

Secondary data collected using the annual report of the sampled for the financial year 2014/2015. Data on dividends derived from the financial statements, directors' proposals and the rate of dividend. Corporate profitability derived from the main financial ratios in the financial statements.

- Independent variable- Profitability of food & beverage industries listed in Colombo Stock Exchange (CSE)
- Dependent variable- Dividend policy of food & beverage industries listed in Colombo Stock Exchange (CSE)

Regression model used to establish the causal relationship between two variables, that is, an independent (corporate profitability) and a dependent variable (Dividend policy). A well-known statistical package like 'Statistical Package for Social Sciences' (SPSS) 20.0 Version was used in order to analyze the data.

Considering the dependent, independent variables are engaged in the study, the researcher modeled the study as follows:

$$DPO = \beta_0 + \beta_1 ROE + e$$

Where;

- DPO = Dividend Pay Out
- ROE = Return on Equity
- β_0 = Constant (y- intercept)
- β_1 = Coefficients of Determination
- e = random error

HYPOTHESES

Following two hypotheses have employed for this study.

- H1: There is a positive significant relationship between the Dividend Policy and Corporate Profitability
- H2: There is a negative relationship between the Dividend Policy and Corporate Profitability.

V. DATA ANALYSIS

Coefficient of determination explains the extent to which changes in the dependent variable can be explain by the change in the independent variables or the percentage of variation in the dependent variable (Dividend Pay Out) that is explained by the independent variables (Return on Equity).

Table: 1
Model Summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.843 ^a	.711	.704	.0443240

a. Predictors: (Constant), ROE

Table: 2
ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.184	1	.184	93.554	.000 ^b
	Residual	.075	38	.002		
	Total	.258	39			

a. Dependent Variable: DPO

a. Predictors: (Constant), ROE

Table: 3
Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.059	.016		3.614	.001
	ROE	.917	.095	.843	9.672	.000

a. Dependent Variable: DPO

That the coefficient of determination (R2) is shows as 0.711. This implies that 71.1% of the variations in the dividend payout ratio are account for by the included explanatory variable profitability (ROE). The adjusted coefficient of determination (adjusted R2) is give as 0.704. This means that precisely 70.4% of the variations in the dividend payout ratio are account for by profitability (ROE), after the co-efficient of determination has been adjust to make it insensitive to the number of included variables.

From the ANOVA statistics in table 2 indicates that the model explains the most possible combination of predictor

This model can interpret as follows

$$DPO = 0.059 + 0.917 ROE$$

variables that could contribute to the relationship with the dependent variables. Overall model created by the researcher is significant at 1% level of significance (high significant level). The processed data, which are the population parameters, had a significance level of 0%, which shows that the data is ideal for making a conclusion on the population’s parameter. It shows that the parameters in the model have a strongly significance which shows that there is a highly positive and very significant relationship between Dividend Payout (DPO) and Return on Equity (ROE).

No	Hypothesis	Results
H1	There is a positive relationship between the Dividend Payout(DPO) and Return on Equity (ROE)	Accepted
H2	There is a negative relationship between the Dividend Payout(DPO) and Return on Equity (ROE)	Rejected

VI. SUMMARY, CONCLUSION AND RECOMMENDATIONS

This study explored the relationship between dividend payout and profitability of the Beverage Food and Tobacco (BFT) industry in Sri Lanka. The study came up with findings that are of conspicuous importance to scholars investigating dividend issues in the Sri Lankan context.

Based on the study findings and discussion, the study concluded that there is a positive significant relationship between dividend policy and the profitability of the Beverage Food and Tobacco (BFT) industry in Sri Lanka. A certain percentage earning is pay out to shareholders in the form of dividends. Since the dividend, policy of the Beverage Food and Tobacco (BFT) industry is quantify by its dividend payout ratio. This project examines the effects of dividend policy on profitability of Beverage Food and Tobacco (BFT) industry. The dividend policy was measure using the dividend payout while return on equity was use as a measure of profitability. Based on the study findings and discussion, the study concluded that there is a positive significant relationship between dividend policy and the profitability of Beverage Food and Tobacco (BFT) industry.

An important limitation of this study is the period for which the data sampled. First, the sample horizon is short, compared to samples in the prior literature. Second, as far as the Beverage Food and Tobacco (BFT) companies are consider only 50 percent of the companies selected for the sample.

REFERENCES

- [1] Allli, K.L., Khan, Q.A. & Ramirez, G.G., 1993. Determinants of Corporate Dividend Policy: A Factorial Analysis. *Financial review* , 28(4), pp.523–47.
- [2] Ambarish, R., John , K. & Williams , J., 1987. Efficient Signalling with Dividends and Investments. *The Journal of Finance*, 42(2), pp.321-43.
- [3] Amidu, M., 2007. HOW DOES DIVIDEND POLICY AFFECT PERFORMANCE. *Investment Management and Financial Innovations*, 4(2), pp.103-12.
- [4] Baker, H., 1944. *Dividends and Dividend Policy*. USA: John Wiley & Sons.Inc.
- [5] Barton, L., Ned , C. & Sundaram , S., 1989. An Empirical Test of Stakeholder Theory Predictions of Capital Structure. *Financial Management*, 18(1), pp.36-44.
- [6] Benartzi, S., Michaely, R. & Thaler, R., 1997. Do Changes in Dividends Signal the Future or the Past? *The Journal of Finance*, 52(3), pp.1007-37.

- [7] Bhattacharya, S., 1979. Imperfect Information, Dividend Policy, and. *Bell Journal of Economics*, 10(1), pp.259-70.
- [8] Black, F., 1976. The Dividend Puzzle. *The Journal of Portfolio Management*, 2(2), pp.5-8.
- [9] Black, F. & Scholes, M., 1974. The effects of dividend yield and dividend policy on common stock prices and returns. *Journal of Financial Economics*, 1(1), pp.1-22.
- [10] Carrol , T.J., 1995. The Information Content Of Quarterly Dividend Changes. *Journal of Accounting, Auditing, and Finance*, 10, pp.293-320.
- [11] Easterbrook, F., 1984. Two Agency-Cost Explanations of Dividends. *The American Economic Review*, 74(4), pp.650-59.
- [12] Edelman, R., Baker, H. & Farrelly, G., 1985. A Survey of Management Views on Dividend Policy. *Financial Management*, 14(3), pp.78-84.
- [13] Eugene, B.F. & Myron, G.J., 1968. The Journal of Finance. *Leverage, Dividend policy, and the Cost of capital* , 23(1), pp.85-103.
- [14] Fama, E.F., 1974. The Empirical Relationships between the Dividend and Investment Decisions of Firms. *The American Economic Review*, (64), pp.304-18.
- [15] Fama, F. & French, R., 2002. Testing Trade-Off and Pecking Order Predictions About Dividends and Debt. *The Review of Financial Studies*, 15, pp.1-33.
- [16] Fischer, B., 1976. The Dividend Puzzle. *The Journal of Portfolio Management*, 2(2), pp.5-8.
- [17] Fischer, B., 1996. *The Dividend Puzzle*, (Special), pp.1-5.
- [18] Franco, M. & Merton, M.H., 1958. The cost of capital, corporation finance and the theory of investment. *The American Economic Review*, 18(3), pp.261-96.
- [19] Franklin, A., Antonio, B.E. & Ivo, W., 2000. A Theory of Dividends Based on Tax Clinteles. *THE JOURNAL OF FINANCE*, 15(6), pp.2499-536.
- [20] George, F.M., Bob, W.G. & James, W., n.d. *Dividend Policy: Theory and Practice*. New York: Academic press.
- [21] Gitman, L.A., 2005. Principles of Managerial Finance. *New York: Addison Wesley Publishers*, 11.
- [22] Healy, M. & Palepu, G., 1988. Earnings information conveyed by dividend initiations and omissions. *Journal of Financial Economics*, 21(2), pp.149-75.
- [23] James, A.S. & Stephen , C.J., 2012. Issuing debt to pay dividend. *Journal of Finance*, 7(1), pp.56-67.
- [24] John, F.S. & Muthusamy, K., 2010. Leverage, Growth and Profitability as Determinants of Dividend Payout Ratio-Evidence from Indian Paper Industry. *Asian Journal of Business Management Studies* , pp.26-30.
- [25] Lie, E., 2005. Operating performance following dividend decreases and omissions. *Journal of Corporate Finance*, 12(1), pp.27-53.
- [26] Lintner, J., 1956. Distribution of Incomes of Corporations Among Dividends, Retained Earnings, and Taxes. *The American Economic Review* , 46(2), pp.97-113.
- [27] Litzenberger, R.H. & Ramaswamy, K., 1979. The effect of personal taxes and dividends on capital asset prices: Theory and empirical evidence. *Journal of Financial Economics*, 7(2), pp.163-95.
- [28] Merton, M.H. & Franco, M., 1961. DIVIDEND POLICY, GROWTH, AND THE VALUATION OF SHARES. *THE JOURNAL OF BUSINESS*, 34(4), pp.411-33.
- [29] Merton, M.H. & Modiglian, F., 1961. "Dividend Policy, Growth, and the Valuation of Shares. *The Journal of Business*, 34(4), pp.411- 433.
- [30] Michael, J.C., 1978. Some Anomalous Evidence Regarding Market Efficiency. *Journal of Financial Economics*, 6(23), pp.95-101.
- [31] Michael, F., Jin, G., Jianghua, S. & Yuanyuan, Z., 2014. Institutional stock ownership and firms' cash dividend policies: Evidence from China. *Journal of Banking & Finance*, 65, pp.91-107.
- [32] Miller, M. & Modigliani, F., 1961. Dividend Policy, Growth, and the Valuation of Shares. *The Journal of Business*, (34), pp. 411-433.
- [33] Myers, S.C., 1984. Capital Structure Puzzle. *Journal of Finance*, 39(3), pp.575-92.
- [34] Myers, C. & Majluf, S., 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), pp.187-221.
- [35] Myron, G. & John, L., n.d. *Bird-In-The-Hand Theory*.
- [36] Nissim, & Ziv, A., 2001. Dividend Changes and Future Profitability. *The Journal of Finance* , 56(6), pp.2111-33.
- [37] Oyejide, T.A., 2011. Company Dividend Policy in Nigeria: An. *The Nigerian Journal of Economic and Social Studies*, 18(2), pp.179-94.
- [38] Pandey, I.M. & Ramesh, B., 2007. Dividend behaviour of Indian companies under monetary policy restrictions. *Managerial Finance*, 33(1), pp.14-25.
- [39] Pruitt, S.W. & Gitman, L.J., 1991. The Interactions between the Investment, Financing, and Dividend Decisions of Major U.S. Firms. *The Financial Review*, 26(3), pp.409-30.
- [40] Ross, S.A., Westerfield, R.W. & Jaffe, J., 2002. Corporate Finance. *Journal of Business*, 34(6), pp.411- 433.
- [41] Shefrin, H.M. & Meir, S., 1984. Explaining investor preference for cash dividends. *Journal of Financial Economics*, 13(2), pp.253-82.
- [42] Sheridan, T. & Roberto, W., 1988. The Determinants of Capital Structure Choice. *The Journal of finance*, 43(1), pp.1-19.
- [43] Thomas, C.E., 1979. Liquidity Changes Following Stock Splits. *The Journal of Finance*, 34(1), pp.115-28.
- [44] Titman, S. & Wessels, R., 1988. The Determinants of Capital Structure Choice. *The Journal of finance* , 43(1), pp.1-19.

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Real Time ECG monitoring system based on Internet of Things (IoT)

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Abstract- Heart rate, body temperature and blood pressure are very critical parameters of human body. Doctors use various kinds of medical apparatus for measurement of these parameters like thermometer for checking body temperature, BP monitor for blood pressure measurement and heart rate monitor for heart rate measurement. In this paper, we have proposed ECG MONITORING SYSTEM based on IoT (Internet Of Things). This system calculates heart rate of patient and sends the value of heart rate in beats per minute (bpm) to a database on cloud. Using this system doctors at hospital can analyse the critical parameters sent by this system. Doctors can also analyse the real time health related parameters of a patients which are not admitted in hospital. This system can be integrated in ambulance wherein all the critical health related parameters of patients can be acquired and sent to the cloud. All these critical parameters can be analysed by a doctor in advance while the patient is still in ambulance. The main objective of this system is to acquire the physiological parameter using sensors and uploading these parameters to cloud. We have integrated ECG sensor in this system.

Index Terms- Wireless ECG, Ambulatory Data, AD8232

I. INTRODUCTION

As we are well aware that death and disability due to heart attacks is increasing day by day in India. The Registrar General of India reported that cardiovascular diseases led to 17% of total deaths and 26% of adult deaths in 2001-2003, which

increased to 23% of total and 32% of adult deaths in 2010-2013 [1]. A government in each financial year allocates a huge amount of money for health budget which is utilized on performing various operations at subsidized rates. This system facilitates the process of performing diagnosis and treatment of patients suffering from heart diseases. Using this system the physician can use the cloud platform to diagnose patients at remote locations (like home). The patients can also access their medical records via this cloud service. Various kinds of ECG recorders are available in market manufactured by reputed organisations, but till date there are very less devices available which can record the ECG signals and transmit them to a remote database server on cloud. In this research paper we have proposed a system that will record ECG signals of patient using a sensor and also store the ECG signals to a database server. These signals can be analysed by a doctor at remote location or can be saved and retrieved later for analysis. The conventional ECG monitors are used to measure electrical activity of heart for short time, there is high possibility that Heart related issues are not occurring at that time. So a real time system is required that can measure heart rate at any time.

II. PROPOSED SYSTEM

Proposed system consists of two blocks as shown in figure 1

- 1 .Patient monitoring location
- 2 .Signal analysis location

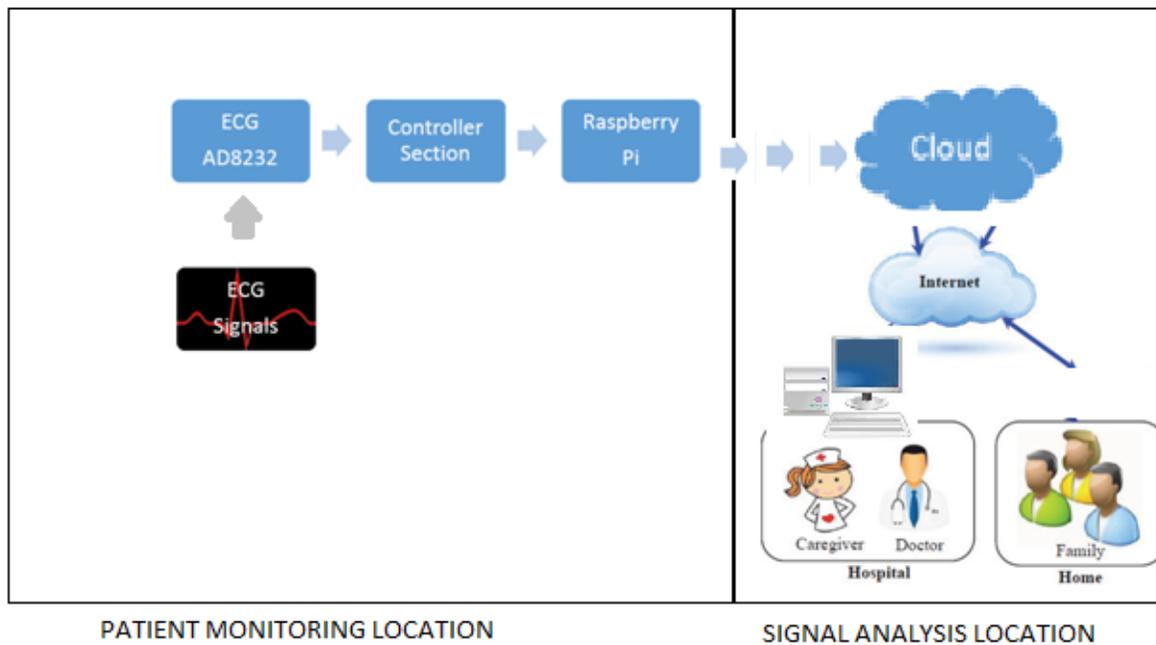


Figure 1 : Block diagram of proposed system

PATIENT MONITORING SYSTEM

It consists of ECG sensor AD8232 which acquire Electrocardiograph (ECG) signals. AD8232 is preferred over another chips, HM301D is three channel, while we only need single channel ECG and ADS1191 doesn't provide high enough gain to get good resolution. AD8232 has the best output impedance and gain [2]. ECG is the process of recording the electrical activity of the heart over a period of time using electrodes placed on the body. These electrodes detect the tiny electrical changes on the skin that arise from the heart muscle's electrophysiologic pattern of depolarizing and repolarizing during each heartbeat. The AD8232 is a neat little chip used to measure the electrical activity of the heart. The AD8232 Single Lead Heart Rate Monitor is a cost-effective board used to measure the electrical activity of the heart. This electrical activity can be charted as an ECG or Electrocardiogram and output as an analog reading. ECGs can be extremely noisy, the AD8232 Single Lead Heart Rate Monitor has as an op amp to help obtain a clear signal from the PR and QT Intervals easily. The AD8232 has an integrated signal conditioning block for ECG and other bio potential measurement applications. It is designed to extract, amplify, and filter small biopotential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement. The AD8232 Heart Rate Monitor consists of 9 pins-LO+, LO-, OUTPUT, 3.3V, GND provide essential pins for operating this monitor with an Arduino or other development board. Also provided on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins through which ECG electrodes are connected to as shown in diagram below Figure 2.

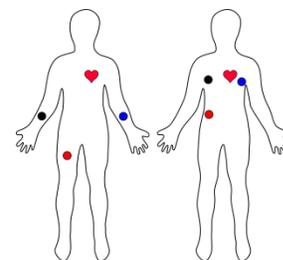


Figure 2:AD8232 electrodes placement

AD8232 works on 3.3 volts [3] . The ECG sensor AD8232 supplies the ECG signal to the controller section. The system is based on ARM 7 controller which is used to acquire the ECG signals. Microcontroller acquires the ECG signals data and processing can be done using embedded C programming. Microcontroller sends the data serially to a single board computer called Raspberry Pi. The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. Raspberry pi works on raspbian operating system which is linux based OS . A Raspberry Pi is a credit card-sized computer. The Raspberry Pi is slower than a modern laptop or desktop but is still a complete Linux computer and can provide all the expected abilities that implies, at a low-power consumption level. We have used this system because it is a portable computer which can be used in any moving vehicle like ambulance and requires dc voltage to operate which is also available in a vehicle .Through the use of AD8232 sensor and the logic used in the program we can see the ECG signals on serial plotter of controller as shown in Figure 3

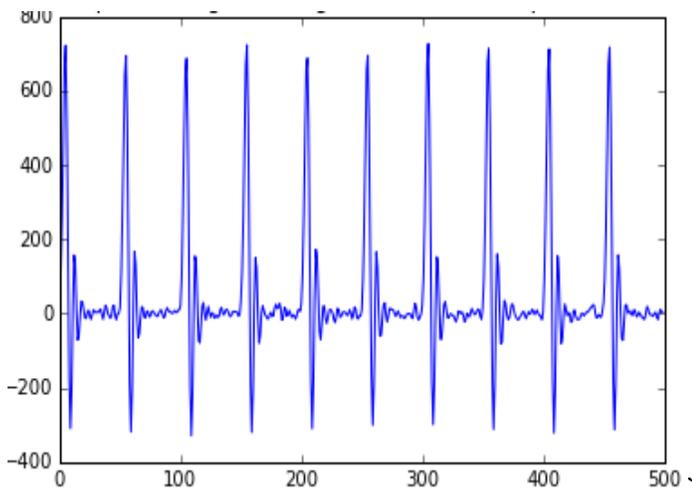


Figure 3: ECG signal plotted on serial plotter

The raspberry pi has also been used to send the data to the cloud through the use of APACHE –an open source web server. The heart rate of patient on being calculated in bpm and sent to database server on cloud. The Table 1 shows the value of bpm of patient with time stamp, this value is acquired by a python code through USB port and filled into a database.

Table 1: Heart beat values in bpm posted on database server with timestamp

id	Username	heart beat	creationtime
7207	Mehak	82	2017-07-25 12:36:51
7206	Mehak	82	2017-07-25 12:35:25
7205	Mehak	82	2017-07-25 12:34:18
7204	Mehak	88	2017-07-25 12:32:27

SIGNAL ANALYSIS LOCATION

The doctors analyses the heartbeat values and ECG signals recorded by this system. Through this the doctors can alert the patient if they found any deviation of heartbeat values or signals from normal heart beat value and ECG signal of a normal person. The doctors can also analyse the signals of the patient in ambulance before the patient reaches hospital.

III. TIME DOMAIN ANALYSIS

Time domain analysis uses temporal data of ECG signals to calculate various parameters like RR interval (RRI) variability, heart rate etc [4]. Before discussing these parameters some understanding of ECG signal is required

Our heart is divided into 4 chambers –left atrium, right atrium, left ventricle, right ventricle. The right atrium first experiences the electrical impulse. Now this impulse travels from right atrium to left atrium. This electrical impulse is referred to as P wave as it compresses the right atrium so in this way the deoxygenated blood flows from right atrium to right ventricle. This deoxygenated blood then flows to lungs through preliminary arteries. Now the electrical impulse that has travelled to left atrium compresses it. Here oxygenated blood flows into left

atrium through veins from lungs. Now the heart beat is measured by noting how many QRS complex has passed in one minute. Heart rate is expressed in bpm (beats per minute). In ST segment the ventricles are waiting to get repolarised. When T wave comes the ventricles get repolarised so that blood can be pumped into it by atrium. The full ECG cycle with P, Q, R, S and T is shown in figure 3.

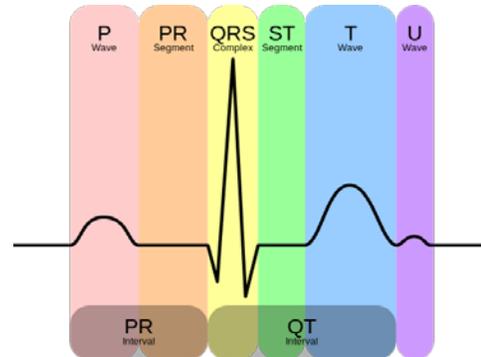


Figure 3: ECG signal showing P, Q, R, S and T waves

The system proposed acquires the ECG values from AD8232 in time domain. QRS complex detector has been applied on the ECG signal to calculate the heart rate in bpm. Raw ECG signal can also be acquired and transmitted to Raspberry Pi and analysis can be done at Raspberry Pi also.

IV. ADVANTAGES

- Portability is given to a great extent
As this system size is quite small so it can be carried at various locations with ease.
- Doctors can see data remotely and analyze the ECG signals of patients
This is the most important advantage of this system. The persons living in remote locations who have no access to a doctor can be helped through a greater extent through this system, as this system sends all the values and signals on the website and the doctors which are far away can get an accurate idea of heart condition of a person. Furthermore this system can be used in ambulance which saves a lot of time and can save a life of a person because every second counts.
- ECG signals are stored for further analysis
Here the ECG signals and heart beat values firstly get stored in database in mysql and then this value is transferred on website through raspberry pi. The storage is required so that if doctor wants to check the previous condition they are able to do so.
- This device is quite useful for real time ECG monitoring. The emphasis must be laid on removing noise and it will then result in very efficient system.
- Very small electrodes can be built in future so there will be no need to carry extra electronics.
- Patient is not tethered to huge machines
One of the biggest advantages of this system includes that through the use of small circuitry the heartbeat and ECG signals of a patient can be viewed rather than using large machines for it.

V. LIMITATIONS

- The noise may disturb the readings. The noise may deviate the actual graph of ECG to an undesired level.
- The system requires good internet connectivity at all the times so that it can be accessed by doctors at any time.

VI. CONCLUSION

This research paper aims at initial prototype development for wireless transmission of ECG signals. It is evident that designing such a system will help in early detection of abnormal conditions of cardiovascular diseases and prevention of its serious consequences [5].

REFERENCES

- [1] Rajeev Gupta, InduMohan ,JagatNarula: Trends in Coronary Heart Disease Epidemiology in India, Volume 82, Issue 2, March–April 2016, pp 307-315.
- [2] Muhammad Wildan Gifari ; Hasballah Zakaria ; Richard Mengko: Design of ECG Homecare: 12-lead ECG acquisition using single channel ECG device developed on AD8232 analog front end, The 5th International Conference on Electrical Engineering and Informatics 2015 August 10-11,

2015, Bali, Indonesia, 978-1-4673-7319-7/15/\$31.00 ©2015 IEEE, pp 371-376.

- [3] AD8232 Datasheet, Analog Devices
- [4] Jani Penttilä,Antti Helminen,Tuomas Jartti,Tom Kuusela,Heikki V. Huikuri,Mikko P. Tulppo,René Coffeng,Harry Scheinin: Time domain, geometrical and frequency domain analysis of cardiac vagal outflow: effects of various respiratory patterns, Clinical Physiology and Functional Imaging,Volume21,Issue3May2001 Pages 365–376
- [5] Istepanian RSH, Jovanov E, Zhang YT: Guest Editorial Introduction to the Special Section on M-Health: Beyond Seamless Mobility and Global Wireless Health-Care Connectivity. IEEE Transactions on Information Technology in Biomedicine 2004,8(4):405-414.

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Urban public transport accessibility for markets and wards: the case study of Mandalay City

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Abstract- Accessibility is the main parameter which contributes to the effective transport system. An effective transport system and associated urban forms will improve the economic and social opportunities. The objective of the paper is to know about the different levels of accessibility to the public transport system. The public transport accessibility level (PTAL) is identified for the selected study area with the help of an indexing system. Accessibility maps create a common language between urban planners and traffic planners, often leading to interesting insights and mutual understanding. The result of the paper would be the base for recommendations to improve the existing public transport system service.

Index Terms- Accessibility, Transportation system, Public transport accessibility level, Indexing system, Urban planners, Traffic planners

I. INTRODUCTION

Accessibility can be related to both the qualities of the transport system like the travel speed and the qualities of land use system like density and mixes. People favor motorcycle and private cars and regard conventional public transport as a last solution. One objective of public transportation is to provide an alternative to the use of the private automobile in order to alleviate negative externalities created by automobile dependency. These negative effects include environmental degradation, equity issues (for example, the difficulty experienced by people who are unable to drive due to some physical and mental disability), and economic impacts (such as time lost due to driving congestion and lack of parking space). As one of many available alternative transportation modes, bus service must attract ridership to be competitive. In Mandalay City, the inability of conventional public transport to deter people from using motorcycle and private cars and the increase in citizen demand for private cars cause traffic problems, and infrastructure investments to eliminate these traffic problems require significant expenditures.

II. LITERATURE REVIEW

Accessibility is a term used in transport and land-use planning, and is generally “ease of reaching”. Accessibility is the suitability of the transit system in helping people get to their destinations in a reasonable amount of time. It is a function of the mobility of the individual, spatial location, opportunities relative to the starting point of the individual, and the times at which the individual is able to participate in the activity. Accessibility helps in identifying the interrelation of transport and land-use. Accessibility measures can be grouped into five categories: travel-cost approach, gravity or opportunities approach, constraints-based approach, utility-based surplus approach, composite approach. The gravity or opportunities approach summarises the contour or cumulative opportunity and gravity models. The constraint-based approach is equivalent to time-space measures, while the utility-based surplus approach uses the utility measures with a greater focus on individual behaviour and decision-making. Composite approaches attempt to combine time-space and utility indicators into a common model.

In a paper regarding Advances in public transport accessibility assessments for development control, Public Transport Accessibility Level (PTAL) is one of the criteria for evaluating the accessibility PTAL is calculated by summing a series of indices for bus, train, underground and rail services to obtain an Index Number was explained by (G Christopher and S Geoff), 2008 [1]. The Index Numbers are compared with a banding regime to obtain a PTAL grade. Walk distance, the number of services and their frequency, walking speed and the reliability of service are all used in the calculations. They suggested a quantitative assessment method for public transport network accessibility as an alternative to PTAL, which could be used in transport assessments to assist with planning applications. A new approach for measuring public transit accessibility was developed by A M Sha and E. L Nicholas (2008) [2] with the help of an index called Local Index of Transit Availability (LITA), The Transit Capacity and Quality of Service Manual (TCQSM) and Time-of-Day Tool. This research stays away from the methods involving software based analysis tools and considers methods that calculation procedures are straight forward and require some basic use of GIS software. Another example of GIS based accessibility measures was developed by L Wei (2009) [3] based on the GIS-based floating catchment method to assess areas with shortage of physicians. The study demonstrates the principle of the floating catchment methodology (FCM) with a simple case study in northern Illinois. FCM defines the basic unit within which to calculate this ratio as a circle of some reasonable radius centered on the census tract centroid. A case study was done by Alan T. M Rex (2010) [4] based on the methods for increasing public transport access and their likely effects. In areas in which public transport access is high, performance improvements were realized by altering the

placement of stops and modifying route service. L Jonathan, G Joe, S Qing, (2010) [5] had done a work on the metropolitan accessibility. In the paper they compared transportation accessibility outcomes for 24 of the largest metropolitan regions in the United States. This study bases its accessibility metrics in the gravity model which is a powerful conceptual tool because it simultaneously accounts for both the transportation network and its surrounding land-use conditions. The paper regarding “Modelling walking accessibility to public transport terminals” by S Sony and O Piotr (2005) [6] explained about the equivalent walking distance (EWD). They developed a model called the walking access model. From the research they concluded that characteristics of walking route could be incorporated into public transport accessibility measurement. Equivalent walking distance can be a method that can measure public transport accessibility more precisely and comprehensively. The accessibility indices are used in measuring the ease of residents going from one place to another. By analysing the accessibility indices, one can review a network system of transportation in the regions under study. There are different methods used for finding the accessibility to a particular facility. The methods are identified from the literature review.

1. Transit service indicator
2. The Land Use and Public Transport Accessibility Indexing Model (LUPTAI)
3. Accessibility index from (database extracted directly from the satellite imagery and the highway network)
4. The transit level-of-service (TLOS)
5. The Local Index of Transit Availability (LITA)
6. Public Transport Accessibility Levels (PTALS)

The present paper deals with the application of PTAL for evaluating the accessibility in the selected study region. The method provides a detailed and accurate measure of the accessibility to the public transportation opportunities.

III. STUDY AREA

Located on the east bank of the Irrawaddy River is Mandalay, Myanmar's second largest city. It is considered the country's cultural hub because it maintained the cultural legacy of the ancient Burmese kingdoms. The study area consists of 93 wards. Fig 1 shows ward map for the site selected for the study.

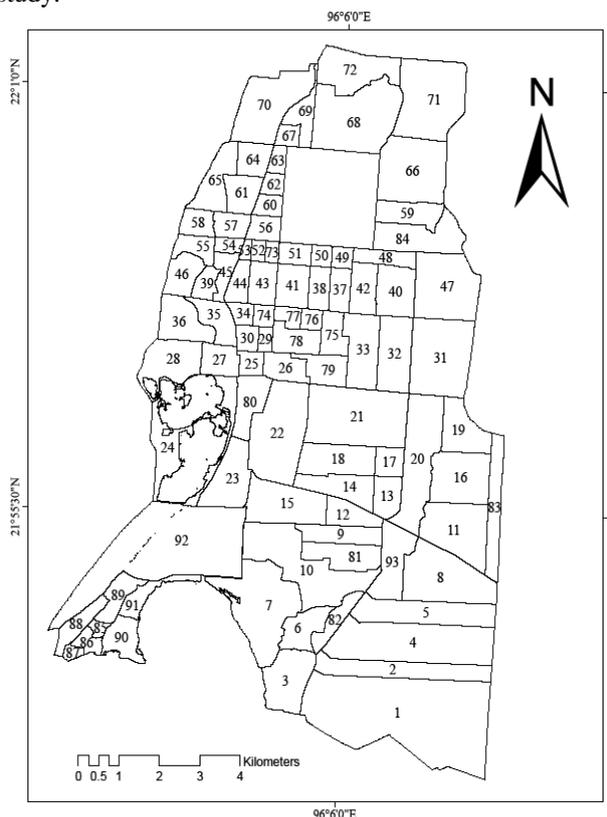


Figure 1. Ward map for the site selected for the study area

The software ArcGIS10.1 has been used as a GIS platform of this study. The current bus teams, number of bus frequency per day, the average number of buses per day and the daily transportable number of passengers are obtained from Bus Line Control Committee, Mandalay Division.

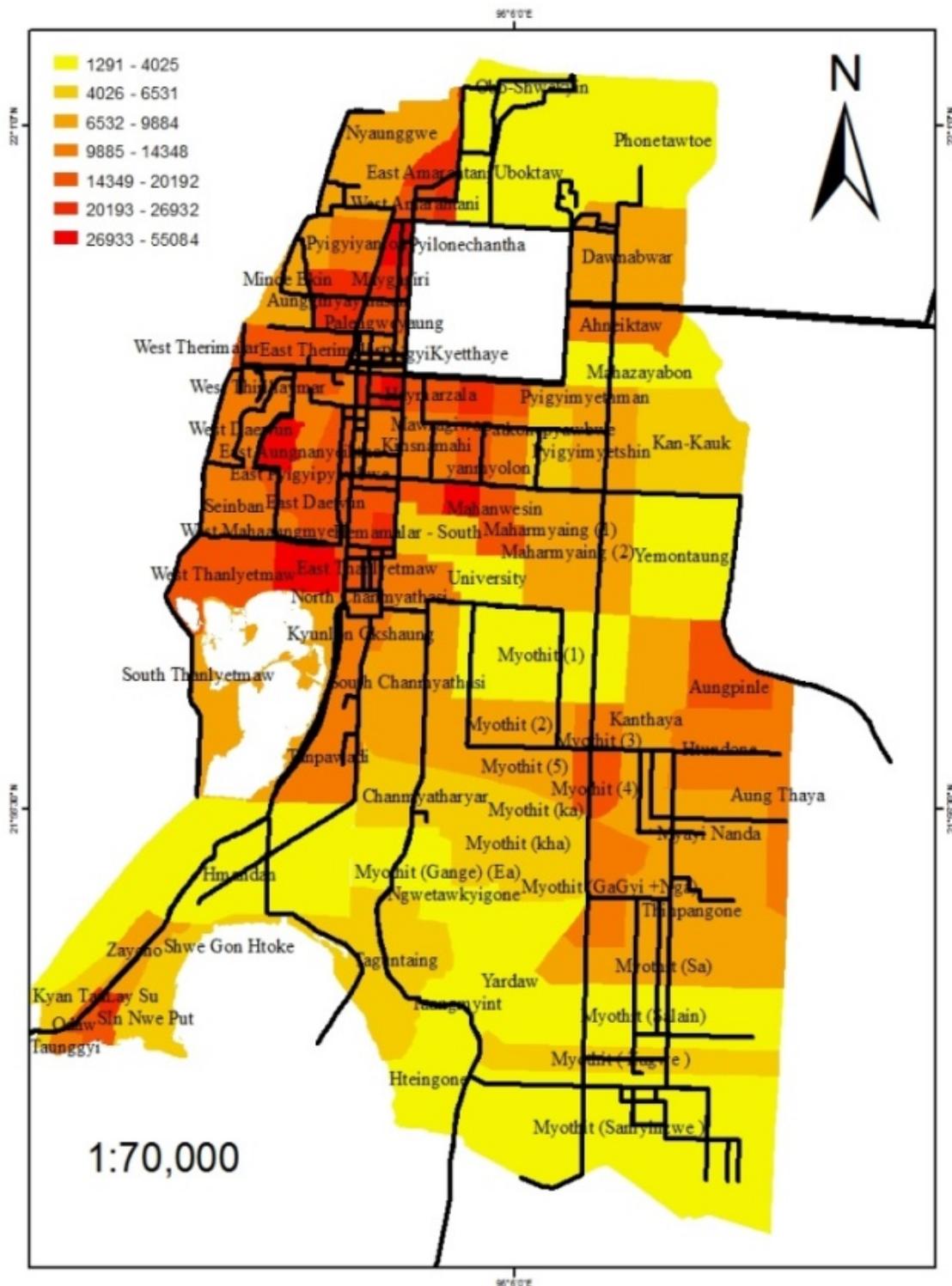


Figure 2. Population density and bus network map in Mandalay city

Land use and population density map, as shown in figure 2 and 3, is taken from department of remote sensing, Mandalay Technological University. Various data types are needed to collect from different sources. Most of data involved two-pronged spatial and attribute data, which included maps of the study area, and locations of bus routes as spatial data. On the other hand, the attribute

data included population; bus routes in terms of statistics and geographic information. After collecting data, the next step is building the geo-database of the study. And then, public transport accessibility index for each ward is calculated by using PTAL method.

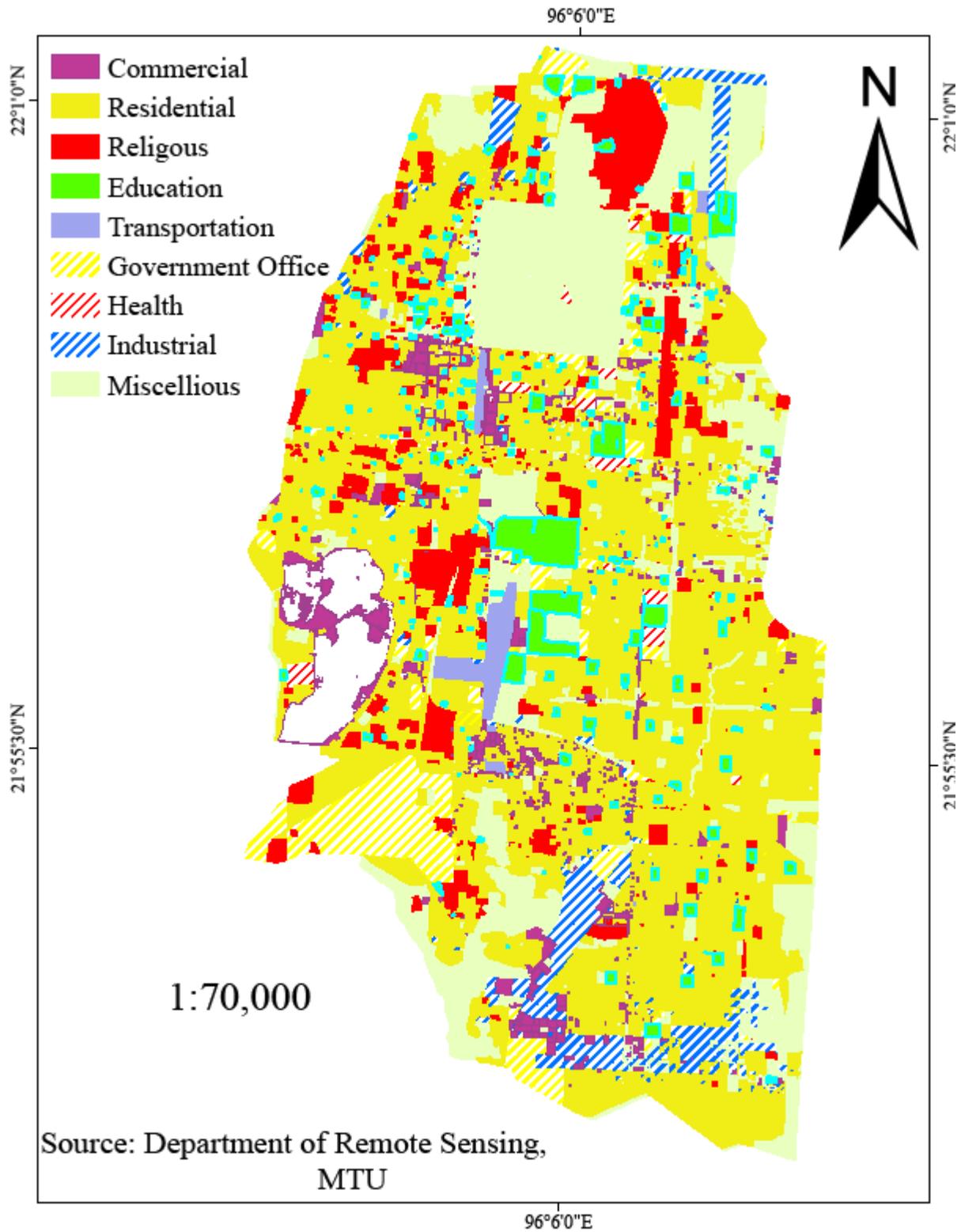


Figure 3. Land use map for the study area

IV. LONDON PTAL METHODOLOGY

PTAL is a detailed and accurate measure of the accessibility of a specific point to the public transport network, taking into account walk access time and service availability. It measures the accessibility level for a specific point (origin) considering the accessibility index (AI) for all available modes of transport from that point. The inclusion of total access time to measure the level of accessibility is an important feature of this method (Mamun and Lownes 2010). The methodology is briefly described below, broken down into key steps for calculation. For a more detailed explanation, please refer Transport for London (2010).

Step 1: Define points of interest (POI) and service access points (SAP) – POI is defined as a point for which the accessibility level is to be measured with reference to an SAP, which is a public transport stop (such as bus stop, metro station, market, zone etc.).

Step 2: Calculate walk access time from POI to SAP – The actual road network distance from POI to SAP is measured and, assuming a walk speed of 4.8 km/h, walk time (WT) is calculated. The maximum walk times for bus and metro rail are 8 and 12 minutes, respectively. Any SAPs beyond these distances are not taken into account to calculate PTAL for that particular POI.

Step 3: Identify valid routes at each SAP and calculate average waiting time (AWT) – The valid routes are bus and metro routes for the peak hour (8:15–9:15 am), and the frequency of services on all these routes during this hour is used in the calculation of AWT. AWT is defined as the period from when a passenger arrives at an SAP to the arrival of the desired service. In the calculation, the hourly frequency (f) is halved because the scheduled waiting time (SWT) is estimated as half the headway. For example, a 10-minute service frequency (6 buses per hour) would give an SWT of 5 minutes. In addition, to make the calculations more realistic, a “reliability factor” (K) is added to the SWT depending on the transport mode, which is assumed to be 2 minutes for buses and 0.75 minutes for rail services.

Step 4: Calculate minimum total access time (TAT) for each valid route at each SAP – This is done as shown in Equation 2 by adding times obtained in steps 2 and 3.

Step 5: Convert TAT into equivalent doorstep frequency (EDF) – This is obtained as 30 divided by TAT. The principle is to treat access time as a notional average waiting time as though the route was available at the doorstep of the selected POI.

Step 6: Obtain the accessibility index (AI) for each POI – In this step, the most dominant route, i.e., the route with the highest frequency, is assigned the weighting factor of 1.0; for all other routes, a weighting factor of 0.5 is assigned. Then, the accessibility index for a POI (AIPOI) is calculated.

Step 7: Map PTAL – The AIs obtained for each POI are allocated to eight bands of PTAL, as shown in Figure 4 (where Range of Index means AI of the POI). A POI with a value of 0 indicates no access to the public transport network within the parameters given and is not colored on the map.

PTAL	Range of Index	Map Colour	Description
1a (Low)	0.01 – 2.50	Dark Blue	Very poor
1b	2.51 – 5.00	Blue	Very poor
2	5.01 – 10.00	Cyan	Poor
3	10.01 – 15.00	Green	Moderate
4	15.01 – 20.00	Yellow	Good
5	20.01 – 25.00	Orange	Very Good
6a	25.01 – 40.00	Red	Excellent
6b (High)	40.01 +	Dark Red	Excellent

Figure 4. Description of map colour for PTAL

The calculation steps in the methodology are the same as the London PTAL methodology. However, for mapping of PTALs in Mandalay, the walking distance considered in the London PTAL methodology is altered to suit the conditions of Mandalay.

V. CALCULATION OF PUBLIC TRANSPORT ACCESIBILITY INDEX

The PTAL is used as a development planning tool in London, to determine both permitted parking standards and development densities. Public Transport Accessibility Levels (PTALS) are a detailed and accurate measure of the accessibility of a point to the public transport network, taking into account walk access time and service availability. The method is essentially a way of measuring the density of the public transport network at any location within the study area.

A. Point of interest

In the study, there are two type of point of interest (POI): Wards and Markets. Public transport accessibility levels for markets are important because the commercial zones are mostly based by the bus network as shown in figure 5.

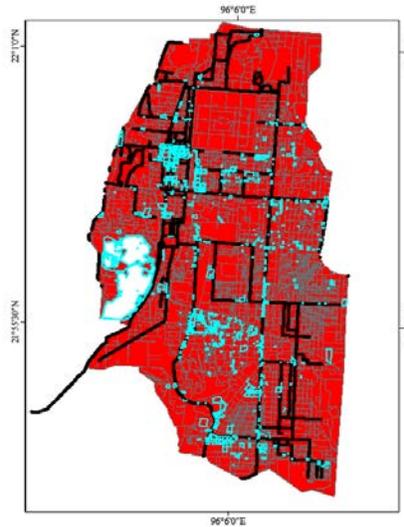


Figure 5. Commercial zones in Mandalay City

B. Walk access times

In the study, two types of the walking distance are analysed: walking distance from markets to the nearest bus stop (figure 6) and walking distance from bus routes to the bus service area in each zone (figure 7). The distances for markets are taken from using the measure tool in ArcGIS software.

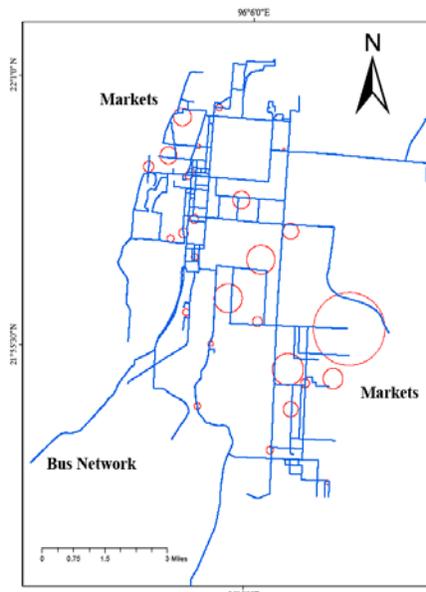


Figure 6. Walking distances form the markets to the nearest bus stops

For the latter distance, the service area is calculated by served people divided by population density. The specific radial distance based on the total supply capacity is calculated by the square root of the result of service area divided by Pi (π). Where Pi (π) represents 3.14. The specific radial distances to estimate bus service area are assumed as walking distances for wards.

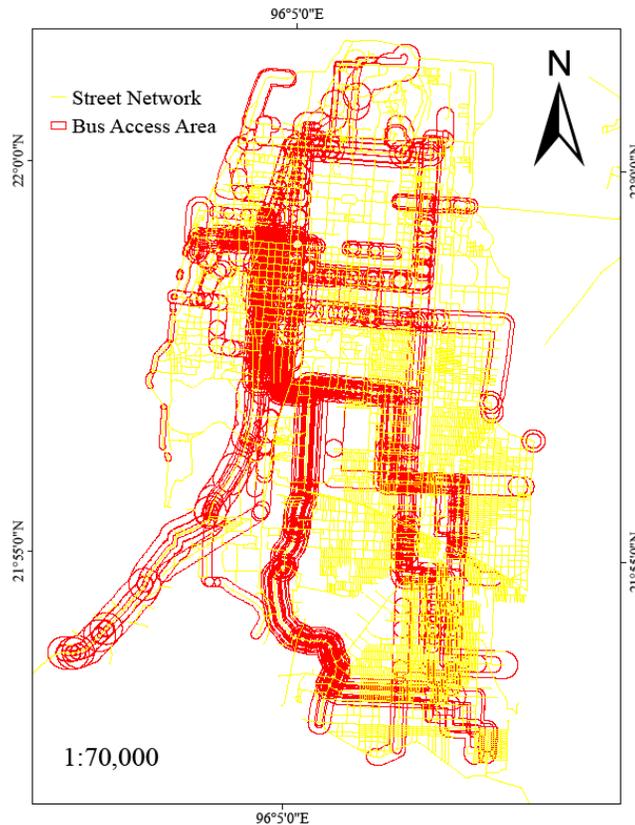


Figure 7. Walking distances from the bus routes to bus service area in each ward

The distances are converted to a measure of time using an assumed a walk speed of 4.8 kph (3 mph), which has been fractionally adjusted for crow flies optimism. Radial distances are converted to a measure of time using an assumed average walk speed of 4.8 kph.

C. Average waiting times (AWT)

Headway data (peak period = 6am-9am) is collected from bus employee interview survey and Bus Line Control Committee. For each selected route the scheduled waiting time (SWT) is calculated. This is estimated as half the headway (H/2) (i.e. the interval between services). To derive the average waiting time, reliability factors (RF) are applied to the SWT according to the mode of transport used. To allow for reliability additional wait times assumed are 2 minutes for buses. For example, a 10-minute service frequency (6 buses per hour) would give an SWT of 5 minutes. In addition, to make the calculations more realistic, a “reliability factor” (K) is added to the SWT depending on the transport mode, which is assumed to be 2 minutes for buses and 0.75 minutes for rail services.

$$AWT = \frac{H}{2} + RF \quad (1)$$

D. Total access times (ATA)

Total access time is made up of a combination of factors: combining the walk time from the POI to the SAP and the time spent waiting at the SAP for the desired service to arrive.

$$TotalAccessTime = WalkTime + AWT \quad (2)$$

E. Equivalent doorstep frequency (EDF)

The access time is converted to an Equivalent Doorstep Frequency where:

$$EDF = \frac{30}{TotalAccessTime} \quad (3)$$

F. Accessibility index (AI)

For bus service area zones, the AI (at a single POI) can be calculated using the following formula:

$$AI_{zone} = EDF_{zone} + (0.5 \times AllOtherEDFs) \quad (4)$$

The above calculation is done in ArcGIS software and then the calculated accessibility indices for each ward and markets are in figures 8,9,10 and 11.

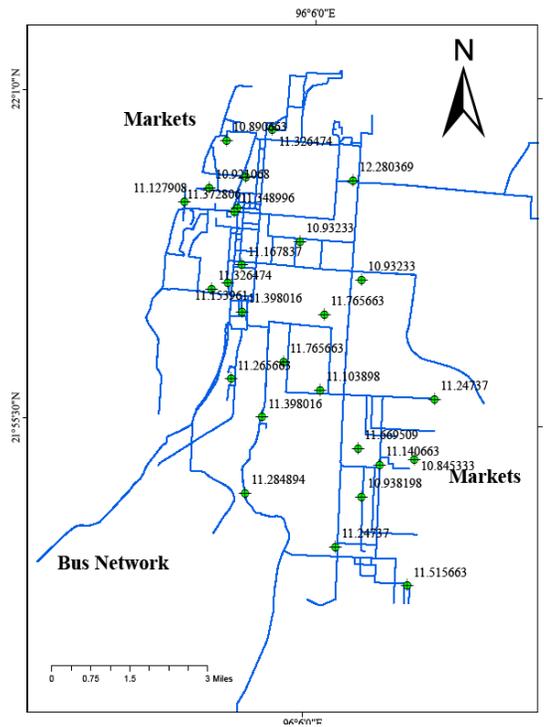


Figure 8. Accessibility index for each market with bus network in Mandalay City

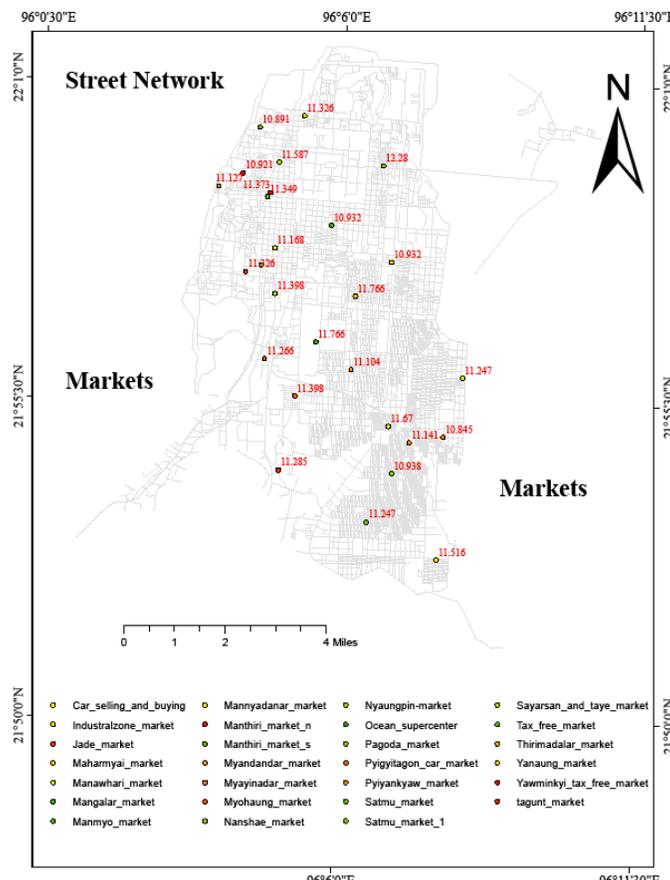


Figure 9. Accessibility index for each market with street network in Mandalay City

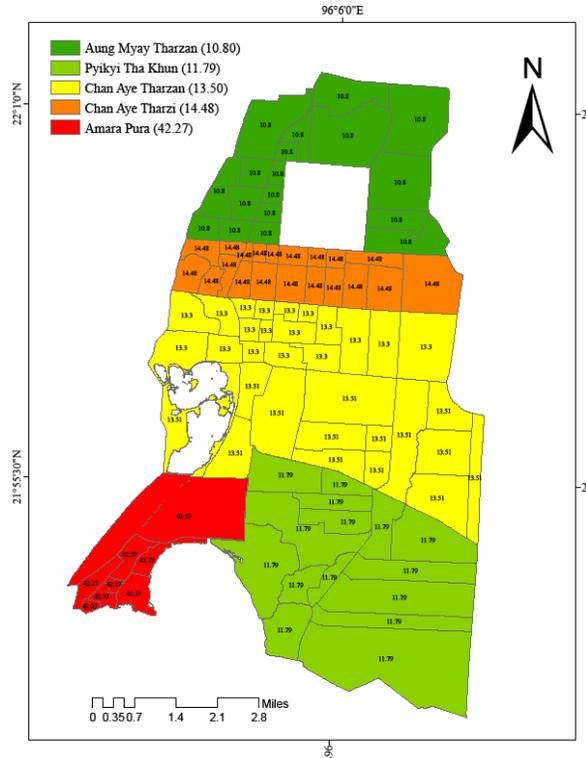


Figure 10. Accessibility index for each township in Mandalay City

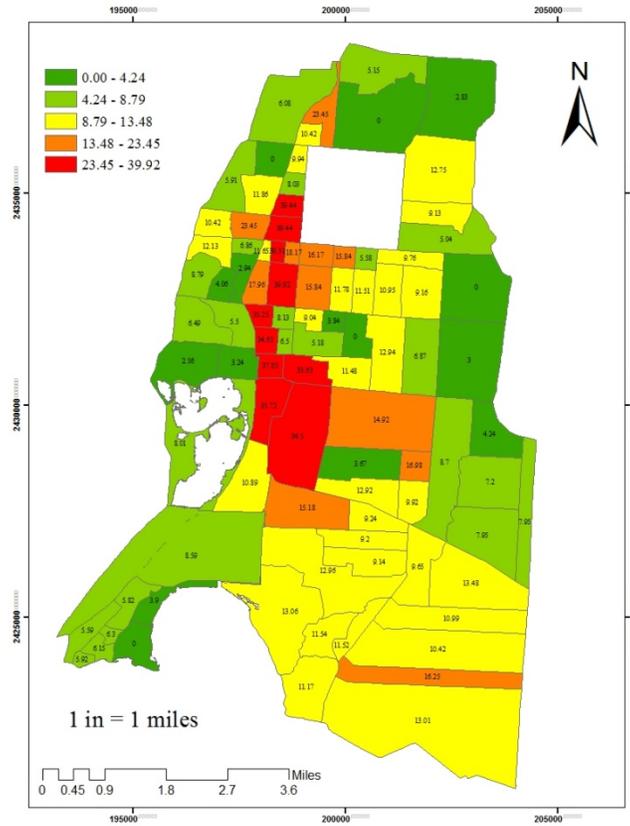


Figure 11. Accessibility index for each ward in Mandalay City

VI. RESULT AND CONCLUSION

The accessibility to public transportation in Mandalay city is determined on the basis of Transport Authority data, population density data and the PTAL method. The PTAL values for different wards are calculated using the service area calculation. From the township analysis, it is found that Amarapura has the highest accessibility to the public transport system with the value of 42.27. The township with the lowest accessibility is AungMyayTharzan with the value 10.80. From the ward analysis, four wards: East Aungmyeiktha (ChanAyeTharzan), Palengweyaung (AungMyayThazan), Pyigyikyettaye (AungMyayThazan) and Middle Chan Aye Tharzan (ChanAyeTharzan) have the high accessibility to the public transportation with the value of 39.92, 39.44, 39.43 and 39.31. There are ninety three wards in the study area. But it can be seen that fifty wards process the lowest accessibility less than the value 10. From the market analysis, the largest one, Manthiri (Zegyo) market in Mandalay has the accessibility of 11.35. The public transport accessibility level of the Nanshae market is fair with the value of 12.28, the best service level in Mandalay city. Although the commercial zones are mostly based by the bus network, the public transport accessibility of markets are low. The result shows that the small urban area is well provided with the public transport services: however, peripheral areas are social exclusion as shown in figure 12. According to the calculation, the whole system is only 48.7% adapted to the city area, so taking the general accessibility level into account Mandalay could hardly be called even partly accessibility for people using motor cycle.

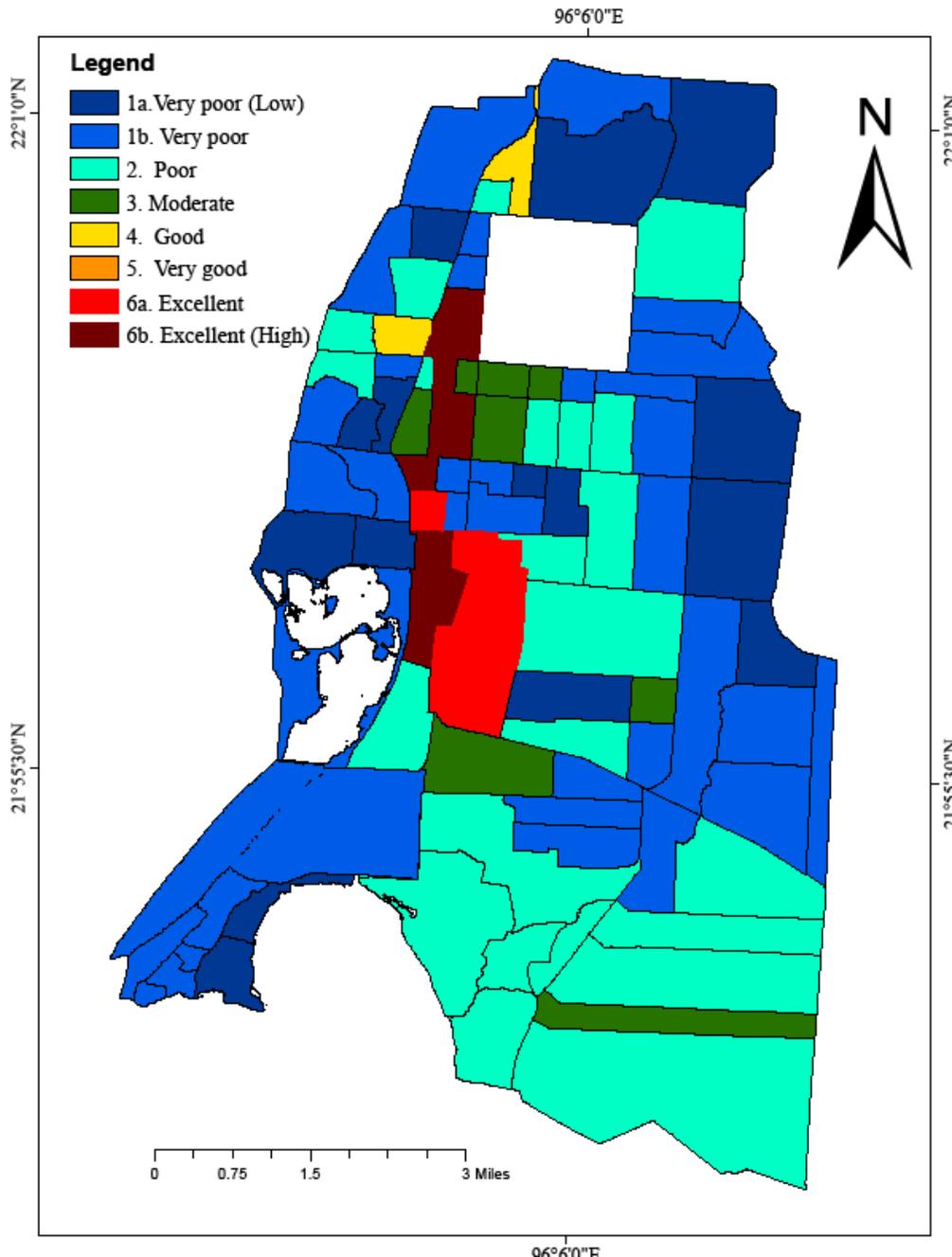


Figure 12. Public transport accessibility level for each ward in Mandalay City

REFERENCES

- [1] G Christopher and S Geoff (2008), "Advances In Public Transport Accessibility Assessments For Development Control – A Proposed Methodology", Capita Symonds Ltd Transport Consultancy
- [2] A M Sha and E. L Nicholas, Aggregated Public Transit Accessibility Measure journal of transportation research board, volume 2217/2011
- [3] L Wei, Q Yi(2009), "An enhanced two-step floating catchment area (E2SFCA) method for measuring spatial accessibility to primary care physicians" Health & Place 15 (2009) 1100–1107
- [4] T.M Alan, J Robert. Stimsonc and F Luis (1998), "Public Transportation Access", Transportation Research Part D: Transport and Environment 3(5)
- [5] L Jonathan , G Joe, S Qing (2010) "Metropolitan Accessibility and Transportation Sustainability," Fifth Urban Research Symposium 2009
- [6] S Sony and O Piotr "Modelling walking accessibility to public transport terminals" Journal of the Eastern Asia Society for Transportation Studies, Vol. 6, pp. 147 - 156, 2005.
- [7] Burrough PA, McDonnell R. "Principles of Geographic Information Systems. Oxford", Oxford University Press. (1998)
- [8] Birkin, M., Clarke, G. P., & Clarke, M. "GIS for business and service planning. In Geographical Information Systems: Principles Techniques Management and Applications", 2 Abridged edition. Edited by Longley PA, Goodchild MF, Maguire DJ, Rhind DW. New York: John Wiley & Sons. (2005).
- [9] Flowerdew, R., & Pearce, J. "Linking point and area data to model primary school performance indicators. Geographical and Environmental Modeling", 5(1), 23-41. (2001).
- [10] KhaledY.M. Almansi, "Developing a technique to calculate the hospital service area and measure the accessibility levels to tertiary hospitals using GIS": University putra, (2015)
- [11] Walsh, S. J., Page, P. H., & Gesler, W. M. "Normative models and healthcare planning: network-based simulations within a geographic information system environment". Health Services Research, 32(2), 243. (1997).
- [12] PTAL Methodology -Measuring Public Transport Accessibility Levels for Landon

FT-IR and Density Studies on Neodymium Doped Zinc Borotellurite Glass System

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Abstract- Glasses with chemical compositional (50-x)B₂O₃-45ZnO-05TeO₂-XNd₂O₃ (X=0.5,1.0,1.5 & 2.0) were prepared by conventional melt-quenching technique. The structural properties of the prepared glasses were determined by X-ray diffraction (XRD) analysis and FTIR analysis. The FTIR spectra were recorded at room temperature in the frequency range from 600 to 4000 cm⁻¹. It was confirmed that the prepared glasses are amorphous in nature. The bonding parameters of the glasses were analyzed by using FTIR analysis and were confirmed to be ionic in nature. The density and molar volume of these glasses have been measured and analyzed.

Index Terms- Borotellurite Glass, Melt Quench, XRD, Density, FT-IR.

I. INTRODUCTION

Tellurite based glass containing rare earth oxide has received significant attention due their excellent optical properties for future applications. It is well known that these glasses are better competitors for optical transmission studies due to their long infrared (IR) cut-off [1]. Among the possible rare earth ions, neodymium is one of the most studied rare earth ions and is also one of the most efficient candidates for photonic devices [2]. Neodymium doped tellurite glasses are suitable candidates to develop waveguide lasers, color display devices, optical fibers and optical amplifiers [3]. In recent years, heavy metallic oxide glasses doped with rare earth ions are very useful material for the better performance of the optical properties [4-5]. There are two types of structural units namely trigonal bipyramid (tbp) and trigonal pyramid (tp) TeO₂ which are responsible for the attractive properties arising from these tellurite based glasses.

II. MATERIALS AND METHODS

In the present study, the glass samples of composition (50-x) B₂O₃-45ZnO-05TeO₂-XNd₂O₃ (X=0.5,1.0,1.5 & 2.0) have been prepared by the melt quench technique. High purity (99.99%) zinc oxide (ZnO), Tellurium Oxide (TeO₂), Boric oxide (H₃BO₃), Neodymium oxide (Nd₂O₃) were used as starting materials. A batch of 20g of the above high purity chemicals in powder form was weighed, well mixed and melted in a alumina crucible in the temperature range 1100–1200°C for 2 hrs. All the melting processes were done using electric furnace TAIE FY 400. After the melting process, each melt was quenched rapidly into cylindrical stainless steel split mould which had been

preheated at 400°C in order to relieve the mechanical stress in sample.

III. RESULT AND DISCUSSIONS

3.1 XRD Study

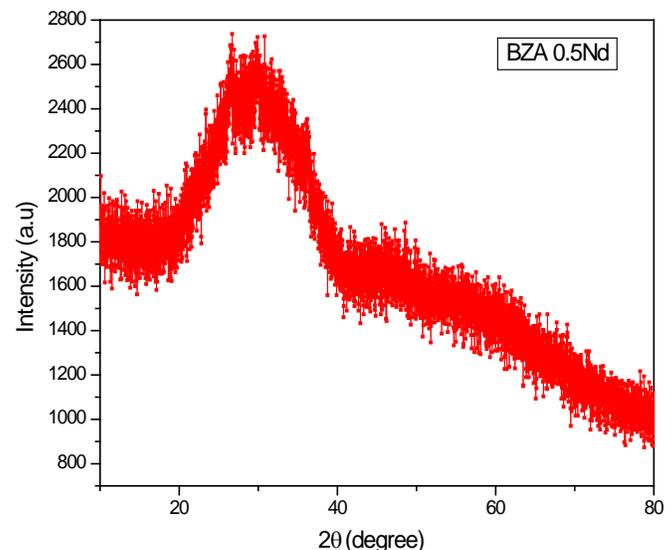


Fig.1. XRD pattern of 0.5% of Neodymium Doped Zinc Borotellurite Glass System.

The glasses were characterized using XRD for their structural study. Powder X-ray diffraction of the (50-x) B₂O₃-45ZnO-05TeO₂-XNd₂O₃ Glass samples showed broad peak as shown in fig.1 the zinc borotellurite doped with neodymium glass samples showed broad peak characteristics of glass structure. Representative XRD pattern is shown in fig.1 confirms the amorphous or glassy nature of the investigated glass samples.

3.2 Density and Molar Volume

The density measurement is considered to be a very important tool to detect the structural changes in the glass network. The density is supposed to change abruptly when the structure of the glass is slightly changed. The density of the prepared glass samples were measured using Archimedes Principle using a sensitive balance with pure xylene as immersion fluid. The density was calculated. The value of density decreases from 1.73 to 1.03 g/cm³, while the values of

the molar volume increases from 49.04 to 81.49 cc/mol with the gradual increase of the Nd_2O_3 in the zinc borotellurite glasses. The density and molar volume for $(50-x) \text{B}_2\text{O}_3-45\text{ZnO}-05\text{TeO}_2-x\text{Nd}_2\text{O}_3$ glass system is shown in table 1 and fig.2.

Table 1. Variation of Density and Molar Volume of Neodymium Doped Zinc Borotellurite Glass System

Sr.No.	Glass Code	Glass Composition (mol%)				Molar Mass (gm)	Density (g/cm^3)	Molar Volume (cc/mol)
		B_2O_3	ZnO	TeO_2	Nd_2O_3			
1.	BZT-0.5Nd	49.5	45	05	0.5	84.85	1.73	49.04
2.	BZT-1.0Nd	49	45	05	1.0	81.92	1.37	59.79
3.	BZT-1.5Nd	48.5	45	05	1.5	83.26	1.21	68.80
4.	BZT-2.0Nd	48	45	05	2.0	84.59	1.03	81.49

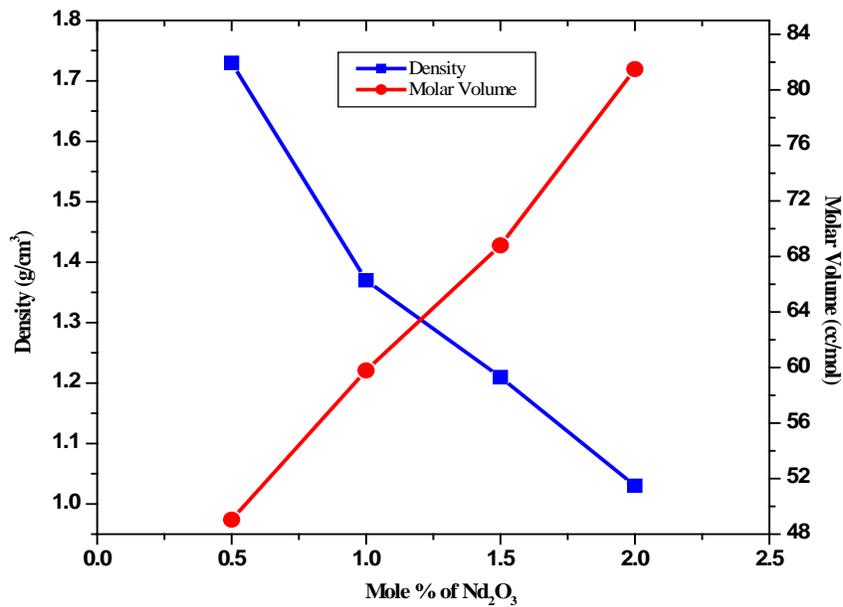


Fig.2. Variation of Density and Molar Volume of Neodymium Doped Zinc Borotellurite Glass System with the Nd_2O_3 content.

3.3 FTIR Analysis

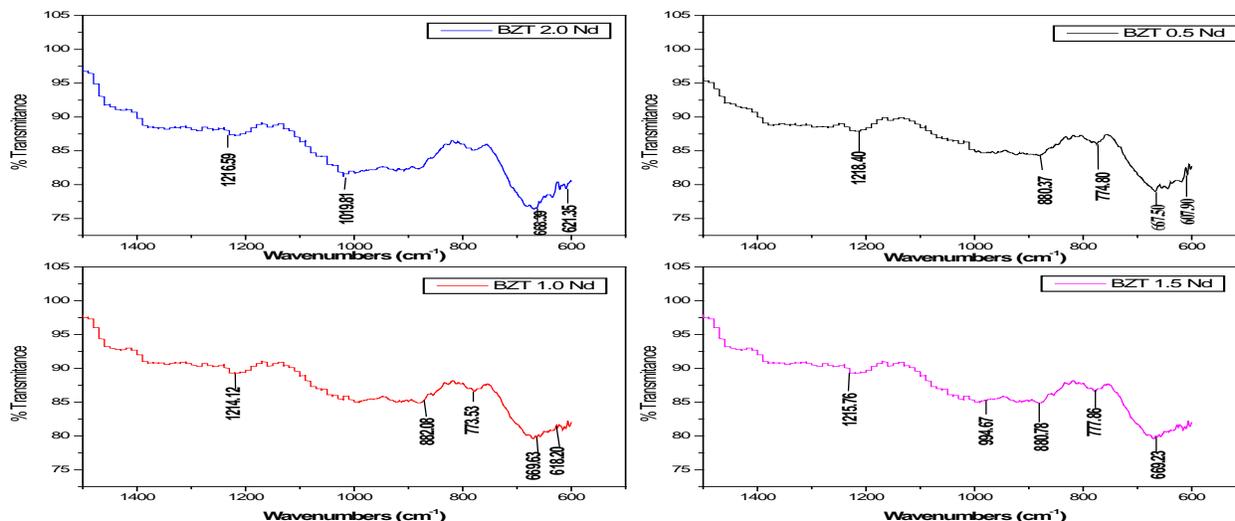


Fig.3. FTIR Spectra of 0.5-2.0% of Nd₂O₃ Doped Zinc

Borotellurite Glass System.

The FTIR spectroscopy is an analysis method which offers structural studies to explore the fundamental and functional fractions in crystalline and non-crystalline matrices. The transmission spectra of the prepared glass samples are recorded in Fig.3 with different composition of Neodymium oxide glass sample recorded in the region 600-4000 cm⁻¹. The characteristics of tellurite oxide structural unit located in the range 600-750 cm⁻¹. After the formation of glass, tellurite oxide finds in two structural units which are trigonal bipyramidal TeO₄ and trigonal pyramidal TeO₃. The first group of band (TeO₄) is located in the range 600-621 cm⁻¹ which correlates to the trigonal bipyramidal structural unit. Meanwhile second group of band is located in the region 621-700 cm⁻¹ which corresponds to the trigonal pyramidal, TeO₃ structural unit. Pure TeO₂ is characterized by an infrared absorption at around 640 cm⁻¹. The formation of borate oxide structural unit located in the region 600-800 cm⁻¹ which is attributed to bending vibrations of various borate arrangements. The band located in the range 800-1200 cm⁻¹ is due to the B-O stretching of tetrahedral BO₄ units. The band located in the range 1214-1218 cm⁻¹ is due to B-O stretching of trigonal BO₃ units [6]. The absorption band at 880-882.08 cm⁻¹ could be correspond to B-O stretching vibration of BO₄ units [7]. It can be seen that the band of ZnO does not appear in the spectra which means the zinc lattice is completely broken down [8].

IV. CONCLUSIONS

Neodymium doped zinc borotellurite glass system was successfully prepared and characterized. The amorphous nature of the glasses was confirmed by using XRD analysis. The density of the glasses decreased while their molar volume values increases with the increase of neodymium oxide content in borotellurite glasses. FTIR spectra of the glass sample shows the characteristics of tellurite oxide structural unit were located in the range 600-750 cm⁻¹.

From the IR results, the absorption bands are found to be in the range 667-669 cm⁻¹, 773-778 cm⁻¹, 880-882 cm⁻¹, 994-1019 cm⁻¹ and 1214-1218 cm⁻¹ which correspond to the stretching and bending vibrations mode. All the above conclusions are in complete agreement with the experimental results obtained.

REFERENCES

- [1] M.Farouk, A. Samir, F. Metawe, M. Elokr; Optical absorption and structural studies of bismuth borate glasses containing Er³⁺ ions. *Journal of non-crystalline solids*. 14-21. (2013).
- [2] P.Chimalawong, J.Kaewjhaio , C.Kedkaew., P.Limsuwan.(2010) "Optical and electronic
- [3] polarization of Nd³⁺ doped soda-lime silicate glasses" *Journal of Physics and Chemistry of Solids*.975-970.
- [4] M. Reza Dousti, M. Sahar, S. Ghoshal, "Effect of AgCl on spectroscopic properties of erbium doped zinc tellurite glass," *Journal of Molecular Structure*. Vol 1035, pp 6-12(2013)
- [5] R. Balda, J. Fernandez, A. Mendioroz, M. Al-Saleh. In: S. Jiang, Keys RW (eds.) Rare earth doped materials and devices VI, Proc. SPIE, Vol. 4645, 4/2002, pp 97.
- [6] V. K. Rai, L. de S. Menezes, C. B. de Araujo, *J. Appl. Phys.*, 101 (2007)123514.
- [7] H.W.Li,Sh.Q.Man,Opt. Commun.282(2009) 1579.
- [8] P.Damas, , J. Coelho, G.Hungerford, &N.S. Hussain,2012. Structural Studies of Lithium Borotellurite glasses Doped with Praseodymium and Samarium Oxides. *Materials Research Bulletin*. 47(11): 3489-3494.
- [9] M. N. Azlan, M. K. Halimah, S. Z. Shafinasand, W. M. Daud, *Journal of Nanomaterials*, 2013, 1 (2013).

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Landuse Pattern of Neyyar River Basin (2015-2016), Kerala, India

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Abstract- In order to understand the landuse pattern of Neyyar river basin, very extensive field investigation was conducted, and the findings were cartographically illustrated with the help of Geographic Information System (GIS), to provide an applicable outlook for a better landuse framing, as landuse has an inevitable role in the mere existence of the river. Geospatial pattern of the present landuse of the study area indicated that the sustainability of this river ecosystem is in danger due to unscientific landuse practices such as deforestation, reclamation of paddy fields, extensive rubber cultivation, sand mining, pollution and agglomerated settlements. The major landuse category observed in this region is settlement with mixed tree crops.

Index Terms- Landuse, GIS, Reclamation, Neyyar.

I. INTRODUCTION

Neyyar is the southern-most river of Kerala State has a total basin area of 483sq.km lies between 8°15' to 8°40'-N latitudes and 77°00' to 77°20'-E longitude. The basin covers 24 grama panchayats in Thiruvananthapuram District. The river's main tributaries are Chittar, Kallar, Karavaliar, Mullar, Aruvikod thodu, Maruthur thodu, Edamalai thodu and Talakke thodu. This southern most small river originates from Agasthya malai in the Western Ghat mountain ranges and flows through extremely mottled geologic and physiographic provinces of the area for a length of about 56km.

As far as the landuse pattern and change of Neyyar river basin is concerned, the cultural, socio-economic and population density in the basin has a decisive influence in framing the landuse. The existence of aquatic ecosystem and prosperity in biodiversity is clearly under the impacts that have shaped by landuse (Turner *et al.*, 2001). It is therefore inevitable to describe the landuse regularly, which helps in better conservation and management of natural resources. The foremost hinder for implementing such strategies is the lack of regular monitoring in the study area. In this context, the present study aims to investigate the landuse pattern of Neyyar river basin in meticulous.

II. METHODOLOGY

The landuse pattern of Neyyar basin is prepared using Survey of India Topographic Sheets (Nos.58 H/2 and 58 H/3) of 1:50,000 scale surveyed during 1966-68 (Brigadier Paintal, 1969), Google satellite images and with the help of extensive field visits during the period May 2015 to April 2016 to understand the landuse pattern of the basin in general and that of the six sites such as Neyyar Dam, Kallikadu,

Mandapathinkadavu, Aruvipuram, Neyyattinkara and Poovar in particular. The sites are fixed representatively covering three physiographic components such as high land, mid land and low land. The current landuse pattern is input in the GIS software version Arc GIS 10.1 and a map is prepared. There are fourteen categories of landuse are designed in the map (Fig-1). The stream order map of Neyyar River basin was also prepared by using GIS (Fig-2). The latitude and longitude obtained by using Global Positioning System receiver was input in GIS for locating sites in the prepared map.

III. RESULTS AND DISCUSSION

The landuse categories in Neyyar river basin mainly constitute forest area, mixed crop, settlement with mixed tree crops, built-up area and reclaimed area. The forest area includes dense forest, fairly dense forest, open forest, grassland, land with or without scrub and forest plantations such as eucalyptus, teak etc. The major landuse change observed in the forest area is deforestation and the cultivation of plantations. In Neyyar river basin the forest area is disperses in the highland physiographic region. The region well known for its biodiversity is under the verge of degradation. Forest fire and deforestation are the main threat for the biodiversity. Landslides and widening of river valleys due to physical weathering during the heavy rainy season are also common in the forest area.

Mixed crop category includes all type of agricultural crops and other tree crops. In the mixed tree crops category, the settlement or built up area will be minimal. Mixed crops are mainly concentrated at the midland physiographic area of the Neyyar basin which is dispersed mainly at the moderate relief area. In settlement with mixed tree crops category, settlements are found intercalated with the mixed crops including tree crops. In Neyyar basin majority of the area comes under this category.

Built-up are non-agricultural usage areas with buildings, transport network, communication utilities and other engineering structures. The mere ignorance of the people to consider the construction of huge buildings, transport network, communication utilities and other engineering structures, without considering sustainable ecosystem, as the symbol of development is the main ill-effect in the landuse change of our small and sensitive state. As the paddy fields and wetlands were low cost and easily available, people used to purchase and reclaim it for constructions thereby converting them into built-up areas. In Neyyar river basin majority of built-up areas are dispersed mainly at the lowland area.

The other landuse change is the extensive reclamation of paddy fields and wetlands for agricultural crops, plantation crops and other tree crops. These areas are called reclaimed area.

The dramatic change of agricultural practices during the last 50 years is one of the main driving forces for environmental degradation (George Zalidis *et al.*, 2002). In Neyyar river basin majority of paddy fields and wetlands are reclaimed. In low land physiographic area, the paddy fields are totally reclaimed. In the highland areas also most of the paddy fields are reclaimed with plantation and other agricultural crops mainly by rubber.

In Neyyar reservoir (Plate-1a&b), physiographically highland area mainly constitutes forest area, plantations including rubber, mixed crop and settlement with mixed crops. Extensive forest area can be seen at the upstream of the Neyyar basin and around the Neyyar reservoir as well. The forest area includes the dense forest, fairly dense forest, open forest, reserve forest, shrub forest, forest plantations etc. Deforestation and plantation of tree crops like eucalyptus and rubber is more common in this area. The widening of drainages is more evident in these areas due the erosion caused by huge amount of water flowing through drainage in rainy season. This storm water drainage within the forest area may cause not the destruction of forest only but also may trigger the landslides. Reclaimed paddy fields are occupied mainly by rubber. Bathing at the side of Neyyar dam and disposal of waste water including latrine waste directly into dam are noticed during our field visit, which is quite shocking and should be restricted.

The population density in the highland is less compared to midland and low land areas. Due to the fairly low population density, the struggle for existence of life is less. The paddy fields and wetlands are almost reclaimed with banana, tapioca, rubber and other mixed crops. The wetland land areas near to the roads are all reclaimed. The paddy fields are sparse. Extensive rubber plantation on reclaimed wetlands is so alarming because of the peculiarity of rubber to absorb abundant water. The agglomerated settlement area on the reclaimed wetlands is less in this area.

Due to the extensive reclamation in this area almost all the first order streams and few second order streams in the highland area below the Neyyar dam are reclaimed (Fig-2). Destruction of the basin through reclamation at the source itself is so distressing. This will adversely affect the biodiversity, sustainable ecosystem, and surface and groundwater resources of the entire basin as well. As paddy fields are well known as pollution sinks and media for filtering the ground and surface water, reclamation of them will have an adverse impact on the ecosystem. But due to the less population density, the fresh surface and groundwater in the highland is less polluted compared to midland and lowland. According to Bolstad and Swank, 1997; Liu *et al.*, 2000 and Tong and Chen, 2002, the landuse of high land especially forest area category is associated with minimal pollution threats.

Kallikadu (Plate-2a&b) is located at the highland region with extensive rubber plantation. The reclaimed area in this region is mainly occupied by rubber plantation. Rubber extract lot of water from this reclaimed paddy area is the main reason for water shortage in the highland. This also contributes to enhance the pollution of water in the area. Prior to the reclamation the wetlands and paddy fields of highland and midland contribute as a fresh water resource to the low land. Water in this region is almost stagnant due to the extensive sand mining activities. As the site is located at fairly low population density area, the

chance of heavy contamination is less. Due to the extensive reclamation of paddy field, built-up area generation and conversion to other tree crops in the highland will widely damage the drainage system and sustainable ecosystem of the drainage basin. Highland as the more sensitive area, well known for its biodiversity, good, abundant surface and groundwater, any activity that destructs the area will not only affect its ecosystem, but also damage the sustainable ecosystem of the midland and low land as well.

Mandapathinkadavu (Plate-3a&b) is located in transition area of highland and midland. Here reclamation of paddy fields is mainly concentrated in valley heads and near to the roads. The presence of paddy fields is more in the midlands compared to highland or low land. Banana and tapioca are the major crops in the reclaimed land. Drainage carrying waste water from the settlement of a micro watershed is directly debouching into the river site (Plate-3b). Construction of bunds at the site regulates river water flow. The major landuse categories at Mandapathinkadavu and surroundings are mixed crops including the tree crops, settlement with mixed tree crops, Banana, Tapioca, Rubber etc.

Deforestation and extensive cultivation of rubber plantation is observed at Aruvipuram area. The paddy reclamation is so intense and is mainly occupied by rubber. They are also occupied by crops such as banana, tapioca and the disperse presents of settlements (Plate-4a&b). The first and second order streams are being abandoned due to the crazy reclamation (Fig-2). The unscientific and extensive construction of bunds across the river is very common. All these factors will arrest the natural flow and self purification capacity of the river. Due to reclamation of wetlands, the extensive lateritic hillocks which are the major water holding formations are being derelicted in this region.

The province at Neyyattinkara, located at the lowland area is a municipal region. Due to the presence of the agglomerated settlement and industrial effluence, the site is highly polluted (Plate-5a&b). The constructions of bunds across the river in this region arrest the self purification capacity of the river and thereby enhance its pollution. It is not advisable to build the bunds across the river at the low land where the stream flow will be minimal compared to highland and midland. Consequent to such arrest in the water flow, concentration of pollutants in surface and groundwater may take place. The major landuse category in this region is settlement with mixed tree crops. Paddy and wetland reclamations are most common in this region. The reclaimed area is mainly occupied by banana, tapioca and mixed crops. The residential and other build up areas on reclaimed paddy fields and wetlands are very intense compared to that of Aruvipuram.

Due to the increase in the population density majority of newly constructed roads are laid on the reclaimed area. Most of the houses have water pumps which may reduce the ground water level to a great extent. Sand and clay mining were also intense in 1990's. First, second and even the portions of the third order streams are being reclaimed (Fig-2). Due to these factors, flash floods on the bank of the river are most often during the heavy rainfall. The widening of the river channel and physical weathering of the banks including the vegetation and settlements is another threat in the area. The reclaimed area near the main

course of the river has become water logged, marshy land especially in the area from Thirupuram to Poovar. Poovar is located near the Coast of Lakshadweep Sea where the river water is stagnant. The water is highly polluted (Plate-6a&b). All the pollutants from the upstream are concentrated in this region. The major landuse around this area is coconut plantation with mixed tree crops.

Most of the drainages in this region are converted into waste water drainage. As the groundwater and surface water are being interrelated, the chance of polluting underground water in this region is very huge. Due to complete reclamation of paddy fields and extensive sand mining most of the low land areas are being converted into areas logged with waste water. This may enhance water borne diseases. The emission of methane, carbon dioxide and hydrogen sulphide from this waste water may also cause the rise in the atmospheric temperature. All these factors trigger the extensive spread of disease in the low land compared to the midland and highland areas.

IV. CONCLUSION

In general, during our filed visits we can feel that Neyyar river basin is in the verge of total destruction due to all the above mentioned factors. The existence of a sustainable ecosystem is in danger. The surface as well as the groundwater pollution is more intense in the low land compared to the midland and high land. This reflects in the water quality as well. Human intervention enhances the pollution of Neyyar river and it will be very much high in the region at Neyyattinkara and Poovar. As paddy fields can act as water holding and water purifying region, the extensive reclamation of them will enhance the pollution of the river basin. Most of the first and second order streams especially in mid and lowland almost abandoned, point towards the intensity of damage of the basin as well as landuse scenario. All the above mentioned factors are the main reason for the flash floods at the low land region.

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REFERENCES

- [1] Bolstad, P. V. and Swank, W. T. (1997). Cumulative impacts of land use on water quality in a southern Appalachian watershed. *J. Am. Water Res. Assoc.*, 33 (3): 519-534.
- [2] Brigadier Paintal, J. S. (1969). Topographic Sheets (Kerala and Tamil Nadu). Published under the direction of Surveyor General of India. Printed at the 104 (HBD) printing group of Survey of India, Sheet No. H/2 and H/3 (First Edition).
- [3] George Zalidis., Stamatis Stamatidis., Vasilios Takavakoglou., Kent Eskridge and Nikolaos Misopolinos. (2002). Impacts of agricultural practices on soil and water quality in the Mediterranean region and proposed assessment methodology. *Elsevier-Agriculture, Ecosystems and Environment*, 88: 137-146.
- [4] Liu, A. J., Tong, S. T. Y. and Goodrich, J. A. (2000). Land use as a mitigation strategy for the water-quality impacts of global warming: a scenario analysis on two watersheds in the Ohio River Basin. *Environ. Eng. Policy*, 2: 65-76.
- [5] Tong, S. T. Y. and Chen, W. (2002). Modeling the relationship between land use and surface water quality. *J. Environ. Manage*, 66 (4): 377-393.
- [6] Turner, M. G., Gardner, R. H. and O'Neill, R. V. (2001). Landscape Ecology in Theory and Practice Pattern and Process. *Springer-Verlag*, New York, pp. 401.

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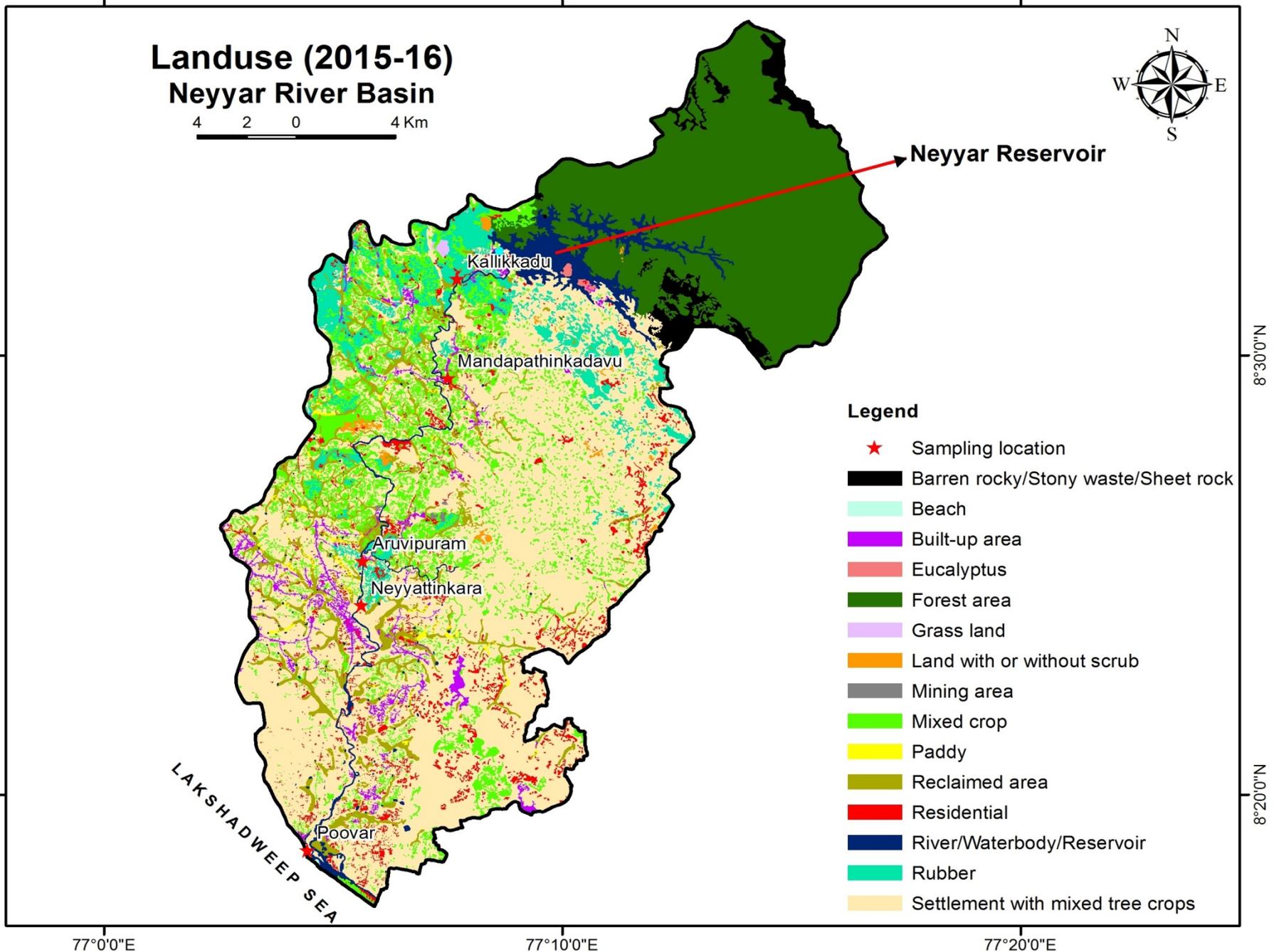


Fig 1: Landuse pattern of Neyyar River basin (2015-2016)

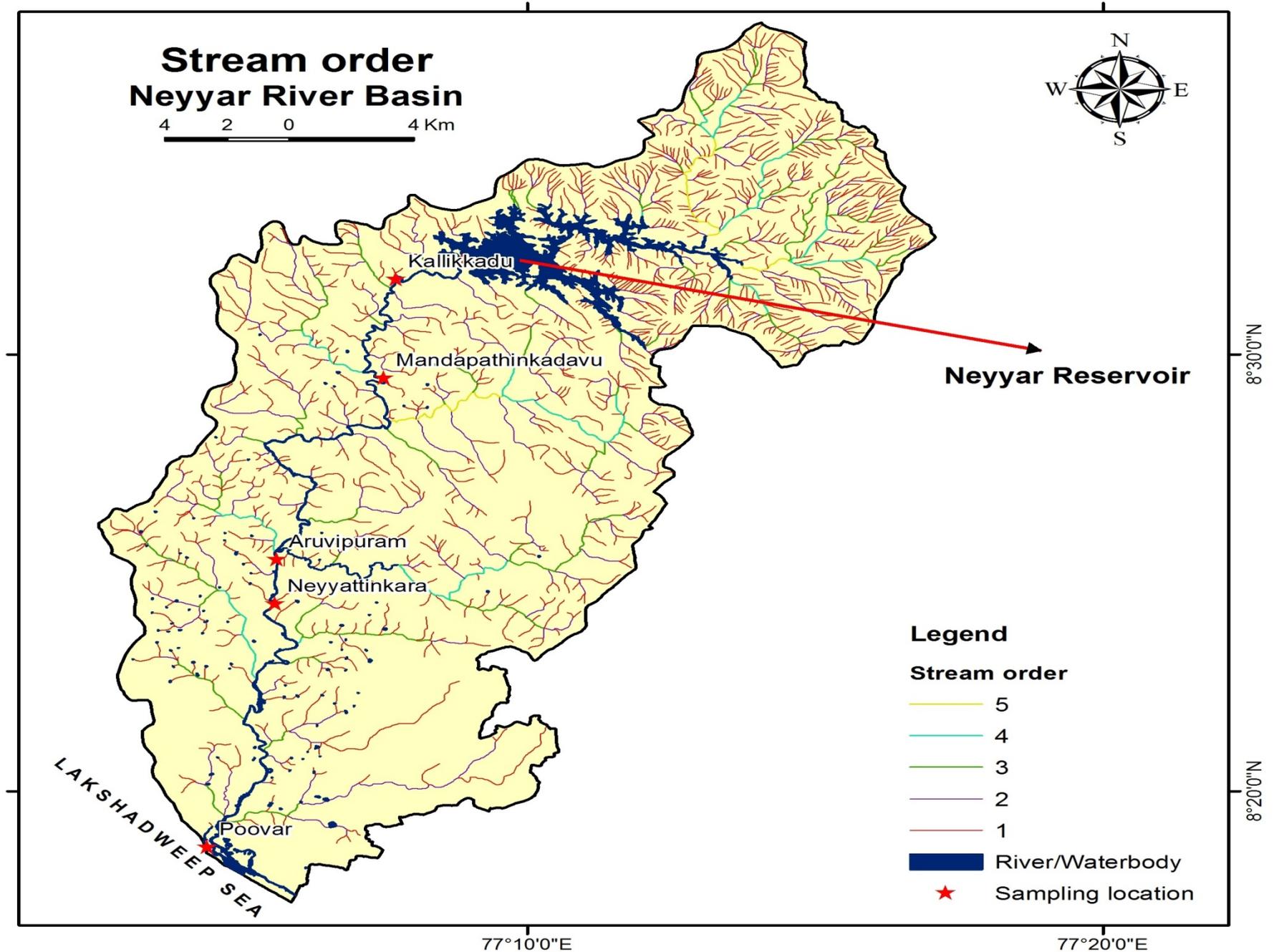


Fig 2: Stream order of Neyyar River basin



Plate 1 (a) Neyyar Reservoir



Plate 2 (b): Kallikadu



Plate 1 (b): Neyyar Reservoir



Plate 3 (a): Mandapathinkadavu



Plate 2 (a): Kallikadu



Plate 3 (b): Mandapathinkadavu



Plate 4 (a): Aruvipuram



Plate 5 (b): Neyyattinkara



Plate 4 (b): Aruvipuram



Plate 6 (a): Poovar



Plate 5 (a): Neyyattinkara



Plate 6 (b): Poovar

Design and Realization of a Conical Beam Slot Antenna for Mobile Direct Broadcasting Satellite Application

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Abstract—This Paper investigates a satellite on the move DBS (Direct Broadcasting System) receiver for receiving signal in K-band. A radially arrayed slot antenna has been designed and implemented with circular polarisation. The antenna has five concentric rings made with slots to achieve conical beam, better directivity, gain and wider frequency bandwidth. The antenna supports waveguide structure, air cavity and dielectric materials. From the simulation and measurement results we can see that our antenna has achieved the required technical specification. The antenna has demonstrated a maximum gain of 21.4 dBi at 20.6 GHz with an operational frequency bandwidth from 19 GHz to 22 GHz. The antenna has successfully satisfied the condition of circular polarisation with appropriate radiation patterns. At operating frequency 20 GHz, the antenna has achieved a directivity of 20.4 dBi with side lobe level as low as -14.8 dB.

Keywords RAS, mobile DBS, conical beam, K-band, slot antenna

I. INTRODUCTION

Recent year have witnessed a strong demand of microwave antennas in different communication systems such as in television, high-speed wireless LAN, satellite reception and mobile communication. The satellite communication market on moving vehicles such as aircrafts, trains, buses, and ships is now increasing [1]. Also there is a growing demand for broadband data communication services such as voice communication, web browsing, video streaming, high speed data transfer and so on. High frequency and high gain antennas have been at the center of interest for mobile satellite applications. Among the diversity of microwave antennas, satellite communication commonly uses parabolic dish antennas [1]–[3].

Parabolic dishes are mounted on a stabilized platform. Despite giving a pretty good gain and efficiency, the use of parabolic dishes on moving air, land, and sea vehicles are constrained by air resistance and snow build-up [4]–[6]. Also its heavy mass is difficult for manufacturing and deployment. Another solution is a flat and thin microstrip array antenna to maintain the continuous connection with the moving vehicle but the antenna provides poor efficiency when the gain is high [6], [7]. Many literature suggest several challenging techniques to overcome the limitations of this antenna. RAS antennas were originally designed for direct broadcast from satellite application at 12

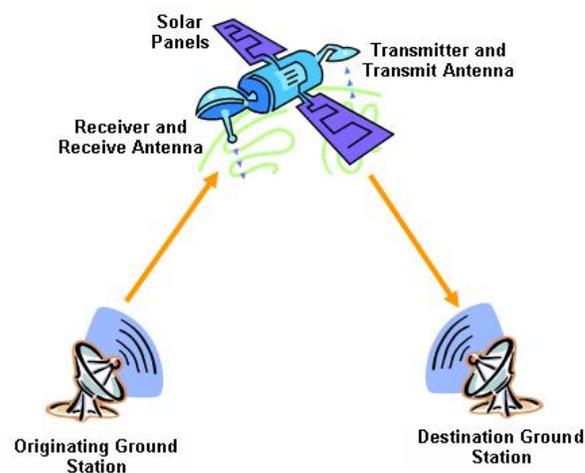


Fig. 1: Satellite on the move DBS receiver.

GHz in Japan [2], [8], [9]. Due to its compact structure, high efficiency and high gain characteristics, RAS antennas have been proposed for satellite on-board applications ever since [10]–[12]. Figure 1 and Figure 2 show the antenna with good stability to receive signal from satellite while one the move [13].

To achieve a working direct broadcast satellite (DBS) system on mobile platform a more beneficial and efficient antenna is needed which has good stability to receive the signal from satellite while on the move. The main objective of this research is to design a low cost, low profile and high-gain DBS reception antenna which will provide the continuous connection with the satellite signal without any phase array or mechanical beam steering system.

Waveguide slotted antennas are planar DBS reception antennas popular for high efficiency and high gain [14], [15]. In this paper, we have designed and investigated radially arrayed slots (RAS) antenna with conical beam pattern to cope with the problems encountered in microstrip array and parabolic antennas. The RAS antenna is a lightweight, planar antenna suitable for DBS reception, with advantages including high gain, low cost, high radiation efficiency, The antenna utilises waveguide, which maintains the outward travelling waves.

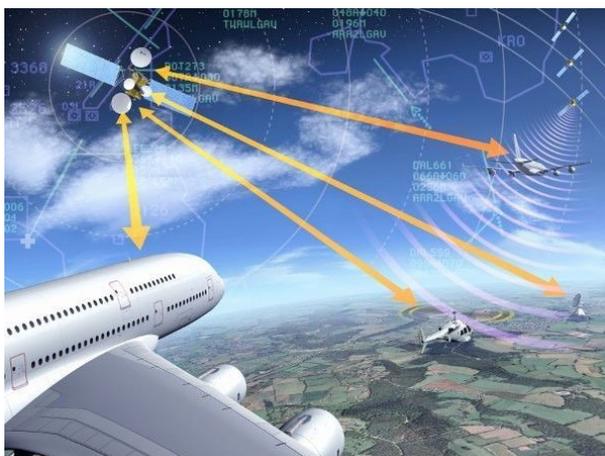


Fig. 2: Transmitting and receiving satellite signal in mobile platform.

II. CONFIGURATION AND OPERATIONAL PRINCIPLE OF RAS ANTENNA

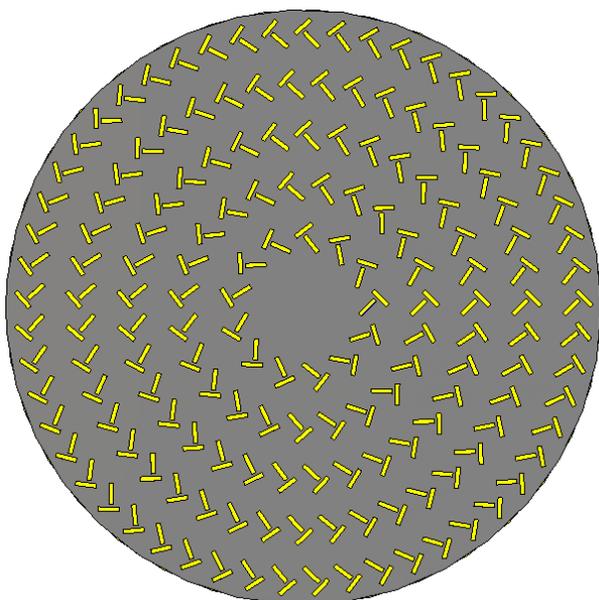


Fig. 3: Front plate with radiating slot elements.

Construction of a radially arrayed slot antenna is presented in Figure 3 and Figure 4. The basic structure consists of two metallic conducting plates with an air-cavity and dielectric slab forming an waveguide like structure. The front is consisted with radiating slots. The radiating elements are arrayed such a way that their radiation are added in phase towards the beam direction. The orientation of slots is in such a direction so as to transmit and receive the signal waves with proper polarisation, and proper coupling inside the waveguide cavity. Figure 3 shows the front plate with radiating slot elements. Dielectric materials are used widely in the design of slot antennas.

In the design of RAS antenna, grating lobes affect the overall performance of the antenna. Dielectric materials are used to reduce the risk of grating lobes in the direction of main lobe. They provide a measure of their effect that is related to the permittivity of the material. Permittivity is a quantity which

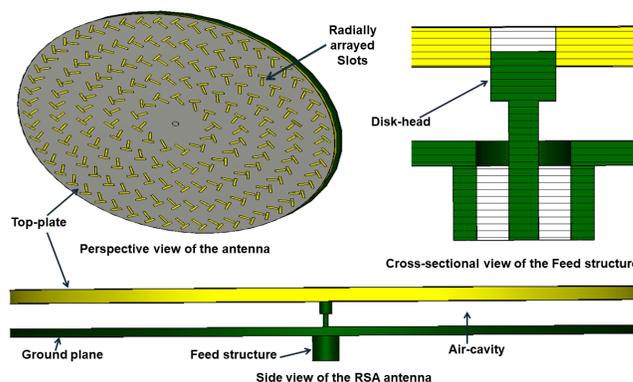


Fig. 4: Prospective view of radially arrayed slot antenna.

describes the effect of a material in an electric field: the higher the permittivity, the ability of the material is more to reduce any field set up into it. The dielectric constant $\epsilon_r > 1$ was chosen here to suppress the grating lobes. The power is fed into the waveguide via a rear mounted coaxial to waveguide transition feed. The transition feed is consisted with disc ended head ensures proper matching of the radial waveguide to the coaxial transmission line.

The disk ended head converts the power from transverse electromagnetic (TEM) transmission line mode to TEM cavity line mode. The energy radiated from the disk-ended feed probe travels outwardly into the waveguide cavity. The dielectric material filling the cavity creates a slow wave structure and minimizes reflection inside the coaxial transmission line. An area of radius ρ_{min} around the center on the radiating surface is left unmodified for stability of the travelling wave before the slots are encountered. The slots are arrayed on the radiating surface in a specified distribution so that a greater percentage of the energy in the cavity forms a conical beam with a specific polarization. Energy not radiated by the antenna is either reflected back or lost to the space outside the wave cavity. In this case, the lost energy escapes via an open edge.

III. TECHNICAL SPECIFICATION

In this research, the target design is used for SOTM (satellite-on-the-move) DBS receiver which operates at K-band. The antenna should also has conical beam pattern with bandwidth > 2 GHz. The detail of technical specifications can be seen as Table I below.

TABLE I: Technical Specification

Frequency	20 GHz
Polarization	Circular
Slot Length, L	4.91 mm
Slot Width, W	1 mm
Antenna Radius, R	177 mm
Number of Slot pairs	166
Slot Pair Types	Concentric

IV. FEEDER

This RLSA antenna is fed by a coaxial adaptor in the mid bottom of the antenna which emitting an outward travelling

wave. The excitation mode is coaxial mode. Here, we used a 50 ohm SMA connector that has 6.4 mm height inner conductor. The coaxial probe is coated with Teflon to feed the signal into the cavity.

V. SIMULATION RESULTS

The antenna design was simulated using CST Microwave Studio. Figure 5 shows the return loss of the antenna. The return loss bandwidth is 500 MHz from 19.6 GHz to 20.1 GHz.

Figure 6 shows the radiation efficiency and total efficiency of the antenna. The antenna efficiencies have enhanced significantly. Radiation efficiency is more than 95% from 19 GHz to 22 GHz. At 20 GHz the total efficiency is 90.6% and radiation efficiency is 95.2%.

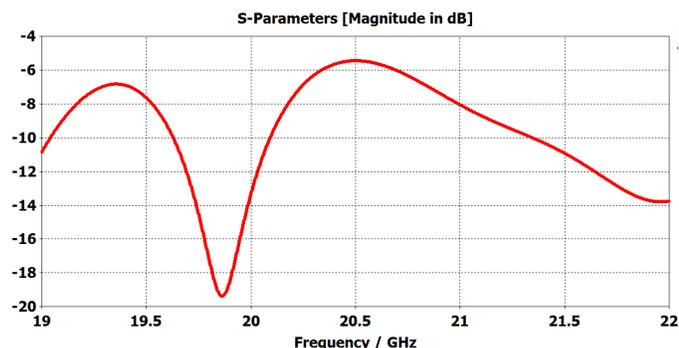


Fig. 5: Return loss of the RAS antenna.

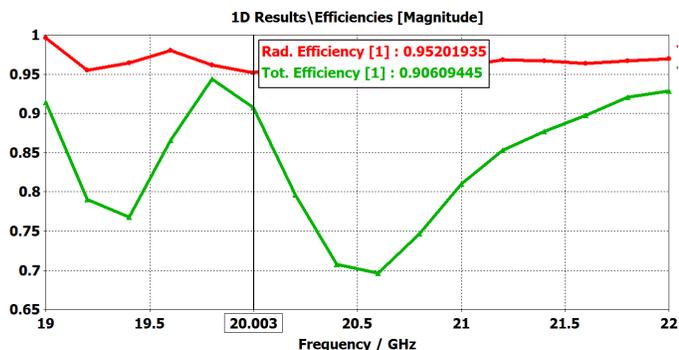


Fig. 6: Total efficiency and radiation efficiency of the antenna.

Figure 7 shows the simulated radiation pattern of the RAS antenna at 20 GHz. We can see from Figure 7 that simulated RAS antenna has conical radiation pattern. The maximum gain achieved with the radiation beam is 20.6 dBi.

Figure 8 shows the axial ratio of the RAS antenna which is below 3-dB level that satisfies the circular polarisation condition. Figure 9 and Figure 10 show the simulated radiation pattern in cartesian plots at 20 GHz. The side lobe level obtained at 20 GHz was -14.8 dB. The radiation pattern is symmetrical and the first side lobe level -14.8 dB indicates the normal antenna operation. Figure 9 shows us the radiation pattern in elevation plane and Figure 10 shows us the radiation pattern in azimuth plane.

The aperture amplitude and phase are almost uniform over the aperture. The directivity of the antenna has shown in

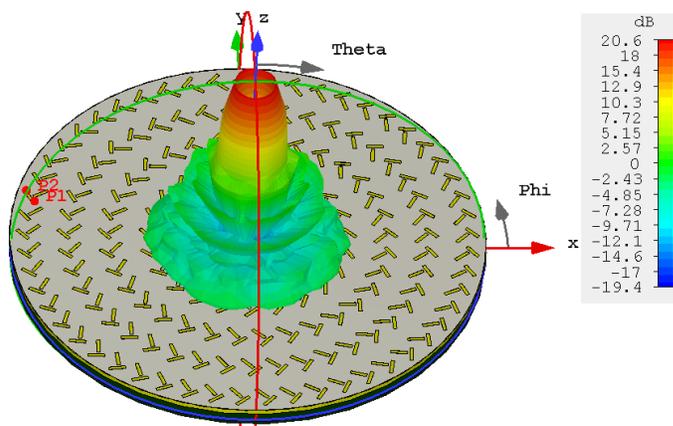


Fig. 7: Simulated radiation pattern of the RAS antenna at 20 GHz.

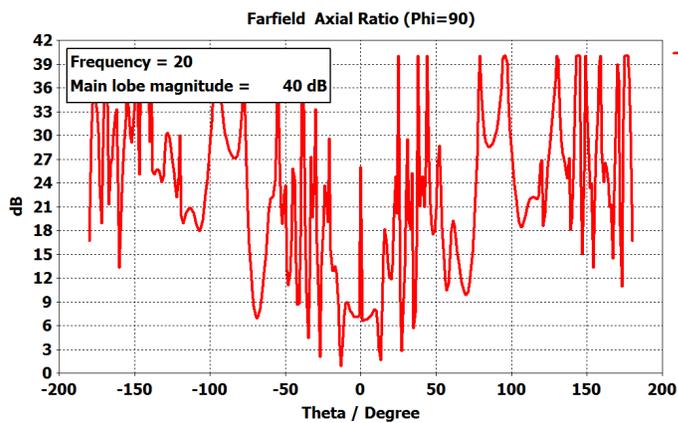


Fig. 8: Axial ratio of the RAS antenna.

Figure 11. The antenna has demonstrated a maximum gain of 21.4 dBi at 20.6 GHz.

Figure 12 shows the realised gain of the RAN antenna at the frequency of maximum directivity i.e, 20.6 GHz in polar coordinates. The maximum gain is demonstrated as 19.6 dBic at 20.6 GHz. The angular beamwidth is 5.6 degree. The side lobe level is as low as -15.2 dB. We can see that our optimized RAS antenna has provided better performance than previously obtained models and also fulfilled the technical specification.

VI. CONCLUSION

A SOTM DBS receiver has been designed and implemented successfully based on radially arrayed slot antenna which operates at K-band. This RAS antenna has five concentric array slot pairs to achieve conical beam, better gain and wider frequency bandwidth compared to others model. This RAS antenna has conical beam and circular polarization, with 20.4 dBi dBi at 20 GHz, operational frequency bandwidth about 4 GHz and axial ratio is below 3 dB level. The high potential of RAS antennas as well as the validity of their analysis and the design are fully demonstrated in this paper. Therefore our optimised antenna has passed the technical specifications and appropriate for satellite on the move DBS receiver. Moreover, this low cost implementation of RAS antenna will decrease the

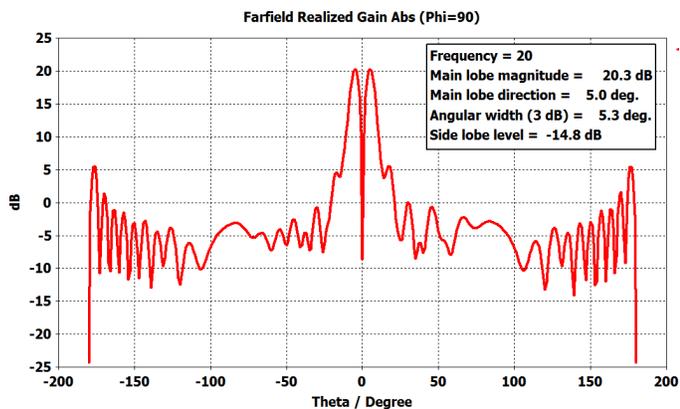


Fig. 9: Simulated radiation pattern in elevation plane at 20 GHz.

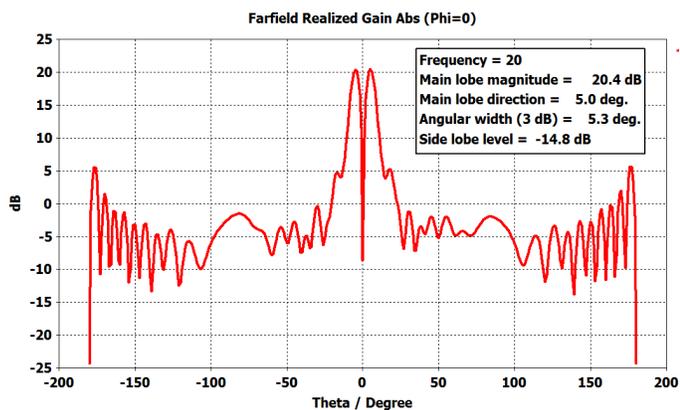


Fig. 10: Simulated radiation pattern in azimuth plane at 20 GHz.



Fig. 11: Directivity of the radially arrayed slot antenna.

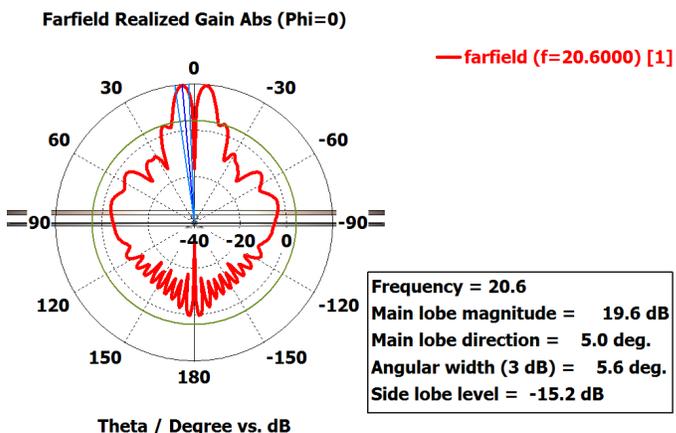


Fig. 12: Realised gain of the antenna at 20.6 GHz.

DBS deployment and manufacturing at public trains, ships and buses all over the world.

REFERENCES

[1] M. Takahashi, J. I. Takada, M. Ando, and N. Goto, "A slot design for uniform aperture field distribution in single-layered radial line slot antennas," *IEEE Transactions on Antennas and Propagation*, vol. 39, no. 7, pp. 954-959, Jul 1991.

[2] M. Ando, K. Sakurai, and N. Goto, "Characteristics of a radial line slot antenna for 12 GHz band satellite TV reception," *IEEE Transactions on Antennas and Propagation*, vol. 34, no. 10, pp. 1269-1272, 1986.

[3] Y. Liu, H. Xiao, and G. Lu, "Design of a high gain circular polarized radial line slot antenna," in *2014 Seventh International Symposium on Computational Intelligence and Design*, Dec 2014, vol. 2, pp. 490-493.

[4] C. W. Yuan, S. R. Peng, T. Shu, Z. Q. Li, and H. Wang, "Designs and experiments of a novel radial line slot antenna for high-power microwave application," *IEEE Transactions on Antennas and Propagation*, vol. 61, no. 10, pp. 4940-4946, Oct 2013.

[5] M. Albani, A. Mazzinghi, and A. Freni, "Automatic design of CP-RLSA antennas," *IEEE Transactions on Antennas and Propagation*, vol. 60, no. 12, pp. 5538-5547, Dec 2012.

[6] S. Peng, C. W. Yuan, T. Shu, J. Ju, and Q. Zhang, "Design of a concentric array radial line slot antenna for high-power microwave application," *IEEE Transactions on Plasma Science*, vol. 43, no. 10, pp. 3527-3529, Oct 2015.

[7] P. W. Davis and M. E. Bialkowski, "Linearly polarized radial-line slot-array antennas with improved return-loss performance," *IEEE Antennas and Propagation Magazine*, vol. 41, no. 1, pp. 52-61, Feb 1999.

[8] M. Ando, T. Numata, J. I. Takada, and N. Goto, "A linearly polarized radial line slot antenna," *IEEE Transactions on Antennas and Propagation*, vol. 36, no. 12, pp. 1675-1680, Dec 1988.

[9] P. W. Davis and M. E. Bialkowski, "Experimental investigations into a linearly polarized radial slot antenna for DBS TV in Australia," *IEEE Transactions on Antennas and Propagation*, vol. 45, no. 7, pp. 1123-1129, Jul 1997.

[10] S. I. Zakwoi, T. A. Rahman, I. Maina, and O. Elijah, "Design of Ka band downlink radial line slot array antenna for direct broadcast satellite services," in *2014 IEEE Asia-Pacific Conference on Applied Electromagnetics (APACE)*, Dec 2014, pp. 159-162.

[11] M. Takahashi, M. Ando, N. Goto, Y. Numano, M. Suzuki, Y. Okazaki, and T. Yoshimoto, "Dual circularly polarized radial line slot antennas," *IEEE Transactions on Antennas and Propagation*, vol. 43, no. 8, pp. 874-876, Aug 1995.

[12] J. M. Fernandez Gonzalez, P. Padilla, G. Exposito-Dominguez, and M. Sierra-Castaner, "Lightweight portable planar slot array antenna for satellite communications in X-Band," *IEEE Antennas and Wireless Propagation Letters*, vol. 10, pp. 1409-1412, 2011.

[13] TS Lim and KG Tan, "The development of radial line slot array antenna for direct broadcast satellite reception," *International journal of electronics*, vol. 94, no. 3, pp. 251-261, 2007.

[14] M. Sierra-Castaner, M. Sierra-Perez, M. Vera-Isasa, and J. L. Fernandez-Jambina, "Low-cost monopulse radial line slot antenna," *IEEE Transactions on Antennas and Propagation*, vol. 51, no. 2, pp. 256-263, Feb 2003.

[15] I. M. Ibrahim, T. A. Rahman, M. I. Sabran, and M. F. Jamlos, "Bandwidth enhancement through slot design on RLSA performance," in *2014 IEEE Region 10 Symposium*, April 2014, pp. 228-231.

The role of Home health visiting in improving knowledge on primary health care services in selected Gramaniladhari divisions in Gangawatakorale MOH area, Sri Lanka

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Abstract- Home health visiting (HHV) is a proven strategy for strengthening families and improving the health status of women, children and their families. Advantages of HHV are: Reach families who wouldn't come to the regular clinics and work with family members in their home setting. HHV in Sri Lanka is used in Family Health Programme to promote family health. A HHV programme has been conducted by the nursing undergraduates of Faculty of Allied Health Sciences to promote PHC concepts of Alma-Ata declaration in Udaperadeniya (UDA) and Augustawaththa (AUG) Gramaniladhari (GN) areas. Since there is an intent to ensure the primary health care strategies in the community, it is necessary to assess the level of achievement of those mentioned PHC strategies. A descriptive cross-sectional study was conducted recruiting all the home health visited families on the last day of HHV using a pre-tested self-administered questionnaire. All the PHC concepts mentioned in the seventh statement in Alma-Ata declaration were considered. Among total participants 51.4% represent the Augustawaththa GN area. Following PHCs were always promoted during HHV in both GN areas: Methods of preventing and controlling health problems (AUG=55.6%, UDA=64.7%), Proper nutrition (AUG=55.6%, UDA=44.4%), Basic sanitary practices (AUG=61.1%, UDA=58.8%) and Support to communicate other health care resources (AUG=50%, UDA=58.8%). Maternal and child health care ($p < 0.05$), and Prevention and control of locally endemic diseases ($p < 0.05$). More than 95% of study participants mentioned that in general HHV upgraded their knowledge on individual and family health. The number of children in a family has influenced in upgrading knowledge on PHC concepts. HHV is an essential component in upgrading knowledge on the health of family in Udaperadeniya and Augustawaththa GN divisions in Gangawatakorale MOH area.

Index Terms- Home Health visiting (HHV), Primary health care concepts, Sri Lanka

I. INTRODUCTION

1.1 BACKGROUND

Home visiting is a proven strategy for strengthening families and improving the health status of women, children and their families. Home visitation or health visiting has been widely

used as an intervention strategy in health care services in many countries. It has been defined as "planned activities aimed at the promotion of health and prevention of disease. It therefore contributes substantially to individual and social well-being, by focusing attention at various times on an individual, a social group or a community" (Cowley, 2003). Home visits are an important part of work at a Family Place. Families who participate in therapeutic interventions in clinics are also receiving field clinic services at their houses. It's a valuable time to help coach the parents in important skills as well as identify any additional needs the family may have.

Parents and children often feel more relaxed in their own home, and parents appreciate having time to talk on a one-to-one basis. It helps to develop a relationship and trust in a more relaxed environment (Marshall, 2006). After a home visit, parents often feel more confident in approaching a practitioner with comments and questions. The closer relationship may also mean families are more inclined to take part in the achievement of goals related to home visiting. Other than that there are many advantages of home visiting; Reach families who wouldn't come to the regular clinics, Work with more of the family members, Work with families in their own setting where they are more at ease, Gain greater understanding of the family's life and strengths are some of those. There is a lack of evaluative research about health visiting practice, service organization or universal health visiting as potential mechanisms for promoting health and reducing health inequalities (Cowley et al, 2014).

1.2 LITERATURE REVIEW

Home health visiting (HHV) began in Great Britain in the mid-nineteenth century, Denmark in the 1930s, and in most other European countries in the period immediately following World War II. The British system has been especially influential cross-nationally, and its history is instructive (Goodwin, 1991, 1992). HHV exists to some extent in all of the northern and western European countries as part of their national, universal systems of health care. These countries include Denmark, Finland, France, Germany, Great Britain, Ireland, Italy, the Netherlands, Norway and Sweden. All the HHV services are voluntary, free, and not income-tested (Wasik, Bryant and Lyons, 1991).

HHV began to focus on problems of sanitation and epidemics. Early on, nurses, sanitary engineers, or lay visitors were sent into the homes of families with young children to offer advice about health and hygiene. The first special training course for nursing and health visiting was established in 1892, a parallel in time to the first social work courses in the United States. There were early ties to the cooperative movement and workers' institutes, again paralleling early social work and settlement house work in the Britain. Today, the HHV program in many countries is a key component of its Maternal and Child Health (MCH) service (Kamerman and Kahn, 1993).

HHV in Sri Lanka is conducted in relation to the Family Health Programme and several packages of interventions that are aimed to promote the health of families around the country with special emphasis on mothers and children. The programme provides the most wide spread community based health care services enjoyed by Sri Lankan public. The origin of it dates back to 1926, when it was initiated in Kalutara, as the first field based health unit system of the country (Annual Report on Family Health, 2013).

The Government of Sri Lanka is committed to achieve the Millennium Development Goals with strengthening of Primary Health Care (PHC) as a key strategy. Sri Lanka is experiencing a shift in its disease patterns. Whilst still being affected by communicable diseases like Tuberculosis, Dengue fever, diarrhea and Acute and Chronic Respiratory infections; clearly evidence based studies showing a greater significance in the shift of the morbidity and mortality patterns. Preventive health care services contributed significantly to reduce the morbidity and mortality patterns. Home health visiting is one of the key activities conducted to achieve primary health care strategies at grass root level.

The Nursing undergraduates of Faculty of Allied Health Sciences also expected to get opportunity to do the Home Health visiting for the partial fulfillment of the degree. The primary health care concepts (PHC) were expected to be promoting during their HHV. HHV were conducted during two months period. According to the Alma-Ata declaration, following PHC concepts were considered; Education concerning prevailing health problems, Methods of preventing and controlling prevailing health problems, Promotion of food supply, Proper nutrition, Adequate supply of safe water, Basic sanitary practices, Maternal and child health care, Family planning, Immunization against the major infectious disease, Prevention and control of locally endemic disease, Appropriate treatment of common disease and injuries and support to communicate other health care resources. Since there is entreat to ensure the primary health care strategies in the community it is necessary to assess whether those mentioned factors are being properly addressed through the home visit done by the nursing undergraduates of the Faculty of Allied Health Sciences. Therefore assessment of role of Home visiting in improving knowledge on primary health care services in selective Gramaniladhari divisions in Gangawatakorale MOH area was paramount importance.

1.2 OBJECTIVE

To determine the extent of achievement of primary health care concepts and influence of socio-demographic characteristics when achieving primary health care concepts by the selected communities in Gangawatakorale MOH area.

II. METODOLOGY

3.1 Study Design

A descriptive, cross sectional, quantitative study was conducted.

3.1 Study setting

The present study was conducted in selected communities in Augustawaththa and Udaperadeniya gramaniladhari areas in Gangawatakorale MOH area situated in the Kandy district.

3.2 Study population

Study population was parent who had low body weight children in Augustawaththa and Udaperadeniya gramaniladhari area.

3.3 Inclusion criteria

A parent from home visiting families, who had the ability to understand and speak Sinhala and Tamil language and who consented participation in the study were included as study participants.

3.4 Exclusion criteria

Women who had chronic or diagnosed psychiatric disorders, Women who did not consent to participate and Women who were unable to answer the questionnaire were excluded from the study.

3.7 Data collection instruments

A self administered structured questionnaire (SAQ) was used to collect information. Some questions were taken from already developed and used questionnaire in the literature. Questionnaire was offered in Sinhala and Tamil languages.

3.8 Data collection

Initially, the questionnaire was translated into Sinhala and Tamil languages and cross-checked by competent translators. Necessary changes were made where relevant. In order to avoid any ambiguities in words/questions and also to check the logical coherence of questions, the questionnaire was pretested by recruiting ten parents from Hindagala gramaniladhari area.

3.9 Ethical consideration

Ethical clearance was obtained from the ethical clearance committee of Faculty of Allied Health Sciences, University of Peradeniya. Informed consent was obtained from each participant before being recruited to the study.

3.10 Data entry and analysis

Data was managed by using Microsoft excel and SPSS version 20 software. After collection of the data it was entered into tables in Microsoft Excel and the results were, when possible,

tested with Chi square test to see whether there was statistically significant or not, by using SPSS statistical software. All variables were nominal. Differences in the distribution of answers were also analyzed.

IV.RESULTS

Table1: Distribution of participants by socio-demographic characteristics

Demographic Data	Rating & Intervals	Frequency	Percentage (%)
Age	20-25	5	14.3
	26-30	12	34.3
	31-35	13	37.1
	>35	5	14.3
Civil Status	Married	35	100
Education level	Below G.C.E O/L	13	37.1
	G.C.E O/L Passed	5	14.3
	Up to G.C.E A.L	8	22.9
	G.C.E.A/L Passed	5	14.3
	Graduate/Post Graduate	4	11.4
Nationality	Sinhala	29	82.9
	Tamil	6	17.1
Religion	Buddhist	27	77.1
	Hindu	3	8.6
	Catholic/Christian	5	14.3
No of children in family	one	14	40.0
	Two	15	42.9
	Three	3	8.6
No of family visits	Six	3	8.6
	Seven	16	45.7
	more than seven	16	45.7

Results revealed that, majority of the participants (37.1%) were in 31-35 age categories. All respondents (100%) were married. Concerning the educational level, the study indicated that the majority of participants (37.1%) were illiterate. Regarding the Nationality 82.9% were Sinhala, while 17.1% were Tamil and among total participants 77.1% were Buddhist. In regard to number of children in the family, majority of the participants (42.9%) had two children in their family.

Table 2: Distribution of the study sample according to successfully achieved PHC concepts through the HHV

Primary health care concept	Rating	Frequency	Percentage (%)
Education concerning prevailing health problems	Rarely	2	5.7
	Some times	4	11.4
	Usually	17	48.6
	Always	12	34.3
	Total	35	100%
Promotion of food supply	Rarely	2	5.7
	Some times	4	11.4
	Usually	14	40.0
	Always	15	42.9
	Total	35	100%
Proper nutrition	Not at all	1	2.9
	Rarely	1	2.9
	Some times	1	2.9
	Usually	18	51.4
	Always	14	40.0
	Total	35	100%

Adequate supply of safe water	Some times	1	2.9
	Usually	20	57.1
	Always	14	40.0
	Total	35	100%
Basic sanitary practices	Some times	2	5.7
	Usually	21	60.0
	Always	12	34.3
	Total	35	100%
Maternal and child health care	Some times	5	14.3
	Usually	18	51.4
	Always	12	34.3
	Total	35	100%
Immunization against the major infectious disease	Some times	5	14.3
	Usually	18	51.4
	Always	12	34.3
	Total	35	100%
Prevention and control of locally endemic disease	Rarely	1	2.9
	Some times	7	20.0
	Usually	16	45.7
	Always	11	31.4
	Total	35	100%

Results found that, among the extent of successfully achieved primary health care concepts, promotion of food supply was the most absorbed area by the participants (42.9%). Subsequently, concepts of proper nutrition and adequate supply of safe water were absorbed equally (40%).

Table 3: Distribution of the study sample according to considerably poor achieved PHC concepts through the HHV

Primary health care concept	Rating	Frequency	Percentage (%)
Methods of preventing and controlling prevailing health problems	Rarely	3	8.6
	Some times	3	8.6
	Usually	21	60.0
	Always	8	22.9
	Total	35	100%
Family planning	Rarely	1	2.9
	Some times	11	31.4
	Usually	14	40.0
	Always	9	25.7
	Total	35	100%
Appropriate treatment of common disease and injuries	Rarely	2	5.7
	Some times	9	25.7
	Usually	18	51.4
	Always	6	17.1
	Total	35	100%
Support to communicate other health care resources	Rarely	4	11.4
	Some times	2	5.7
	Usually	19	54.3
	Always	10	28.6
	Total	35	100%

Study results revealed that, among the extent of considerably poor achieved primary health care areas, appropriate treatment of common disease and injuries was the most poorly absorbed area by the study participants (17.1%). Concepts of methods of preventing and controlling prevailing health problems (22.9%), Family planning (25.7%) and Support to communicate other health care resources (28.6%) were poorly achieved respectively.

Table 4: Association between number of home visits & Achievements of PHC concepts

Answer	PHC Concepts Achieved n (%)	PHC Concepts Not Achieved n (%)	X ²	df	P value
Home visits Sufficient	62.5%	37.5%	4.375	1	0.036
Home visits not sufficient	0.0%	100%			

df= degree of freedom

Study results showed that there was significant association remained between numbers of HHVs and PHC concepts achievement (P=0.036).Statistical significant set at p=0.05.

V. DISCUSSION

Home health visiting is one of the fastest growing segments of the health care industry. HHV can meet both medical and non medical needs of the family as an effective tool for meet the primary healthcare needs of the whole family. The central attributes of primary care are: first contact (accessibility), continuity and longitudinality (personal-focused preventive and curative care overtime), patient-oriented comprehensiveness and coordination, including navigation towards secondary and tertiary care. This means that the primary health care team deals with continuous care for all unselected health problems in all patient groups, irrespective of social class, religion, ethnicity, etc (Stuteley., 2002). Present study, conducted by the nursing undergraduates of the faculty of Allied Health Sciences among selected gramaniadhari divisions in Gangawatakorale- MOH area, in order to assist for meet the primary health care needs of the community in that area in some extent without regarding their differences of socio demographic characteristics. Assessment of need is still a core component of health visiting practice and an educational requirement for qualification (Nursing and Midwifery Council 2004)

Needs identification and understanding the concept of need from the family’s perspective have been described as a central pre-requisite to gaining access to the family’s physical private space (the home) and also to building trust and to relationship formation (Mays, 2005). Needs identification and attempts to meet identified needs may symbolize the good intent and efficacy of the health visitor (Watson., 2007) Present study was assessed few selected areas of primary health care needs of the participant’s family by several visits. Nursing

Undergraduates were specially addressed the maternal and child health since its play a vital role in the HHV. Cowley, Caan, Dowling and Weir (2007) found that home visiting was central to the delivery of health promotion for families with young infants, with contacts mainly concerning families with babies aged less than one year.

VI. CONCLUSION

Home-visitation programs can be an effective early-intervention strategy to improve the health and well-being of all family members, particularly among children, if they are embedded in comprehensive community services to families at risk. Number of HHVs significantly influence on improving the awareness on PHC concepts among participants.

VII REFERENCES

Annual Report on Family Health, 2013, Family Health Bureau, Ministry of Health care and Nutrition-Sri Lanka.

Cowley, S., & Houston, A. M. (2003). A structured health needs assessment tool: acceptability and effectiveness for health visiting. *Journal of Advanced Nursing*, 43(1), 82-92.

Kamerman, S, B., Kahn, A, J.(1993 Winter) Home Health Visiting in Europe. *The future of Children*, 3 (3), 39-53

Watson, M., Kendrick, D., Coupland, C., and Futers, D. (2007). Childhood injury prevention: the views of health visitors and nursery nurses working in deprived areas. *International Journal of Health Promotion & Education*, 45(1), 4-10.

Stuteley, H. (2002). The Beacon Project - a community-based health improvement project. *British Journal of General Practice*, 52(Supplement 1), 44-45.

Nursing & Midwifery Council (2004) Standards of Proficiency for Specialist Community Public Health Nurses. London, Nursing and Midwifery Council

Mays N., Pope C. and Popay J. (2005) systematically reviewing qualitative and quantitative evidence to inform management and policy-making in the health field. *Journal of Health Service Research and Policy*. 10 (Suppl. 1), pp. S1:6-S1:20

Marshall, J. L., Renfrew, M. J., and Godfrey, M. (2006). Using evidence in practice: What do health professionals really do? A study of care and support for breastfeeding women in primary care. *Clinical Effectiveness in Nursing*, 9, Suppl 2, e181-e190.

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ICT Competence among College Teachers: An Assessment

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Abstract- Education is a reflection of good civilization. Human civilization has progressed by innovation in education since periods. Education spreads awareness in society about how we can be a good social being and help others in our daily life. Understanding how education system work and how it evolve over time has been one of the most important research agendas in recent years. The education system of any economy performs following main tasks: first, it handles the basic and higher education; second, it provides better opportunities of income; third it enhances the living standard and helps in social development. This study attempts to assess the competency level of college teachers in the use of ICT, their level of motivation and the challenges faced by them. The study was conducted in five colleges of Ernakulam District. 50 teachers were taken in to consideration by adopting Multi stage random sampling. And the study found that majority of the teachers have access to broad band but the use of ICT enabled facilities are lacking. Inadequate training, Insufficient time due to work load, absence of ICT facilities, lack of funds are some of the factors which hinders the successful integration of ICT.

Index Terms- ICT, Competency Level of Teachers, Level of Motivation.

I. INTRODUCTION

Education is the backbone of a nation. It focuses on the creation of high quality and well trained human resources to fulfill the need of ever growing Indian economy, but on other hand it face challenges at operational level. Educational governing bodies like UGC, AICTE, ICMR, ICAR, all possess difficulties to maintain proper coordination, administration, monitoring and evaluation for improving the quality of education and also imparting the education. Considering the higher education in India it has seen a massive growth in post-independence era by integrating ICT. The education system has changed from the traditional classroom of desks, notebooks, pencils, and blackboard to an online forum of computers, software, and the Internet intimidates. Because the students are expecting more than a traditional classroom can provides to them. This necessitates a study about the teacher's competence in the use of ICT.

II. METHODOLOGY

The universe of the study comprised the teachers of Government and Aided Colleges in Kerala state. But the sample is confined to Ernakulam district from where 50 teachers were

taken by adopting multi staged random sampling. Primary data is collected through questionnaires. Secondary data is collected from journals, business magazines and web sites. The primary data collected were classified, tabulated and analysed keeping in view the objectives of the study. Percentages are expressed to the nearest multiple of one. The mathematical tools applied are weighted averages to measure the level of motivation and percentages.

III. RESULTS

This study attempts to assess the competence of college teachers in the usage of ICT. Data were collected from 50 respondents from both Government and Aided colleges of Ernakulam district by using a survey schedule. Result of analysis is given below:

Table: 4.1-Profile of Respondents

Group	Number	%
• Gender		
Male	22	44
Female	28	56
• Age		
Below 30	4	8
30 to 50	36	72
Above 50	10	20
• Subject		
Commerce	16	32
Economics	14	28
Science	12	24
Language	8	16
• Area		
Urban	15	30
Rural	35	70
	50	100

• Nature of Management		
Government	19	38
Aided	16	32
• Grade as per NAAC accreditation	15	30
B		
• Teaching experience		
Below 10		
10-20		
More than 20 years		

Source: Field survey

Table 4.1 shows the details about the profile of the respondents. Out of the 50 respondents 28 respondents are females (56%) and 22 respondents are males (44%). Majority of the respondents belong to the age group of 30 to 50 (72%), 10 respondents belong to the age group of above 50(20%), and only 4 teachers belong to the age group of below 30. Major portion of the respondents belong to commerce faculty (32%), followed by economics (28%) and science and language teachers are 24% and 16% respectively. Area wise classification of the teachers shows that majority of the respondents (88%) belong to the rural area. 70% of the teachers belong to the aided colleges and the remaining 30% of teachers belong to government colleges. All the respondents belong to B grade colleges accredited to. 38% of teachers having teaching experience of below 10 years, 32% of the teachers having experience of 10 to 20 years and the remaining 30 % of teachers having teaching experience of more than 20 years.

Table 4.2: Access to Broadband and Teaching Aides

	Sufficient	Moderate	Insufficient	Total
Broadband	40	8	2	50
Teaching Aids	29	16	5	50

Source: Field Survey

Table 4.2 shows the teacher’s access to broad band and other teaching aids like LCD and computer .It is revealed that that majority of the respondents have sufficient access to broad band and teaching aids.

Table4.3: Mode of Teaching

Mode of Teaching	%
Lecture method	34
Lecture and use black board	74
Lecture and LCD projector	22
E-Content	08

Source: Field Survey

From the above table it is clear that 74% of the teachers depend on lecture and black board. Only 22% use LCD projector along with lecture method and 8% of the teachers depend on E-Content. 34% of the teachers still follow the traditional method text lecturing.

Table4.4: Use of Hardware

Hardware Used	Mean Rank	Rank No
Computer	1.27	1
Printer	3.27	3
LCD	2.73	2
Television	3.73	4
Scanner	5.27	6
Video	4.73	5

Source: Field Survey

Table 4.4 shows the competency level of the teachers in the usage of ICT hardware’s. From the table it is clear that computer (1.27) is the most preferred hardware among the college teachers followed by LCD (2.73), printer (3.27) and television (3.73). And video and scanner are least preferred by the respondents by (4.73) and (5.27) respectively.

Table4.5: Use of Software

Software Used	Mean Rank	Rank No
Electronic Journals	3.14	3
Web Browser to Search Internet	2.29	1
E Mail	4.86	5
Discussion Forum	4.45	4
Video Conferencing	6.86	7

E –Library	4.92	6
Power Point Presentations	2.30	2
Educational Games	6.90	8

Source: Field Survey

Majority of the teachers use web browser as an ICT software ,followed by Power point presentation and electronic journals and the 4th ,5th,6th,7th and 8th ranks are assigned to discussion forum, E mail, E-Library, Video Conferencing and Educational Games respectively.

Table4.6: Competency level of Hardware and software

Competency Level of Hardware and Software	Number	%
Beginner Level	4	8
Intermediate Level	35	70
Advanced Level	11	22

Source: Field Survey

It is clear that 70% of the respondents are in the intermediate level with respect to the competency level of both hardware’s and software’s. And 22% are in the advanced level of usage and only 8% of the teachers are in the beginner level.

Table4.7: Ownership of personal computers

Ownership	Number	%
Yes	48	96
No	2	4

Source: Field Survey

It is evident from the above table that 96% of the teachers have their own computers

Table 4.8: Mode of access to internet

Mode of Access	Frequency	%
Own Computer	38	76
Computer of College	8	16
Internet Café	4	8

Source: Field Survey

Table 4.8 shows the teachers mode of access to internet. From the table it is clear that 76% of the teachers depends on own computer to access to internet, and 16% of the teachers

depend college computer and only 8% of teachers resorted to internet café.

Table 4.9: Level of Satisfaction

Factors contributing satisfaction	Mean	S.D
Support from Colleagues	4.16	.511
Support from Principal	4.06	.467
Officials of Directorate of Collegiate education	3.78	.618

Source: Field Survey

Table 4.9 shows the level of satisfaction of the teachers with respect to their Colleagues, Principal and Official of Directorate of Collegiate Education is high.

Table 4.10: Rating of overall Satisfaction

Score	%
10	20
9	4
8	22
7	20
6	16
5	8
4	10

Source: Field Survey

Table 4.10 shows the overall satisfaction of the teachers from the job. Majority of teachers (66%) assigned a score above “7” which shows that their overall satisfaction is high.

Table 4.11 Factors Motivate the Usage of ICT

Motivation Factors	Mean Rank	Rank No
ICT make lesson more interesting	1.71	1
ICT make lesson more diverse	2.76	2
ICT improves presentation of materials	2.79	3
ICT impairs pupils learning	3.71	4
Give me more prestige	5.15	6
Enhance my career prospects	4.88	5

Source: Field Survey

Table 4.11 shows the factors motivate the teachers to use ICT. Majority of the respondents are of the opinion that ICT

make lesson more interesting (1.71). Second rank is assigned to the factor that ICT makes lesson more diverse (2.76). Third rank is assigned to “ICT improves presentation of materials” (2.79) followed by the factors “ICT impairs pupils learning” (3.71) “ICT gives more prestige” (5.15) and “enhance career prospects” (4.88).

(4.68) and ICT illiteracy among (4.72) .Lack interest in ICT and teachers negative attitudes towards ICT are ranked by 7 and 8 respectively.

IV. CONCLUSION

It is clear from the analysis that inspite of sufficient access to broadband and teaching aids, the use of ICT among teachers is not effective. The reason for ineffective use of ICT is neither the lack of job satisfaction nor the incompetency level. It is an issue of attitude. Teachers should change their mindset and should accommodate with the changes that took place in education sector. To a certain extent, training will help but the introspection of teachers and a feel for updation may be more effective than any compulsion.

REFERENCES

- [1] Smeets, E. (2005). „Does ICT contribute to powerful learning environments?,, *Computers & Education*, 44 (2005), pp. 343–355.
- [2] Mumtaz, S. and Hammond, M. (2002), ‘The word processor re-visited: observations on the use of the word processor to develop literacy at key stage 2’, *British Journal of Educational Technology* 33(3), pp. 345-347.
- [3] Fister, K. R., & McCarthy, M. L. (2008). “Mathematics instruction and the tablet PC”. *International Journal of Mathematical Education in Science and Technology*, Vol. 39 No. (3), Pp; 285-292. Daniels J.S. (2002) “Foreword” in *Information and Communication Technology in Education–A Curriculum for Schools and Programme for Teacher Development*. Paris:UNESCO.
- [4] Karagiorgi, Y. and Charalambous, K. (2006). „In-service training and school practices: In search for the impact,, *Journal of Education for Teaching*, Vol. 32, No. 4, November 2006, pp. 395-411.

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Table.4.12: Hindrances for the successful integration of ICT

Hindrances	Mean Rank	Rank No
Absence of ICT facilities in college	4.32	4
Lack of funds	4.68	5
Lack of training	3.48	1
Inadequate power supply	4.28	3
ICT illiteracy	4.72	6
Insufficient time due to workload	4.24	2
Lack interest in learning ICT	4.76	7
Teachers negative attitudes towards ICT	5.52	8

Source: Field survey

Table 4.12 shows the factors hinders the successful integration of ICT. Majority of the respondents reported that lack of training (3.48) is the main factor which hinders the successful integration of ICT. Insufficient time due to work load (4.24) is the second factor followed by inadequate power supply in colleges (4.28) absence of ICT facilities (4.32) lack of funds

Endoscopic Tympanoplasty And Microscopic Tympanoplasty: A Comparative Analysis.

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Abstract- Aim: This study was conducted to compare the results of endoscopic and microscopic tympanoplasty.

Methods: This was a retrospective comparative study conducted by the dept. of ENT HNS at SHKM GMC Mewat from January 2015 to January 2016. 73 patients who underwent type I tympanoplasty were classified into two groups; endoscopic tympanoplasty (ET, n=25), microscopic tympanoplasty (MT, n=48). Pure tone audiometric results preoperatively and 3 months postoperatively, operation time and graft success rate were evaluated.

Results: Mean operation time of MT (88.9±28.5 minutes) was longer than that of the ET (68.2±22.1 minutes) with a statistical significance (P=0.002). Graft success rate in the ET and MT group were 92% and 95.8%, respectively; the values were not significantly different (P=0.304). Pre- and postoperative audiometric results including bone and air conduction thresholds and air-bone gap were not significantly different between the groups. In all groups, the post-operative air-bone gap was significantly improved compared to the preoperative air-bone gap.

Conclusion: With endoscopic system, minimal invasive tympanoplasty can be possible with similar graft success rate.

Index Terms- Endoscopy; Tympanoplasty.

I. INTRODUCTION

Since the introduction of tympanoplasty in the 1950s [1], variety of surgical techniques have been developed for closure of tympanic membrane perforation. Temporalis fascia is the most widely used materials with reported success rates of around 80% to 90% in patients who undergo primary tympanoplasty with a microscopic approach [2]. Postauricular skin incisions is the most widely used approach for microscopic tympanoplasty. This conventional procedure results in surgical scar and significant pain to the patient. Minimally invasive otologic surgery has recently been developed along with endoscopic techniques [3]. Endoscopic ear surgery has become popular nowadays [4]. Advantages of endoscopic ear surgery compared to the conventional microscopic surgery include avoiding endaural and postauricular incisions, minimal soft tissue dissection and angled view avoiding bone dissection [5,6]. Transcanal approach is the most commonly used approach for

endoscopic tympanoplasty. Endoscopic approach has resulted in decreased incidence of residual and recurrences during surgeries for cholesteatoma removal [5,7-9]. The value of endoscopes combined with the conventional microscopic eradication of cholesteatoma has been well established [6-15]. However, endoscopic surgery has several disadvantages which include one hand technique, difficulty during bleeding and risk of thermal damage [17,18].

This study has been conducted to compare the success results of endoscopic tympanoplasty with microscopic tympanoplasty with success being defined as improvement in hearing and closure of tympanic membrane perforation. In addition operation time for microscopic and endoscopic tympanoplasty was also evaluated.

II. MATERIALS AND METHODS

This retrospective study was conducted by the department of ENT HNS at SHKM GMC Mewat from January 2015 to January 2016. The study enrolled 73 patients aged 23 to 87 years (mean, 54.0±12.2 years) who underwent tympanoplasty type I. All patients had endoscopic examination, pure tone audiometry, and temporal bone computed tomography as preoperative work-up and had postoperative follow-up with endoscopic examination and pure tone audiometry at 3 months after surgery. Mean follow-up was 6.4 months (range, 3 to 11 months). Patients were classified into two groups according to type of surgery: endoscopic tympanoplasty (ET) and microscopic tympanoplasty (MT). Postaural was the approach used for microscopic surgery "figure 1" and transcanal for endoscopic procedure "figure 2". Tympanoplasty type I procedures were performed in all patients. In the MT group Carl Zeiss was used and in the ET group, an endoscopic system (Karl Storz) and 0- or 45-degree rigid endoscopes (4.0-mm diameter, 16 cm long) were used. Temporalis fascia was the graft used in both groups and postoperatively EAC was packed with Gelfoam. Pre- and postoperative audiometric parameters were compared using paired t-tests. Statistical significance was accepted at P<0.05. Patients with other than central perforation, wet ear, cholesteatoma, ossicular erosion or fixation and other medical illness like COPD were excluded from the study.



FIGURE 1: POSTAURICULAR APPROACH

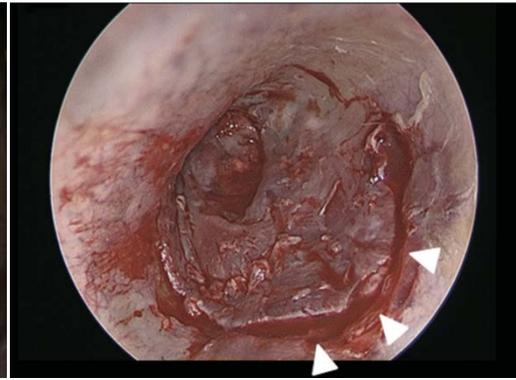


FIGURE 2: TRANSCANNAL APPROACH

III. RESULTS

The demographic data and the clinical findings of each group (ET, n = 25; MT, n = 48) are presented in Table 1.

Table 1: Comparison between MT and ET groups.

Variables	Overall(n=73)	ET(n=25)	MT(n=48)	P-value
Age(yr)	54.0 +/- 12.2	54.4+/-11.7	53.7+/-12.6	0.810
Operation Time (min)	81.8+/-28.1	68.2+/-22.1	88.9+/-28.5	0.002
Graft Success rate	71(97.3)	23(92)	46(95.8)	0.304
PTA-preoperative				
Bone	26.6+/-16.2	23.9+/-16.9	28.0+/-15.8	0.174
Air	45.2+/-18.1	42.7+/-19.7	46.5+/-17.3	0.276
Air-Bone gap	18.7+/-7.3	18.9+/-7.8	18.6+/-7.1	0.995
Air-Bone gap(dB)				
Preoperative	18.7+/-7.2	18.9+/-1.6	18.6+/-1.0	0.877
Postoperative	11.3+/-8.6	9.2+/-1.4	12.5+/-1.3	0.120
P-value	<0.001	<0.001	<0.001	
Bone conduction (dB)				
Preoperative	26.6+/-16.2	23.9+/-16.9	28.0+/-15.8	0.174
Postoperative	27.8+/-18.1	29.9+/-19.6	29.8+/-18.5	0.105
P-value	0.098	0.221	0.342	

Mean ages were 54.4±11.7 years (ET) and 53.7±12.6 (MT). The ages did not differ significantly. Preoperative audiometric

tests including bone and air conduction, and air-bone gap were not significantly different between the two groups ($P = 0.174$,

0.277, and 0.995, respectively). Mean operation time of the MT group (88.9±28.5 minutes) was significantly longer than the ET group (68.2±22.1 minutes) ($P = 0.002$). Graft success rate in the ET and MT group was 92% and 95.8%, respectively, which was not statistically significantly different ($P= 0.304$). Preoperative audiometric parameters including bone conduction, air conduction, and air-bone gap were not significantly different between ET and MT group ($P=0.174$, $P=0.276$, and $P= 0.995$, respectively). Pre- and postoperative air-bone gap was analyzed with paired *t*-test separately in each group. In the ET group, the pre- and postoperative air-bone gap was 18.9±1.6 dB and 9.2±1.4 dB, respectively, which was a significant improvement ($P<0.001$). The respective values in the MT group (18.6±1.0 dB and 12.5± 1.3 dB) also represented a significant ($P<0.001$). Bone conduction preoperatively and 3 months postoperatively were compared using the paired *t*-test in each group to evaluate inner ear damage. All groups had no significant difference between pre- and postoperative bone conduction (ET, 23.9± 16.9 vs. 29.9±19.6 dB, $P=0.221$; MT, 28.0±15.8 vs. 29.8± 18.5 dB, $P = 0.342$). In the ET group, bone conduction hearing level was 25.8±21.9 dB preoperatively and 28.2±20.3 dB at 3 months postoperatively. There was no significant changes in the ET group ($P = 0.200$). Otherwise, there was significant aggravation of bone conduction in the MT group ($P = 0.004$). Preoperative bone conduction of the MT group was 30.5±21.0 dB and postoperative bone conduction was 37.4±22.8 dB.

IV. DISCUSSION

Rigid endoscopes have been used initially for myringoplasty and as an adjuvant to microscopic mastoidectomies. However nowadays the use of endoscope in ear surgery is increasing and include middle ear tumor, ossiculoplasty, tympanoplasty, and cochlear implantation [17]. Several meta-analyses and review articles of endoscopic ear surgery support the safety of the approach, with minimal morbidity evident [15,17,21]. Since endoscopic technique is minimally invasive and has the advantage of angled view thus it can avoid mastoidectomies, external incisions, and soft tissue dissection in selected cases as compared with the conventional microscopic approach [9,13,14,17]. In addition, endoscopic view offers a better chance of education to trainees. However, endoscopic surgery has several disadvantages which include one hand technique, difficulty during bleeding and risk of thermal damage.[17,18]. In spite of the one-handed nature of the endoscopic surgery, the current data indicate that endoscopic tympanoplasty can be successfully performed by an experienced surgeon. The endoscopic group had significantly shorter operation time than the microscopic tympanoplasty group[16]. Studies have shown significant hearing improvement after endoscopic ear surgeries[16,23]. Similarly, significant improvements of air-bone gap after endoscopic tympanoplasty were found presently.

The endoscopic system has been used for second-look procedures or primary resection of middle ear cholesteatoma. Advantages include clear observation of middle ear cavity, low recurrence rate, prevention of a retraction pocket, and preservation of ossicles [9,11,13,24].

We achieved a graft success rate of 92% at 3 months, with no recurrence of otorrhea at 3 months after endoscopic

tympanoplasty. Therefore, we suppose that the endoscopic technic could be helpful for eradication of pathologic processes in the middle ear, such as granulation tissue or adhesion, as well as cholesteatoma.

In summary, the endoscopic technique is a minimally invasive technique with less operative time and success rate similar to microscopic surgery. However it is a one handed technique and needs more training as compared to conventional method.

V. CONFLICT OF INTEREST

None

REFERENCES

- [1] Zollner F. The principles of plastic surgery of the sound-conducting apparatus. *J Laryngol Otol.* 1955 Oct;69(10):637-52.
- [2] Dornhoffer JL. Hearing results with cartilage tympanoplasty. *Laryngoscope.* 1997 Aug;107(8):1094-9.
- [3] Thomassin JM, Duchon-Doris JM, Emram B, Rud C, Conciatori J, Vilcoq P. Endoscopic ear surgery: initial evaluation. *Ann Otolaryngol Chir Cervicofac.* 1990;107(8):564-70.
- [4] Marchioni D, Alicandri-Ciuffelli M, Piccinini A, Genovese E, Presutti L. Inferior retrotympanum revisited: an endoscopic anatomic study. *Laryngoscope.* 2010 Sep;120(9):1880-6.
- [5] Ayache S, Tramier B, Strunski V. Otoendoscopy in cholesteatoma surgery of the middle ear: what benefits can be expected? *Otol Neurotol.* 2008 Dec;29(8):1085-90.
- [6] Migirov L, Shapira Y, Horowitz Z, Wolf M. Exclusive endoscopic ear surgery for acquired cholesteatoma: preliminary results. *Otol Neurotol.* 2011 Apr;32(3):433-6.
- [7] Thomassin JM, Korchia D, Doris JM. Endoscopic-guided otosurgery in the prevention of residual cholesteatomas. *Laryngoscope.* 1993 Aug;103(8):939-43.
- [9] Good GM, Isaacson G. Otoendoscopy for improved pediatric cholesteatoma removal. *Ann Otol Rhinol Laryngol.* 1999 Sep;108(9):893-6.
- [10] Presutti L, Marchioni D, Mattioli F, Villari D, Alicandri-Ciuffelli M. Endoscopic management of acquired cholesteatoma: our experience. *J Otolaryngol Head Neck Surg.* 2008 Aug;37(4):481-7.
- [10] Badr-el-Dine M. Value of ear endoscopy in cholesteatoma surgery. *Otol Neurotol.* 2002 Sep;23(5):631-5.
- [11] Tarabichi M. Endoscopic management of limited attic cholesteatoma. *Laryngoscope.* 2004 Jul;114(7):1157-62.
- [12] Marchioni D, Mattioli F, Alicandri-Ciuffelli M, Presutti L. Endoscopic approach to tensor fold in patients with attic cholesteatoma. *Acta Otolaryngol.* 2009 Sep;129(9):946-54.
- [13] Tarabichi M. Transcanal endoscopic management of cholesteatoma. *Otol Neurotol.* 2010 Jun;31(4):580-8.
- [14] Marchioni D, Villari D, Alicandri-Ciuffelli M, Piccinini A, Presutti L.

- Endoscopic open technique in patients with middle ear cholesteatoma. *EurArch Otorhinolaryngol.* 2011 Nov;268(11):1557-63.
- [15] Presutti L, Gioacchini FM, Alicandri-Ciufelli M, Villari D, Marchioni D. Results of endoscopic middle ear surgery for cholesteatoma treatment: a systematic review. *Acta Otorhinolaryngol Ital.* 2014 Jun; 34(3):153-7.
- [16] Dundar R, Kulduk E, Soy FK, Aslan M, Hanci D, Muluk NB, et al. Endoscopic versus microscopic approach to type 1 tympanoplasty in children. *Int J Pediatr Otorhinolaryngol.* 2014 Jul;78(7):1084-9.
- [17] Kozin ED, Gulati S, Kaplan AB, Lehmann AE, Remenschneider AK, Landegger LD, et al. Systematic review of outcomes following observational and operative endoscopic middle ear surgery. *Laryngoscope.* 2015 May;125(5):1205-14.
Bottrill I, Perrault DF Jr, Poe D. In vitro and in vivo determination of the thermal effect of middle ear endoscopy. *Laryngoscope.* 1996 Feb;106(2 Pt 1):213-6.
- [18] Lempert J. Endaural, antauricular surgical approach to the temporal bone principles involved in this new approach: summary report of 1,780 cases. *Arch Otolaryngol.* 1938 May;27(5):555-87.
- [19] Gulya AJ, Minor LB, Poe DS. Glasscock-Shambaugh's surgery of the ear. 6th ed. Shelton, CT: People's Medical Publishing House-USA;
- [20] Marchioni D, Alicandri-Ciufelli M, Gioacchini FM, Bonali M, Presutti L. Transcanal endoscopic treatment of benign middle ear neoplasms. *EurArch Otorhinolaryngol.* 2013 Nov;270(12):2997-3004.
- [21] Kozin ED, Lehmann A, Carter M, Hight E, Cohen M, Nakajima HH, et al. Thermal effects of endoscopy in a human temporal bone model: implications for endoscopic ear surgery. *Laryngoscope.* 2014 Aug; 124(8):E332-9.
- [22] Hanna BM, Kivekas I, Wu YH, Guo LJ, Lin H, Guidi J, et al. Minimally invasive functional approach for cholesteatoma surgery. *Laryngoscope.* 2014 Oct;124(10):2386-92.
- [23] Barakate M, Bottrill I. Combined approach tympanoplasty for cholesteatoma: impact of middle ear endoscopy. *J Laryngol Otol.* 2008 Feb;122(2):120-4

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PHYTOCHEMICAL STUDIES OF *ACMELLA CAULIRHIZA* AND *SPERMACOCE PRINCEAE* USED BY POSTPARTUM MOTHERS IN NYAMIRA COUNTY, KENYA

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Abstract- Introduction: Traditional medicine have been used in health maintenance, disease prevention and treatment for example *Acmella caulirhiza* used to treat a child's mouth sores and *Spermacoce princeae* used to accelerate healing of umbilical cord and to clean the system after birth.

Objective: The main objective of the present study was to determine phytochemical compounds of *A. caulirhiza* and *S. princeae* used by postpartum mothers in Nyamira County, Kenya.

Methodology: The study area was Nyamira County where the two plant specimens were collected. Plant materials were identified at East Africa Herbarium. Plant specimens were transported to M.K.U. Pharmacognosy laboratory where processing was done. Phytochemical analysis methods were employed to determine phytochemicals compounds in the crude plant extracts. Data was stored in Excel spread sheet in a personal computer protected with a password. Data was presented using tables and photographs.

Results: Phytochemical examinations revealed that *Acmella caulirhiza* contains flavonoids, terpenoids, coumarins and sterols compounds. On the other hand, *Spermacoce princeae* contains flavonoids, terpenoids, tannins, saponin alkaloid and glycoside compounds.

Conclusion and recommendation: The plants may be used in treating puerperal sepsis although commercially available drugs are recommended as they are highly effective. The two plants can be a potent source of complementary and modern medicine. Further research is recommended to isolate and identify pure compounds of the two plants

Index Terms- Traditional medicine, phytochemical investigation, Asteraceae, Rubiaceae.

I. INTRODUCTION

Traditional medicine has been used in health maintenance, disease prevention and treatment (WHO, 2014). The use of medicinal plants has been known to mankind as the oldest practice of healthcare (Yogayata and Vijay, 2012). Nowadays, isolation and characterization of biologically active compounds from medicinal plants continues and drug discovery techniques have been applied to the standardization of herbal medicines, to elucidate analytical marker compounds (Marcy and Douglas, 2005). Medicinal plants used to manage postpartum complications include; *Basella alba* plant which belongs to Basallaceae family, is used to manage stomachache, stimulate milk production and is used to remove the placenta after birth (Jeruto *et al.*, 2015). *Toddalia asiatica* and *Pentas longiflora* species which belongs to Rutaceae and Rubiaceae family respectively. The leaves of these herbs are used to manage Urinary tract infections (Jeruto *et al.*, 2015).

Acmella caulirhiza is similarly known as *Spilanthes acmella*. It is a flowering herbal plant, which belongs to Compositae/Asteraceae family (Berhane *et al.*, 2014). It is an annual or perennial herb. Locally it is known as Ekenyunyuntamonwa (Ekegusii) and Ajuok-olwa Salamatwe (Dholuo) (Kokwaro, 2009). It is used by different communities in Kenya and the rest of Africa to treat various medical conditions. Example in Kenya, its flowers and leaves are used to treat venereal diseases (Jeruto *et al.*, 2015). It is used to relieve painful sores of the mouth, gums and throat, as well as stomach ache (Kokwaro 2009). Also it is used to treat decayed teeth, gingivitis or wounds in the mouth, toothache and sore throat (Kipruto *et al.*, 2013). The Zulu people of South Africa use *A. caulirhiza* as a local analgesic for toothache and to ease sensitivity of gums during dental extractions (Crouch *et al.*, 2005).

Spermacoce princeae is a flowering herbal plant which belongs to the family Rubiaceae (Augustin *et al.*, 2015). Locally it is known as Omoutakiebo (Ekegusii), Gakungathe (kikuyu), Murkugwet (kipsigis) and Nyamwoch (Dholuo) (Kokwaro, 2009). It grows in tropical regions and it is used extensively. Normally it is used by different communities in Kenya and the rest of Africa to treat

several diseases. Just to mention a few, leaves and roots are used to treat chronic asthma, cancer, mastitis in cows and venereal diseases by the Nandi people in Kenya (Jeruto *et al.*, 2011). Another study carried out in Vihiga County, Kenya found that, cold infusion is made from leaves and drunk in the treatment of diarrhea (Antony *et al.*, 2016). Leaves and stem are used to treat female infertility in Baham, Cameroon (Telefo *et al.*, 2011). In Cameroon, leaves of *Spermacoce princeae* are warmed on fire, ground and mixed with red oil and salt, then is taken orally in treatment of kidney disease (Focho *et al.*, 2009).

II. MATERIAL AND METHODS

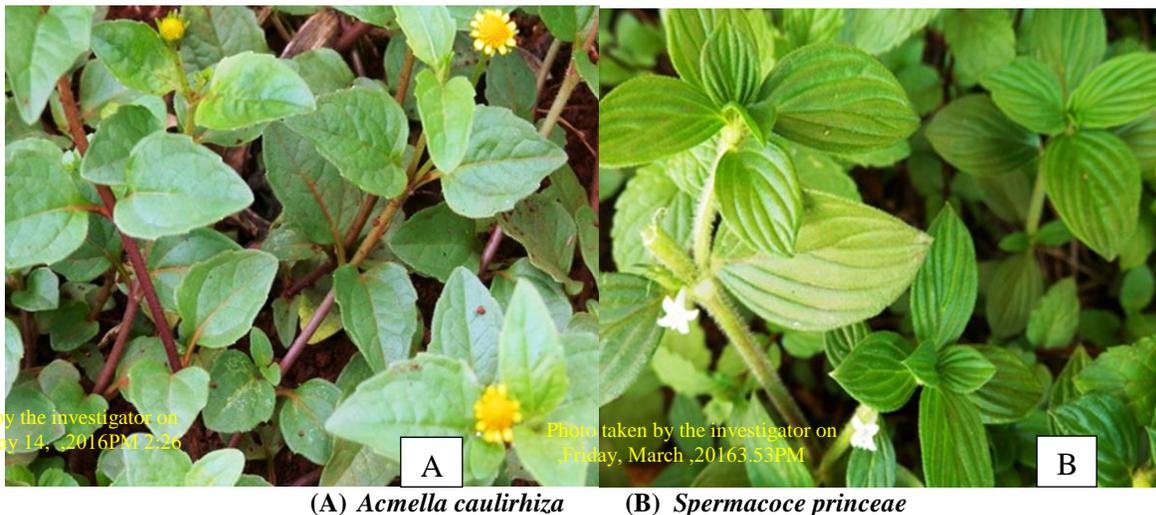
2.1 Study Area

The study site was North Mugirango and West Mugirango constituencies of Nyamira County. The study points in West Mugirango constituency were; Sirona (0° 33'14.8536 S and 34° 58' 2.4996 E), Bonyunyu (0° 31'36.2532 S and 34° 53'20.4108 E) and miruka (0° 29'13.902 S and 34° 53'20.3208 E) whereas the study point in North Mugirango constituency was; Magong'a (0° 28' 46.7724 S and 34° 57'6.4836 E) in Nyamira County. In this County, local inhabitants regularly use medicinal plants for personal and domestic animal health. Local inhabitants in this County, follow traditional beliefs and customs. Further, most inhabitants living in this area have a tendency of harvesting the medicinal plants from undisturbed vegetation. This is due to the fact that many plant species grow in the study region (Omwenga *et al.*, 2015). Postnatal mothers use *Acmella caulirhiza* and *Spermacoce princeae* to treat child sores and to clean reproductive system respectively in women after birth. Nyamira County is one of highly populated area with approximately 912.5 Km² with a population of 598,252 and a population density of 656 persons per Km² according to (KNBS, 2009).

2.2 Plant materials collection

Acmella caulirhiza and *Spermacoce princeae* medicinal plant specimen were collected from West Mugirango and North mugirango constituencies in Nyamira County with acceptable bio-conservation methods (WHO, 2003a). Harvesting was done in a dry weather morning after the dew had evaporated (Prajapati *et al.*, 2010). The two specimens were carried separately in gunny bags and transported to Pharmacognosy Laboratory of Mount Kenya University within 72 hours of collection (WHO, 2003a).

Fig. 1: The two medicinal plant materials collected



2.3 Processing of plant materials

Processing was done within 72 hours after collection. Herbarium preparations were established and the voucher specimens were processed in duplicate. They were mounted on herbarium sheets, pressed to flatten, to dry and were labeled. Voucher specimen (Number JN001 and JN002) were identified at East African Herbarium in the National Museums of Kenya on basis of morphological characteristics and compared with the voucher specimens recorded in East Africa Herbarium. Voucher specimen (Number JN001 and JN002) were deposited at Mount Kenya University Botanical Herbarium Laboratory in the school of Pharmacy. The collected materials were washed thoroughly with tap water and then air dried under a shade at room temperature for one week. When dried, the plant materials (*A. caulirhiza* and *S. princeae*) were ground into coarse powder using a porcelain mortar and pestle (Hena, *et al.*, 2010). The coarse powder materials were labeled and stored in brown paper bags under a dry condition, away from light at room temperature till the time of extraction and phytochemical screening (Prajapati *et al.*, 2010).

2.4 Plant extraction using organic solvents

Using a top loading Weighing Electronic Balance (Models TP-B 2000), 50 grams of the Kenyan *Acmella caulirhiza* and 50 grams *Spermacoce princeae* each powder was weighed separately and transferred into separate conical flasks, labeled with the

constituency of collection, plant species and date. Then 500mls of 100% Ethyl Acetate (Loba Chemie Company Lot#L157601502) was added to cover each plant materials and covered with a stopper, then macerated in the solvent at room temperature for 48 hours with intermittent agitation. Using a funnel and Whatman filter paper No. 1 the crude extracts from each of the plant materials were strained separately into glass reagent bottles then covered with stoppers. The process was repeated with 500mls of 100% Ethanol Analar Normapur (VWR Prolabo Company Batch 12D250511) and Methanol (Loba Chemie Company Lot #B193331604). The filtrates were labeled and concentrated in a rotary evaporator at 40 degree Celsius for Ethyl acetate, 60 degree Celsius for Ethanol and Methanol respectively. Using analytical balance, empty beakers were weighed, the extracts from the distillation flask were transferred into them, labeled appropriately and the solvents were evaporated in an Oven set at appropriate temperature. Quantity of each crude plant extract paste was calculated by the formula: Plant crude residue = (weight of beaker + extract) - (weight of empty beaker). The extracted paste of each plant species examined was kept in beakers covered in a refrigerator a waiting for bioactivity assay (Afolayan *et al.*, 20008).

2.5 Aqueous extraction of crude plant material

Aqueous extracts of *Acmella caulirhiza* and *Spermacoce princeae* was made from crude plant material according to Bibi *et al.*, (2012) by weighing 20 grams of *Acmella caulirhiza* and 20 grams of *Spermacoce princeae*. They were boiled separately in 400mls distilled water in beakers of 400ml capacity on Hot Plate set at 100⁰ C for 5 minutes. The extracts were cooled, using a funnel and Whatman filter paper (No. 1) they were filtered and freeze dried according to Pikal *et al.*, (2010), to extract dry powders from the aqueous solutions of the two plants. Freeze-drying was done in the following steps; freezing, primary drying and secondary drying. Primary drying involves; evacuating the system, increasing shelf temperature resulting to product temperature 2–3⁰ C below collapse temperature. Secondary drying involves; removing unfrozen water from the solute phase by desorption through raising temperatures. The dry and lyophilized extracts were weighed and stored in a freezer for bioactivity testing (Bibi *et al.*, 2012).

2.6 Phytochemical investigation

Phytochemical analysis for various secondary metabolites of the plant extract was done using methods described below. The groups of phytochemical compounds investigated were alkaloids, flavonoids, tannins, coumarins, steroids, sterols, saponins, terpenoids and glycosides.

Test for tannins

Ferric Chloride Test: *Acmella caulirhiza* 0.5 grams and 0.5gms *Spermacoceprinceae* dry powdered samples were boiled in 10ml distilled water on a hot plate separately and the extracts were filtered. 2ml portion of each filtrate was measured and 3drops of 0.1% ferric chloride solution was added. Formation of a green colored solution shows tannins presence (Kiran and Prasad 2015).

Test for coumarins

Onto separate filter papers, a few drops of ammonia were added and then a drop of *Acmella caulirhiza* and *Spermacoceprinceae* extracts were added separately. Fluorescence on the paper shows coumarins presence (Sangeetha *et al.*, 2014).

Test for flavonoids

Ferric chloride test; 2ml *Acmella caulirhiza* and 2ml *Spermacoceprinceae* crude extracts were separately treated with 5 drops of Ferric chloride solution each. Formation of a blackish red colour shows flavonoids presence (Kiran and Prasad 2015).

Tests for steroids

Liebermann test: To 1ml *Acmella caulirhiza* and 1ml *Spermacoceprinceae* extract solution in 10ml chloroform solution separately, 3drops of acetic anhydride and Sulphuric acid solutions were added slowly from the side of test tube separately. Observation of a brown ring at the junction of the two layers and the upper layer turns green separating the liquids shows steroids presence (Kiran and Prasad, 2015).

Test for sterols

Liebermann test: Few grams of *Acmella caulirhiza* and *Spermacoceprinceae* in separate test tubes were dissolved in 0.5 ml hot acetic anhydride and 0.5 ml of chloroform was added. Observations of blue-green ring at interphase a positive reaction (Sabri *et al.*, 2012).

Testing for saponins

Froth test: Using a top loading weigh balance, 0.5 grams *Acmella caulirhiza* and 0.5gms *Spermacoceprinceae* powder were weight, placed in separate test tubes and 10ml distilled water added to each. Then themixture was shaken and left to stand. Persistent froth shows saponins presence (Kiran and Prasad 2015).

Test for terpenoids

Five ml *Acmella caulirhiza* and 5ml *Spermacoceprinceae* extracts were mixed separately in 2ml chloroform and then 3ml concentrated sulphuric acid was added. At the interface a reddish brown color shows terpenoids presence (Ablude, 2001).

Test for glycosides

Keller-kiliani test; *Acmella caulirhiza* (50mg), and 50mg *Spermacoceprinceae* extracts in separate test tubes, 2ml and 1ml glacial acetic acid and ferric chloride solution were added respectfully. The contents were heated and cooled then transferred to a test tube containing 2ml concentrated sulphuric acid. Formation of a brown ring at the interface (presence of deoxy sugar characteristic of cardenolides) and observation of pale green colour in the upper layer (steroidal nucleus) shows glycoside presence (Kiran and Prasad 2015).

Test for alkaloids

Using a top loading weigh balance, 0.5gms of *Acmella caulirhiza* and 0.5gms *Spermacoceprinceae* dried powdered sample free extract were measured, agitated with 3mls diluted hydrochloric acid and filtered separately. Then the filtrates were tested for alkaloids using dragendorff's reagent: To 2mls of *Acmella caulirhiza* and *Spermacoceprinceae* filtrate in separate test tubes, 2 mL Dragendorff's reagent was added to each. A prominent yellow precipitate shows presence of alkaloids (Harborne, 2005).

2.7 Data Analysis and Presentation

Data was stored in Excel spread sheet in a personal computer protected with a password. Also a flash disk secured with a password was used as a backup. Data was presented using tables and photographs.

2.8 Ethical Considerations

Ethical clearance was obtained from Mount Kenya University Ethical Review Committee and NACOSTI before commencement of the study. Phytochemical analysis was conducted in Mount Kenya University Pharmacognosy laboratory.

III. FINDINGS

Quantity of crude plant extracts

Table 1: % yields of extract obtained by different extraction solvent

Percentage yield					
Plant species	Part used	Ethyl Acetate	Ethanol	Methanol	Aqueous
<i>Acmella caulirhiza</i>	Whole plant	1.68 (2.1%)	3g (3.75%)	4g (5%)	2.45g (12.25%)
<i>Spermacoce princeae</i>	Whole plant	2g (2.5%)	4g (5%)	5(6.25%)	3g (15%)

Fig. 2: Preliminary phytochemical screening of *Acmella caulirhiza* whole plant



Fig. 3: Preliminary phytochemical screening of *Spermacoce princeae* whole plant



Determination of Phytochemical Compounds in Crude Plant Extracts of *A. caulirhiza* and *S. princeae*

Phytochemical examinations revealed that *Acmella caulirhiza* contains flavonoids, terpenoids, coumarins and sterols compounds. However, tannins, saponin and glycoside were absent. On the other hand, *Spermacoce princeae* contains flavonoids, terpenoids, tannins, saponin alkaloid and glycoside compounds. However, sterols and coumarins were not found.

Table 2: Phytochemical Analysis of *Acmella caulirhiza* and *Spermacoce princeae* from Nyamira County

Phytochemical compounds	Flavonoids	Terpenoids	Coumarins	Sterols	Tannins	Saponins	Alkaloids	Glycoside	Steroid s
<i>Acmella caulirhiza</i>	+	+	+	+	-	-	-	-	-
<i>Spermacoce princeae</i>	+	+	-	-	+	+	+	+	-

IV. DISCUSSION

Medicinal plants usage is increasingly popular among the Gusii community of Nyamira County. Many medicinal plants grow around the homestead and have been used naturally for many years by traditional healers to control common health problems.

Determination of Phytochemical Compounds in Crude Plant Extracts of *Acmella caulirhiza* and *Spermacoce princeae*

Phytochemical examinations revealed that, *Acmella caulirhiza* contains flavonoids, terpenoids, coumarins and sterols phytochemical compounds. However, tannins, saponin and glycoside were absent. The presence of coumarin compound in this plant is consistent with other study Chhabra *et al.*, (1989). Other findings indicates that, *A. caulirhiza* leaves and flowers contain spilanthol compounds believed to prevent bacterial pathogens in addition to numbing the pain when used in toothache therapy (Neil and Jerald, 2005). Besides, *A. caulirhiza* plant is believed to treat sore throat and stomachache traditionally (Kipruto *et al.*, 2013; Giday *et al.*, 2010; Njoroge and Bussmann, 2006; Chhabra *et al.*, 1989).

On the other side, *Spermacoce princeae* contained flavonoids, terpenoids, tannins, saponin alkaloid and glycoside phytochemical compounds. However, sterols and coumarins were not found. This result concurs with the phytochemical results reported by Jeruto *et al.*, (2011) on phytochemical compounds present in this plant. *S. princeae* is used traditionally to clean reproductive system after birth. Other findings have shown that *S. princeae* treats venereal diseases, pneumonia, typhoid, Chronic asthma, cancer, wounds, eye

problems, venereal diseases, diarrhoea skin and kidney diseases (Jeruto *et al.*, 2011). This validates therapeutic value of this plant, in traditional management of typhoid, pneumonia and eye infections (Jeruto *et al.*, 2011).

Therapeutic value of medicinal plants is determined by the presence of phytochemical compounds having certain functional and pharmacological activity (Geeta *et al.*, 2012). Flavonoids compounds have been reported to have antimicrobial activity (Pandey *et al.*, 2010; Cowan, 1999). Example flavonoids such as flavone and flavonol glycosides, apigenin, isoflavones, galangin flavanones, and chalcones have been revealed to possess effective antibacterial activity (Cushnie and Lamb, 2005). A new flavanone, 7-hydroxy-6,8-dimethoxyflavanone, showed anti-mycobacterial activity against *M. tuberculosis* H37Ra at 50 µg/mL MIC value (Prawat *et al.*, 2013). Mode of action results from their ability to inactivate microbial cell envelope transport proteins, enzymes and adhesins (Kumar and Pandey 2013; Mishra *et al.*, 2009; Cowan, 1999). Lipophilic flavonoids may disrupt microbial membranes (Mishra *et al.*, 2009; Cowan, 1999). Flavonoids inhibit cytoplasmic membrane function and they inhibit DNA gyrase and hydroxyacyl-acyl carrier protein dehydratase activities (Zhang *et al.*, 2008).

Terpenoids have antimicrobial activity against bacterial and fungi (Omojate *et al.*, 2014; Ghoshal *et al.*, 1996). Example petalostemumol terpenoid exhibited excellent effects against *Bacillus subtilis* and *Staphylococcus aureus* (Omojate *et al.*, 2014). They also control *Listeriamonocytogenes* Cowan, (1999). Terpenoids derived from essential oil inhibitory 60% fungi while they inhibit 30% bacteria (Omojate *et al.*, 2014; Mohd *et al.*, 2014). Terpenoids act by disrupting cellular membrane by lipophilic compounds (Cowan, 1999; Hatice and Ayse 2014). Coumarin, has been reported to contain antimicrobial activity against *Candida albicans* and chronic infections (Thornes *et al.*, 1982). Example coumarin compound isolated from *Angelica lucida* L. is effective against oral pathogens such as *Streptococcus viridians* and *Streptococcus mutans* (Widelski *et al.*, 2009). They act by activating other cells of immune system stimulating macrophages, indirectly affecting the disease causing agents (Casley *et al.*, 1997).

Sterols have been reported to contain antimicrobial activity. Examples stem sterols of *Withania somnifera* is reported to have antimicrobial effects against *P. aeruginosa*. As well stem sterol of *Euphorbia hirta* and *Terminalia chebula* is active against *S. aureus* (Geeta *et al.*, 2012). There is no information on antimicrobial mode of action of plant steroids and sterols. Tannins have been reported to contain bactericidal activity against gram positive organisms such as *S. aureus* and used for the treatment of diarrhea an example of enteric diseases (Omojate *et al.*, 2014; Chung *et al.*, 1993). Tannins have been used as antiseptic whose activity is due to manifestation of the phenolic group. Tannin-rich plants have been shown to be toxic to filamentous fungi, yeasts, and bacteria (Omojate *et al.*, 2014). Example tannins extracted from *Solanum trilobatum* plant have been reported to possess high antibacterial activity against *Staphylococcus aureus* and *Proteus vulgaris* at 2.5mg/ml concentration (Doss *et al.*, 2009). Tannin compounds act by interfering with bacterial cell wall causing disintegration of bacterial colonies thus inhibiting microbial growth (Erasto *et al.*, 2004). They also act by forming complexes with proteins and polysaccharide through hydrogen bonding, hydrophobic bond and covalent bond resulting to inactivation of microbial adhesion, enzymes and cell envelope transport proteins (Haslam, 1996; Haslam *et al.*, 1988). Also they have the ability to inactivate microbial adhesins, enzymes, cell envelope and transport proteins (Omojate *et al.*, 2014). Condensed tannins have been confirmed to bind to cell walls of ruminal bacteria, thus inducing bacterial stasis and protease activity (Jones *et al.*, 1994).

Saponins have been reported to have antimicrobial activity (Moyo *et al.*, 2012). Example Yucca saponin have antibacterial activity against *Staphylococcus aureus* and *Lactobacillus* (Tanaka *et al.*, 1996). Mode of action is by altering with the permeability of cell walls hence they exert toxicity on all tissues. Also they form complexes with cell membranes hence elicit changes in cell morphology leading to cell lysis (Moyo *et al.*, 2012).

Alkaloids have antibacterial properties against gram-positive and gram-negative bacteria (Donald *et al.*, 2016). Example alkaloids Chloroform and ethanol extracts from *Callistemon citrinus* leaves have been reported to have antibacterial activity against *Staphylococcus aureus*, *E. coli*, *S. typhi* and *P. aeruginosa* via disc diffusion methods (Krishna *et al.*, 2012; Donald *et al.*, 2016). They act by disrupting cell wall membrane (Cowan, 1999). Glycosides: have been reported to contain antibacterial activity. Example glycosides compounds extracted from *Caesalpinia coriaria* (Jacq) Willd exhibited antibacterial activity against *E.coli*, *Staphylococcus aureus* and *Klebsiella pneumonia* (Anandhi *et al.*, 2014). Glycosidic compounds (G1) extracted from *Citrus laurantiifolia* L. fruits exhibited broad spectrum antibiotic effects against *Staphylococcus aureus*, *Streptococcus*, *Pseudomonas aeruginosa* and *Escherichia coli* (Sameerah *et al.*, 2013). Mode of action glycoside act by causing leakage of cellular materials by breaking the outer membrane. Also glycosides inhibit the respiration and growth of pathogenic micro-organisms by entering the inner membrane and inactivating the enzyme system dehydrogenase (Anandhi *et al.*, 2014).

V. CONCLUSION AND RECOMMENDATION

Demonstration of phytochemical compounds in the two plants such as flavonoids, terpenoids, coumarin, sterols, tannins, saponin, alkaloids and glycosides validates their use in management of puerperal sepsis. Mode of action of compounds present in the two plants indicates that the plants have therapeutic potential. Phytochemical compounds analysis lays a foundation for ethnobotanical and pharmacological investigations for new drug discovery.

A. caulirhiza and *S. princeae* plants may be used in treating puerperal sepsis. The two plants may be used as medicine and can be a potent source of complementary and modern medicine. Further research is recommended to isolate and identify pure compounds of the two plants

REFERENCES

- [1] **Ablude, F. O. (2001)**. Mineral and phytate content of ten vegetable grown in Nigeria and calculation of their phytate; Zn and Ca: phytate molar ratios, "Adv. Food Science"23:36-39
- [2] **Afolayan, A. J., Ncube, N. S. and Okoh, A. I.(2008)**. Assessment techniques of antimicrobial properties of natural compounds of plant origin: Current methods and future trends. *African Journal of Biotechnology*7 (12): 1797-1806.
- [3] **Augustin, N. Donatien, G., Simeon, P. C. F. and Huguette, N. M. (2015)**. Toxicological Evaluation of the Aqueous Leaf Extract of *Spermacoce princeae* (Rubiaceae): A Traditional Antibacterial Preparation. *International Journal of Toxicological and Pharmacological Research* 7(3); 123-129.
- [4] **Anandhi, D., Srinivasan, P.T., Praveen, Kumar G. and Jagatheesh, S. (2014)**. Influence of flavonoids and glycosides from *Caesalpinia coriaria* (Jacq) wild as bactericidal compound. *Int.J.Curr.Microbiol.App.Sci* 3(4): 1043-1051
- [5] **Antony, O. R., Michael, K., Makokha, A. O. and Festus, M. T. (2016)**. Types of Herbal Medicine Used for HIV Conditions in Vihiga County, Kenya. *European Journal of Medicinal Plants* 13(2): 1-23
- [6] **Berhane, K., Tinde, A., Laurentius, J. M. and Zemedu, A. (2014)**. Use and management of traditional medicinal plants by Maale and Ari ethnic communities in southern Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, 10:46
- [7] **Bibi, Y., Nisa, S., Zia M., Waheed, A., Ahmed, S. and Chaudhary, F. M.(2012)**. *In vitro* cytotoxicity activity of *Aesculus indica* against breast carcinoma cell lines (MCF-7) and phytochemical analysis. *Pak. J. Pharm. Sci.*, 25 (1): 183-187
- [8] **Casley-Smith, J. R. and Casley-Smith, J. R. (1997)**. Coumarin in the treatment of lymphoedema and other high-protein oedemas, p. 348. *In* R. O'Kennedy and R. D. Thornes (ed.), *Coumarins: biology, applications and mode of action*. John Wiley & Sons, Inc., New York, N.Y.
- [9] **Chhabra, S. C., Mahunnah, R. L. A. and Mshiu, E. N. (1989)**. Plants used in traditional medicine in eastern Tanzania: II. Angiosperms (Capparidaceae to Ebenaceae) *Journal of Ethnopharmacology*, 25 (1989), pp. 339-359
- [10] **Chung, K. T., Stevens, S. E., Lin, W. F. and Wei, C. I. (1993)**. Growth inhibition of selected food-borne bacteria by tannic acid, propyl gallate and related compounds. *Letters in Applied Microbiology* 17, 29-32.
- [11] **Crouch, L. A., Mulholland, D. A. and Nair, J. J. (2005)** A novel alkylamide from the leaves of *Acmella caulirhiza* (Asteraceae), a traditional surface analgesic. *South African journal* 71(2): 228-230
- [12] **Cushnie, T. P. T. and Lamb, A. J. (2005)**. "Antimicrobial activity of flavonoids," *International Journal of Antimicrobial Agents*, vol. 26, no. 5, pp. 343-356.
- [13] **Cowan, M. M. (1999)**. Plant products as antimicrobial agents. *Clin Microbiol Rev.* 12(4):564-82.
- [14] **Donald, M., Tariro, C., and Stanley, M. (2016)**. Antibacterial Properties of Alkaloid Extracts from *Callistemon citrinus* and *Vernonia adoensis* against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. *International Journal of Medicinal Chemistry* Volume 2016 Article ID 6304163, page 7
- [15] **Doss, A., Mohammed, M. H. and Dhanabalan, R. (2009)**. Antibacterial activity of tannins from the leaves of *Solanum trilobatum* Linn. *Indian Journal of Science and Technology* Vol.2 No 2.
- [16] **Erasto, P., Bojase-Moleta, G. and Majinda, R. R. T. (2004)**. Antimicrobial and antioxidant flavonoids from the roots wood of *Bolusathus spesiosus*. *Phytochem.* 65, 875-880.
- [17] **Focho, D. A., Ndam W. T. and Fonge, B. A. (2009)**. Medicinal plants of Aguambu – Bamumbu in the Lebiale highlands, southwest province of Cameroon. *African Journal of Pharmacy and Pharmacology* Vol. 3 (1). pp. 001-013.
- [18] **Geeta, S., Padma, K. and Alka, J. (2012)**. Antibacterial Potential of Sterols of some Medicinal Plants. *International Journal of Pharmacy and Pharmaceutical Sciences*. Vol 4, Issue 3,
- [19] **Ghoshal, S., Krishna, B. N., Prasad, and Lakshmi, V. (1996)**. Antiamoebic activity of *Piper longum* fruits against *Entamoeba histolytica* in vitro and in vivo. *J. Ethnopharmacol.* 50:167-170.
- [20] **Giday, M., Asfaw, Z. and Woldu, Z. (2010)**. Ethnomedicinal study of plants used by Sheko ethnic group of Ethiopia. *J. Ethnopharmacol.* 132 (1):75-85.
- [21] **Harborne, J. B. (2005)**. *Phytochemical Methods*, Springer (India) Pvt. Ltd, New Delhi, 17
- [22] **Haslam, E. (1996)**. Natural polyphenols (vegetable tannins) as drugs: possible modes of action. *J. Nat. Prod.* 59:205-215.
- [23] **Haslam, E. Ya, C., Gaffney, S. H. and Lilley, T. H. (1988)**. Carbohydrate polyphenol complexation, p. 553. *In* R. W. Hemingway and J. J. Karchesy (ed.), *Chemistry and significance of condensed tannins*. Plenum Press, New York, N.Y.
- [24] **Hatice, Z. and Ayse, H. B. (2014)**. Antibacterial and Antioxidant Activity of Essential Oil Terpenes against Pathogenic and Spoilage-Forming Bacteria and Cell Structure-Activity Relationships Evaluated by SEM Microscopy. *Molecules Journal* 19(11), 17773-17798
- [25] **Hena, J. S. I., Adamu, A. K. L., Iortsuun, D. N. and Olonitola, O. S. (2010)**. Phytochemical Screening and Antimicrobial Effect of the Aqueous and Methanolic Extracts of Roots of *Balanites aegyptiaca* (Del.) On Some Bacteria Species. *Science World Journal* Vol 5 (No 2)
- [26] **Jeruto, P., Mutai, C., Catherine, L. and Ouma, G. (2011)**. Phytochemical constituents of some medicinal plants used by the Nandis of South Nandi district, Kenya. *Journal of Animal and Plant Sciences*; Vol. 9, Issue 3: 1201- 1210.
- [27] **Jeruto, P. Too, E. Mwamburia, L. A. and Amuka, O. (2015)**. An Inventory of Medicinal Plants used to Treat Gynaecological-Obstetric-Urino-Genital Disorders in South Nandi Sub County in Kenya. *Journal of Natural Sciences Research* ISSN 2224-3186 (Paper) Vol.5, No.18, 2015
- [28] **Jones, G. A., McAllister, T. A., Muir, A. D. and Cheng, K. J. (1994)**. Effects of sainfoin (*Onobrychis viciifolia* scop.) condensed tannins on growth and proteolysis by four strains of ruminal bacteria. *Applied Environmental Microbiology* 60:1374-1375. Kenya national bureau of statistics census (2009). Kipruto, A. Sinei, F. A., Okalebo, A., Hannington, N., Mugo, B. and Josephat, M. M. (2013). An Investigation of the Antimicrobial Activity of *Acmella caulirhiza*. *African Journal of Pharmacology and Therapeutics* Vol. 2 No. 4 Pages 130-133.
- [29] **Kiran, C. D. N. and Prasad, B. S. S. (2015)**. Preliminary pharmacognostic and phytochemical Studies on *Nerium oleander* Linn. (White cultivar). *Journal of Pharmacognosy and Phytochemistry*; 4(1):185-188
- [30] **Kokwaro, J. O. (2009)**. *Medicinal plants of East Africa*: East Africa Literature Bureaus Nairobi-Kenya. Page 11 production. *J Lab Clin Med*; 53:807.
- [31] **Krishna, K. V. V. S., Surendra, G., Anjana, M. and Nagini, K. S. K. (2012)**. Phytochemical screening and antimicrobial activity of *Callistemon citrinus* (L.) leaves extracts. *International Journal of Pharmaceutical and Technology Research*.; 4 (2):700-704.)
- [32] **Kumar, S. and Pandey, A. K. (2013)**. Chemistry and Biological Activities of Flavonoids: An Overview. *The Scientific World Journal* Volume 2013 Article ID 162750, 16 pages
- [33] **Marcy, J. B. Douglas, K. A. (2005)**. Drug discovery from medicinal plants *Life Sciences* 78; 431 – 441

- [34] Mishra, A. K. Mishra, A. Kehri, H. K. Sharma, B. and Pandey, A. K. (2009). "Inhibitory activity of Indian spice plant *Cinnamomum zeylanicum* extracts against *Alternaria solani* and *Curvularia lunata*, the pathogenic dematiaceous moulds," *Annals of Clinical Microbiology and Antimicrobials*, vol. 8, article 9
- [35] Mohd, I., Shakeel, A. and Manik, S. (2014). Antimicrobial activity of terpenoids from *Sphaeranthus indicus* L. *Asian Journal of Plant Science and Research*, 4(1):1-6
- [36] Moyo, B., Masika, P. J. and Muchenje, V. (2012). Antimicrobial activities of *Moringa oleifera* extracts. *African Journal of Biotechnology*; 12:34-42.
- [37] Neil, C. and Jerald, J. (2005). A novel alkylamide from the leaves of *Acmella caulirhiza* (Asteraceae), a traditional surface analgesic. *South African Journal of Botany*.
- [38] Njoroge, G. N. and Bussmann, R. W. (2006). Traditional management of ear, nose and throat. *J. Ethnobiol. and Ethnomed.* 2: 1-9.
- [39] Omojate, G. C., Enwa, F. O, Jewo, A. O. and Eze, C. O. (2014). Mechanisms of Antimicrobial Actions of Phytochemicals against Enteric Pathogens. *Journal of Pharmaceutical, Chemical and Biological Sciences* ISSN: 2348-7658; 2(2):77-85
- [40] Omwenga, E. O., Ogot, C., Paul, K. M. and Paul, O. O. (2012). Ethnobotanical Identification and Anti-microbial Evaluation of Some Anti-Diarrhoeal Plants Used by the Samburu Community, Kenya. *Malaysian Journal of Microbiology*, Vol 8(2) pp. 68-74
- [41] Pandey, A. K. Mishra, A. K. Mishra, A. Kumar, S. and Chandra, A. (2010). "Therapeutic potential of *C. zeylanicum* extracts: An antifungal and antioxidant perspective," *International Journal of Biological and Medical Research*, vol. 1, pp. 228-233.
- [42] Pikal, J. M., Takayuki, D. and Patel S. (2010). Determination of End Point of Primary Drying in Freeze-Drying Process Control. *AAPS PharmSciTech.* 11(1): 73-84.
- [43] Prajapati, N. D., Purohit, S. S., Sharma and Tarun, K. (2010). *A handbook of Medicinal plants*. A complete source book. Agrobios publishers India. Page 140,150.
- Prawat, U., Chairerk, O., Lenthas, R., Salae, A. W. and Tuntiwachwuttikul, P. (2013). Two new cycloartane-type triterpenoids and one new flavanone from the leaves of *Dasymaschalondasymaschalum* and their biological activity. *Phytochem Lett* 6: 286-290.
- [44] Sabri, F. Z., Belarbi, M., Sabri, S., Alsayadi, M. M. S. (2012). Phytochemical Screening and identification of some compounds from Mallow. *J. Nat. Prod. Plant Resource* 2 (4):512-516
- [45] Sameerah, A. Z., Adnan, J. M. A. and Ghosoon, F. A. (2013). Antibacterial activity of the glycosidic extract From *Citrus laurantiifolia* L. fruits, *Scholars Research Library* 5(6):73-78
- [46] Sangeetha, V. S., Michael, B. and Beena, L. (2014). Phytochemical Analysis of *Annona Reticulata* L. Leaf Extracts. *Int. Res J Pharm. App Sci.*, 4 (5):4-8
- [47] Tanaka, O., Tamura, Y., Masuda, H. and Mizutani K. (1996). Application of saponins in foods and cosmetics: Saponins of Mohave yucca and *Sapindus mukurossi*. Pages 1-11 in Saponins Used Food and Agriculture. G. R. Waller, and K. Yamasaki, eds. Plenum Press, NY. Telefo, P. B., Lienou, L. L., Yemele, M. D., Lemfack, M. C, Mouokeu C, Goka CS, Tagne, S. R. and Moundipa, F. P. (2011). Ethnopharmacological survey of plants used for the treatment of female infertility in Baham, Cameroon. *Journal of Ethnopharmacology* 136: 178-187.
- [48] Thornes, R. D., Lynch, G. and Sheehan, M. W. (1982). Relationship between structure and Anti-Coagulant activity of coumarin derivatives. *Lancet.* 2: 328-339.
- [49] Vichith, L., Hugo J. B. and Lars, B. (2011). Traditions and plant use during pregnancy, childbirth and postpartum recovery by the Kry ethnic group in Lao PDR. *J Ethnobiol*
- [50] Widelski, J., Popova, M., Graikou, K., Glowniak, K. and Chinou, I. (2009). Coumarins from *Angelica lucida* L. Antibacterial Activities. *Molecules* 14, 2729-2734
- [51] World Health Organization (2003a). Guidelines on good agricultural and collection practices for medicinal plants. Page 11
- [52] World Health Organization (2014). Traditional Medicine Strategy 2014-2023 Page 1, 2
- [53] Yogayata, S. P and Vijay, D. W. (2012). Herbal medicines and nutritional supplements used in the treatment of glaucoma. *Research Journal of Pharmaceutical, Biological and Chemical Sciences* 3 (1): 331
- [54] Zhang, L., Kong, Y., Dalei, W., Haitao, Z., Jian, W., Jing, C., Ding, J., Lihong, H., Jiang, H. and Shen, X. (2008). Three flavonoids targeting the β -hydroxyacyl-acyl carrier protein dehydratase from *Helicobacter pylori*: Crystal structure characterization with enzymatic inhibition assay *Protein Sci.* 17(11): 1971-1978.

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Impacts of Parents' Academic Socialization in Promoting Quality of Education in Public Day Secondary Schools in Meru County – Kenya

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Abstract

In order for public day secondary schools to be effective in providing quality education for the children they serve, it is imperative that they establish and maintain high levels of parental involvement. The purpose of this study was to investigate the impacts of parents' academic socialization activities in promoting quality of education in public day secondary schools in Igembe Central Sub County, Meru County- Kenya. Descriptive survey design was used. Both probability and non-probability sampling procedures were used to get informants for the study. Eight principals, forty eight teachers, thirty two parents and three hundred and fifty two students were included in the sample. The researcher collected both qualitative and quantitative data from school principals, teachers, parents and students using interview schedules for principals, teachers' and students' questionnaires, parents' focus group discussions and document analysis guide. The findings of the study showed a positive correlation between parents' academic socialization factors and the quality of education. An emphasis on academic socialization activities including parents communicating their expectations to their children, monitoring the children's out of school activities and rewarding good grades was seen to have a direct correlation with improved performance in school. It was also clear from the study that with the permissiveness of the culture, most parents were failing since they did not monitor their children's social activities or follow a specific set of rules in disciplining them. This eventually impacted negatively on quality of education offered in public day secondary schools in the Sub County. The study recommends the need to sensitize parents on the importance of their academic socialization role in the education of their children.

Index Terms - Academic Socialization, Parental Involvement, Public day secondary school, Quality of Education, Sub County

I. INTRODUCTION

In order for secondary schools to be effective in providing quality education for the children they serve, it is imperative that they establish and maintain high levels of parental involvement. This is because during adolescence there are major changes in school context, adolescent development processes including biological and cognitive growth, social development, and re-negotiations of family affiliations, particularly the parent-adolescent relationship, all of which require parental guidance (Grolnick, 2009; Hill & Tyson, 2009). In the context of such changes and development, adolescents' academic performance often decline (Hill et al., 2009), thereby increasing the risk that students may not reach their potential and hence, heightens the need to identify sources of support. Despite this, participation of parents in education of their children tend to decline during the post-primary school years.

Academic socialization is a form of parental involvement which includes parents' interaction with children on the importance and expectations from education of their children. It involves linking schoolwork to current events, nurturing educational and professional aspirations, discussing learning strategies with children, making preparations and plans for the future, and linking material discussed in school with students' interests and goals

(Emerson, Fear, Fox, & Sanders, 2012). During adolescence, a child is able to engage in logical and analytical thinking, problem solving, planning, and decision making. Further, it is during adolescence that goals, beliefs, and motivations are internalized and such inner processes shape adolescents' academic performance and course selection. Academic socialization, therefore, creates an understanding about the purposes, goals, and meaning of academic performance; communicates expectations about involvement; and provides strategies that students can effectively use to succeed (Kaplan, 2013).

Academic socialization includes the strategies that will scaffold adolescents' burgeoning autonomy, and cognitive abilities. Besides, this type of involvement posters and builds upon the development of internalized motivation for achievement, focuses on future plans, provides a link between school work and future goals and aspirations, and is consistent with the needs of secondary school students. In addition, it provides young adolescents with the tools to make semi - autonomous decisions about their academic pursuits.

The quality of a country's education is key to its social, emotional and economic well-being. Quality education is an effective means to fight poverty, empower individuals, prepare people to embrace and adapt to change, as well as, manage and influence this change. It is also a human right, a public good and an indispensable element for achieving sustainable development. In addition, it ensures the cognitive development of learners and nurtures their creative and emotional growth, as well as, helping them to acquire values and attitudes for responsible citizenship (UNESCO, 2005). Secondary school education is essential for adolescents to acquire skills that improve their opportunities for the world of work. Quality of secondary education is vital since it prepares the youth for job market and also supplies countries with the educated workforce that they need to participate in today's technologically driven society (UNESCO, 2012).

Parents are fundamentally the primary care - givers and first teachers of their children (Desforges&Abouchaar, 2003; Emerson, et al., 2012; Harris& Goodall, 2007; Jeynes, 2011; Njeru, 2015; and Pushor, 2007). According to Jeynes (2011) the love that parents possess for their children has for centuries propelled many parents to sacrifice towards the course of making their children to succeed academically. Accordingly, parental involvement in their children's education is substantial in promoting quality of education and the educational outcomes of young people in the society. Within research literature the operational use of parental involvement has not been consistent. This is the case because parental involvement has a range of interpretations which suggest that parental involvement is multidimensional and complex in nature. In addition, parental involvement incorporates a wide variety of parental behaviours in their parenting practices. For instance, Desforges et al. (2003) describe parental involvement as good parenting at home, which includes providing secure and sustainable environment, intellectual stimulation, parent-child interactions, the pattern of educational and social values, high prospects for a child's achievement, contact with the school for sharing information and involvement in school life.

Academic socialization is one of the many interventions that can be put in place to enhance quality of education in Kenya's public day secondary schools. This is because parents spend more time with their children than any other adult and have a tremendous influence on their children's social, emotional, and academic development. In addition, parents usually know their children better than anyone else, including their strengths, their environment, community, and cultural context in which they reside.

II. RESEARCH QUESTION

What are the impacts of academic socialization in promoting quality of education in public day secondary schools in Igembe Central Sub County?

III. LITERATURE REVIEW

The Concept of Academic Socialization

In this study, academic socialization designated the parents' behaviours that are related to the child's education which can be perceived as indicators of the parents' commitment to the educational matters of their children, whether at home or in school. Parents' interaction with their children on the importance of education and their interests and aspirations for their children to succeed, affected quality of education offered in public day secondary schools. From this type of involvement, students internalize motivation for achievement, focusing on future plans and ability to make semi - autonomous decisions which have effects on their academic pursuits.

Three decades of research performed by Hanafin and Lynch (2002) have shown that children are inclined to succeed when schools cooperate with families in supporting education through life. This kind of participation of parents is important both in the beginning of the educational process and also throughout the child's entire academic endeavour. Academic socialization is relevant to secondary school students because it develops abilities in students

over time. Such abilities help the students to assess their goals, predict the results and consequences of their own actions, and are also able to learn from their successes and failures independent of their parents (Emerson, et al., 2012).

Parents' beliefs in their capabilities to help their children prosper is fundamental to the form and extent of their involvement in education. Grolnick, Benjet, Kurowski, and Apostoleris (1997) studied parental involvement from various perspectives *Vis a Vis* individual, contextual, and institutional and concluded that parents who considered themselves efficacious in their role of a teacher to their children were more likely to become involved in their children's education. They further recommended some cultural factors like parents' ideas in relation to the teaching of their children to be considered so as to intensify parental participation in education.

The way parents' view their children's school greatly affect their children's perception of the school. This perception eventually contributes either negatively or positively to students' academic, social, and emotional development. Moreover, home-school relations can be fashioned by parents' perceptions of general invitations for their involvement from their children's school. In this case, an encouraging, warm school environment, and constant invitations to parents with ways to become involved in their children's education whether at home and or in school would certainly provoke parents towards the school's efforts.

Parents' beliefs about the desirability of their children's outcomes, the persons responsible for the outcomes, stakeholders' perceptions on their involvement, and parental behaviours associated to those beliefs and expectations, are key determinants of parents' perception of their role in their children's education (Emerson, et al., 2012; Hoover-Dempsey Walker., Sandler, Whetsel, Green, Wilkins, & Closson, 2005). Parental role construction has impacts on both parents' decisions on whether to participate in the education of their children's, and in what ways, as well as on academic attainment of their children. The life aspirations and expectations that parents have for their children are other critical aspects which can be directly linked to educational outcomes. During adolescence for independence which consequently becomes an impediment to parents' involvement in education. Despite this, secondary school students still require involvement of parents in their education if they are to succeed. The view that adolescents do not want their parents involved in their schools at all contradicts adolescents' belief that they can excel at school when their families are actively involved and expect them to succeed (Patrikakou, 2008). Therefore, the quality of education that children receive is to some extent determined by parents' expectations on the academic, social, and emotional development of their children. Since parents' academic socialization is very vital in enhancing quality of education, there is need to know much more about the most effective academic socialization practices that promote quality of education in public day secondary schools of Igembe Central Sub County.

IV. RESEARCH METHODOLOGY

The study was carried out in public day secondary schools in Igembe Central Sub County, Meru County- Kenya. Igembe Central Sub County is one of the nine sub-counties of Meru County. It is in the upper highland zones of Meru with a large number of public day secondary schools. This study employed a descriptive survey design to gather data. The researcher collected both quantitative and qualitative data, hence employed a mixed methods approach. Data was collected using students' and teachers' questionnaires, principals' interview schedules, Focus Group Discussions (FGDs) guide for parents and documents analysis guide. The target population in the study comprised of all the 28 school principals, 266 teachers, 6912 form one to form four students, and 144 PTA representatives, in public day secondary schools of Igembe Central Sub County. This research employed both probability and non-probability sampling procedures to get informants. A total of four hundred and forty (440) informants were sampled.

Primary and secondary data were used in this study. Major attention was given to the primary data for the purpose of this study. Primary data was obtained from in-depth interviews, questionnaires and focus group discussions. The researcher collected both qualitative and quantitative data from school principals, teachers, parents and students using different data collection techniques. The researcher administered the questionnaires to the students and their teachers and conducted interviews with the principals. She also facilitated focus group discussions with the selected parents.

Data from the field was checked for correct entry, coded and then entered into the computer. The quantitative data was analyzed using the Statistical Package for Social Sciences version 20.0 (SPSS 20.0), a computer software programme. Analysis of qualitative data collected was done through thematic analysis. In addition, the report has presented selected vital quotes made by informants that were considered relevant in answering the research question. Besides, informants' views were presented indirectly through paraphrasing while ensuring that the original meaning was maintained. Qualitative data was summarized according to similarities and common themes and was used to complement the quantitative information. The analyzed qualitative data results were integrated into the quantitative data results in the results interpretation. The results obtained were presented in

frequency tables, ANOVA tables, and percentages. In essence both descriptive and inferential statistics were used in the data analysis.

V. RESULTS AND DISCUSSION

Instruments return rate

All the eight (8) targeted principals were interviewed using interview schedules, recording a response rate of 100 per cent. Forty one (41) out of the targeted forty eight (48) teachers returned completed questionnaires. This reflected a response rate of 85.4% which was fairly high. Students' questionnaires were distributed to 352 students sampled from form three and form four classes in eight (8) day secondary schools. All the questionnaires were returned but only 315(89.5%) were complete and were used for data analysis. In addition, eight (8) groups each comprising four parents who were PTA representatives participated in FGDs. The researcher was able to conduct all the eight (8) FGDs in eight (8) schools. She contacted the parents through the school principals and requested the parents to contact each other so as to help schedule the meetings. The researcher used questions as per the FGD guide with the parents, though she could sometimes probe for additional information. The parents gave their views on the parents' academic socialization activities that affect quality of education offered in their children's schools. The majority of the parents who participated in FGDs were female. They had at least primary school education. All of them were literate, hence they were able to follow instructions and participate fully in the group discussions.

Coding was done for the informants who responded to interviews and participated in FGDs. SC stands for schools and the figure 1 the school number, hence, there were 8 schools (SC1 –SC8). P1 - P8 stands for the principals in the respective schools. Similarly, PT1A stands for the first parents' representative in school 1, respectively up to PT8D which stands for the fourth parent from the eighth school.

Informants' characteristics

The researcher conducted face-to-face interviews with eight school principals. Half of them were males and the other half females. Seven out of the eight principals interviewed had a bachelor's degree in education, and one had a diploma in education (Science). The interviews further revealed that all the school principals were married, six of them fell within the age bracket of 48-50 years. One was aged 46 years while the other was 58 years old. Each of the principals had a teaching experience of more than fifteen years. The eldest of the principals (P4) had a teaching experience of thirty three years.

A total of 41 teachers responded to the questionnaires. 43.9 % (18) of teachers involved in the study were aged between 25- 30 years. 24.4% were aged 31 to 35 years. The rest were above 35 years. Only 4.9% (2) of the teachers fell in age bracket of 46 – 50 years. Majority (61%) of the teachers who responded to questionnaires were male, while the rest (39%) were female. It was further established that a high majority of the teachers (61%) were married while the rest (39%) were single. Hence, the composition of teachers in regard to marital status was good for the study, especially as pertains to their views on effects of parental academic socialization in their children's education. All the teachers who responded to the questionnaires were trained. In regard to teachers' working experience, nearly half of the respondents reported a teaching experience of more than five years. Specifically, 51.2% reported that they had an experience of 1 to 5 years, 29.3% recounted an experience of 6 to 10 years while 7.3% specified that they had an experience of 11 to 15 years. In addition, 9.8% stated that they had stayed in the teaching profession for a period of 16 to 20 years and 2.4% reported an experience of 21 to 25 years.

From the research findings, it was established that out of 315 students who returned their questionnaires, 50% were boys, while 50% were girls. This means that gender parity was realized in as far as the students' responses were concerned. Hence, the outcome of the study would be impartial in terms of views of either gender. The respondents were equally distributed amid the form three and form four classes, which were the classes of concern to this study. On analyzing information about the type of family that students came from, the study revealed that 216 of the students (68.6 %) belonged to a nuclear family and lived with both parents. The study also showed that 58 students (18.4 %) lived with single parents, 34 students (10.8 %) lived in polygamous setups, while seven (2.2 %) of them were taken care of by guardians who were not their biological parents.

The researcher had discussions with eight parental focus groups of four parents each. The parents included in the discussion were PTA members who represented parents with children from form one to form four classes. The focus group sessions lasted between one to one-and-a-half hours. Nineteen (19) of the parents engaged in the discussions were males while thirteen (13) were females. They had at least primary education. Twenty seven (27) of the parents were married, while five (5) of them were single parents. In addition, twenty seven (27) of the parents were self-employed, either in farming or small businesses. Two (2) were primary school teachers, the other three were ECDE teachers (2) and one (1) veterinary officer. This is an indication that though parents were working,

majority never had any steady job. In addition, most of parents fell into a very low-income bracket. The study indicated that parents' academic socialization practices decreased, especially with children in secondary schools.

Relationship between parents' academic socialization and students' gender

A t – test was performed to assess the relationship between parents' academic socialization and gender of the students. It was established that the mean academic socializationscore of females was 39.14 (SD = 14.636) while that of their counterparts was 37.73 (SD = 13.626) (Table 4.1). This meant that the academic socializationfor females was higher than that of the males. However, the difference between the academic socializationscoresbetween the genders was not found to be statistically significant as the p – value was greater than .05 (P= 0.378) as shown in Table 4.2.

Table 4. 1 Parents' Academic Socialization and Gender Group Statistics

	Gender	N	Mean	Std. Deviation
Academic Socialization	Male	157	37.73	13.626
	Female	158	39.14	14.636

Table 4. 2 Parents' Academic Socialization and Gender Independent Samples Test

	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
Equal variances assumed	2.489	.116	-.883	313	.378	-1.407	1.594
Equal variances not assumed			-.883	311.7	.378	-1.407	1.593

Relationship between academic socialization and family type

On analyzing information about the type of family that students came from, the study revealed that 216 of the students (68.6 %) belonged to a nuclear family and lived with both parents. The study also showed that 58 students (18.4 %) lived with single parents, 34 students (10.8 %) lived in polygamous setups, while seven (2.2 %) of them were taken care of by guardians who were not their biological parents. These results are shown in Table 4.3.

Table4. 3Students' Family Type

Family Type	Frequency	Percent
Single parent	58	18.4
Nuclear	216	68.6
Polygamous	34	10.8

Other	7	2.2
Total	315	100

From the FGDs, parents from SC2 and SC5 observed that some students in their schools were orphaned, others were from single parent families, while others were from polygamous families. They further noted that some of these students were committed, obedient and disciplined, though some attended school irregularly or dropped out altogether.

PT2A also had this to say:

Children of this school are so committed to their studies that they are always in school by 6.30am each school day. However, some are discouraged by the nature of problems they encounter at home since some have no parents and others have absent and / or irresponsible parents. Ninety percent of the students in this school come from extremely poor homes where parents cannot afford boarding school fees.

The above finding revealed that learners’ family backgrounds varied. It was reported that some students joined school through support from their local churches, while others through non - governmental organizations (NGOs), self-help groups, CDF bursaries and their area member of parliament (MP).

PT4C described the students in these words:

Children are very obedient, disciplined and committed to studies but discouraged by parents’ behaviour. They are always punctual and commit themselves to private studies even late in the evenings. If you pass by the school in the evenings, you will find them there doing their private studies.

PT1C, PT3A, PT3C, PT4B, PT5A, PT6B, and PT7D had similar sentiments. However, PT1A, PT2D, PT5D and PT8C had a different opinion. According to them,

Most students are hardworking while others are negatively aggressive. For example, they fight, insult, and have no courtesy towards teachers and other students. This puts their schools’ discipline at stake. Some are however obedient.

If students possessed such negative traits as described, this would most likely affect quality of their education.

One way ANOVA was done to examine the relationship between parents’ academic socialization and family type.

Descriptive statistics

The academic socialization mean for single parent family type was 39.17 (SD = 14.74, N = 58) followed by nuclear family type with a mean of 38.80 (SD = 13.96, N = 217). Polygamous family type recorded a mean of 36.68 (SD = 14.35, N = 34) while other family types registered academic socialization mean of 28.17 (SD = 11.58, N = 6) as shown in Table 4.4.

Table 4.4 Descriptive Statistics for Academic Socialization versus Family Type

	N	Mean	Std. Deviation	Std. Error
Single parent	58	39.17	14.74	1.94
Nuclear	217	38.80	13.96	0.95
Polygamous	34	36.68	14.35	2.46
Other	6	28.17	11.58	4.73
Total	315	38.44	14.14	0.80

Table 4. 5ANOVA: Relationship between Academic Socialization and Family Type

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	798.51	3	266.17	1.336	.263
Within Groups	61951.03	311	199.20		
Total	62749.54	314			

Table 4.5 shows the results of ANOVA test which revealed that family type had no significant effect on academic socialization, since $P > 0.05$. However, each family had an important role to play in academic socialization of their children.

Post Hoc testing

Multiple comparison procedures looked at all possible pairs of means to determine if each individual pairing of the family type is the same or statistically different. The table Multiple Comparisons' show that none out of six pairs vary since the P values are higher than the significant level of 0.05.

From Table 4.6, it is evident that academic socialization happens in all family types. Hence, the relationship between academic socialization and family type was not found to be statistically significant ($P > 0.05$).

Table 4. 6Multiple Comparisons on Academic Socialization and Family Type

(I) Type of family	(J) Type of family	Mean Difference (I-J)	Std. Error	Sig.
Single parent	Nuclear	0.371	2.086	.859
	Polygamous	2.496	3.048	.414
	Other	11.006	6.053	.070
Nuclear	Single parent	-0.371	2.086	.859
	Polygamous	2.125	2.603	.415
	Other	10.635	5.841	.070
Polygamous	Single parent	-2.496	3.048	.414
	Nuclear	-2.125	2.603	.415
	Other	8.510	6.250	.174
Other	Single parent	-11.006	6.053	.070
	Nuclear	-10.635	5.841	.070
	Polygamous	-8.510	6.250	.174

Various Informants' Views on the Extent of Parental Involvement in Academic Socialization Activities

Teachers, principals, students and parents' representatives held the following opinions on the magnitude of parents' academic socialization activities in the education of their children in public day secondary schools of Igembe Central Sub County:

Table 4. 7Students' Responses on Parents' Academic Socialization Activities

Academic based Item	N	Mean	Std. Deviation
Provide secure and stable learning environment	315	3.59	1.47
Parents communicate their expectations for education and its value	315	3.51	1.48
Follow specific rules in disciplining	315	3.42	1.51
Compliment on doing well in school	315	3.39	1.51
Encourage and reward good grades	315	3.28	1.54
Gets me to help with tasks around home	315	3.23	1.44
Limit time for going out with friends	315	3.17	1.49
Parents link school work with current events, my interests and goals	315	3.12	1.46
Monitor out-of-school activities	315	3.11	1.49
Exemplary reading behaviour	315	2.90	1.51
Discuss learning strategies with me	315	2.87	1.47
Doing outdoor activities together	315	2.83	1.45

Reviewing high correlations among responses from the twelve items (Table 4.6) led the researcher to use one summated scale in looking at academic socialization activities. The answers from the twelve questions were summed to create an academic socialization scale. The range of academic socialization scale was 12 to 60. Out of the 12 items posed to the students on academic socialization, 2 items registered a mean of between 3.51 and 3.59 meaning regular involvement while 10 items enumerated a mean of between 2.83 and 3.42 implying occasional involvement as shown in Table 4.6.

From the FGDs, parents seemed aware of the importance of their role in education. All felt that their involvement would lead to betterment of their children's future lives. They would also be able to socialize their children well so as to fit well in the community. Besides, they knew that education would help them to eradicate poverty and enhance their children's independence in old age.

The findings of the study revealed that most parents had high aspirations for their children though such aspirations would change due to economic constraints and the student's abilities, especially due to low marks upon admission in form one. Parents' high social capital through engagement with the child, communication, shared values and aspirations enhances improvement of education quality in terms of, for instance, improved academic attainment, and positive changes in behaviour. However, the study found out that very few parents cared about what their children were doing in school. They hardly checked on their children's progress, as reported by principal P5:

Most of our students' parents do not care about their children's schooling. Very few check on their children's performance. They do not even ask for their children's report forms. They are never punctual in meetings attendance. They oppose any school policy on finances.

PT8B is quoted to have said,

...there is no need for good teachers and good schools if parents have no interest in their children's education and they do not provide a conducive environment for the child to learn.

From the study, it was clear that students whose parents held high expectations for them and communicated these expectations clearly made a difference in their children's school attendance, discipline and academic attainment. This resonates with findings from previous studies (Patrikakou, 2008) that adolescents' believed that they could do better at school when their families were interested in their schoolwork and expected them to succeed. This therefore, challenges the widespread view that adolescents do not want their parents involved in education at all.

PT8B added;

I talk with my daughter's teachers to find out how she is doing academically and behaviourally and I am always ready to provide for all her needs.

Regarding their expectations for their children's education, quite a number of parents displayed high expectations. For instance, PT2C expected his son to:

...become a great person in the government and society; to fill the gap that I should have occupied. That is why I work very hard and all my money goes towards his upkeep and his education.

PT3D declared:

I look forward to a time when my son would be able to support himself in future life and be able to earn a living.

Parent PT6A had similar expectations for her daughter's education. She professed:

Well, I expect that what my daughter gets from school will equip her for life. I hope that she will do well in her exams... I pray that her education will take her where she wants to go.

Parent PT2D added:

I expect my son to do well in school, join the university and later get himself a job which will make him somebody dependable in our society.

From all the FGDs it seemed that majority of the parents had high expectations of their children's education. All the parents aspired that their children did well in school and became "something". They all wanted a better life for their children, than what they themselves had.

From the principals' interviews, however, it was apparent that quite a large fraction of parents did not know what to expect of their children after school. To them, parent's expectations were never communicated to their children. Most of the principals were in agreement that some parents took their children to school just because their peers had done it. According to principal P3, majority of parents considered form four education / certificate as terminal. To him, the parents lacked preparedness for school after form four. Besides, most of the students' KCSE certificates were never collected. This is an indication that the parents were not quite interested in what happened to their children after form four. This sort of attitude frustrated the children's efforts; since they would then see no future in their education after secondary school. For example, some students had high expectations but felt limited due to a misconception that they could not qualify for some courses like medicine or engineering as long as they were from a day secondary school.

Effects of Academic Socialization in Promoting Quality of Education

All the parents had high expectations of their children's education. Majority believed that education would "open doors for them" with regards to their future. All parents expressed their desire for their children to do well in school and become "something".

The researcher was keen to document some of the parents' practices that socialize their children into education and eventually improve on education quality. These majorly revolved around how these parents viewed education, as it was very likely that the parents' own attitudes would rub off on their children. Echoing views from E.g. PT1D, "I want my daughter to drive her own car one day and help me lead a better life" and parent PT3A who shared similar sentiments for his son's education by stating that:

If children are aware of their parents' expectations, then they cannot drop out of school. ...I expect my son to finish form four and go to the university to pursue a professional course.

From the above findings, it is apparent that parents recognized education to be very important as a gateway to success; one that would see their children achieve great things, lead a better life than them and even free their families from shackles of poverty.

An emphasis on academic socialization activities including parents communicating their expectations to their children, monitoring the children's out of school activities and rewarding good grades was seen to have a direct correlation with improved performance in school; since children who recorded such activities from their parents were seen to mostly get C related grades, compared to their counterparts. It was also clear from the study that with the permissiveness of the culture, most parents were failing since they did not monitor their children's social activities or follow a specific set of rules in disciplining them. This was especially true for the male children; with a parent in one of the FGDs stating in a dismissive tone, "No one minds circumcised boys."

VI. CONCLUSION

Expanding the role of parents in their children's education has benefits to the children, their parents, and the school community. The more the parents were engaged in the education of their children, the more likely their children were to succeed in the education system. The involvement of parents in academic socialization of their secondary school children has effects on continued development, and improved performance in school. This therefore, calls for the need to sensitize parents on their role expectations in their children's school life in a formal setup which would allow for a formal interaction between parents, teachers and even school administrators. Through such an avenue parents can get enlightened on the activities that either directly or indirectly affect the quality of education that their children receive so they may know how to invest their energies and resources to improve education in their children's schools. Consequently, increased interactions between schools, students and their parents result in a higher quality education environment, which can be linked to better examination results, improved discipline and school completion rates.

In Igembe Central Sub County, majority of the parents of day secondary schools consider schools as places where decisions about their children's education are made by teachers. Due to this, there is minimal parental involvement in education which eventually impacts negatively on quality of education offered in public day secondary schools in the Sub County. In order to bring about change in the status quo of minimal parental involvement in secondary education, a strategic intervention is needed in public day secondary schools by all stakeholders in education. Vis a Vis the government, school teachers, school management, and even parents themselves. This is because promoting the education and skills of young people would not only expand their opportunities but could also increase their productivity with gains for their families as well as the wider economy.

VII. RECOMMENDATIONS

- a) There is need to sensitize parents on the importance of the role they play in education of their children and encourage them so that they can be actively involved in the lives of their children.
- b) Parents should encourage their children's performance by rewarding good academic performance and behavior, monitoring their children's progress in school and even selection of friends- for purposes of discipline.
- c) Parents should also be encouraged to be good ambassadors and carry a positive image of public day secondary schools and education. In addition, everyone should know that it is easy to educate their children in public day secondary schools since school fees is less. This awareness can be created in chiefs' barazas or other community gatherings, women group meetings, and religious gatherings, among others.

REFERENCES

- Desforges, C. and Abouchaar, A. (2003). *The impact of parental involvement, parental support and family education on pupil achievement and adjustment: A literature review*. Report Number 433, Department of Education and Skills.
- Emerson, L., Fear, J., Fox, S., and Sanders, E. (2012). *Parental engagement in learning and schooling: Lessons from research*. A report by the Australian Research Alliance for Children and Youth (ARACY) for the Family-School and Community Partnerships Bureau: Canberra.
- Grolnick, W. S. (2009). The role of parents in facilitating autonomous self-regulation for education. *Theory and Research in Education*, 7(2), 164-173.
- Grolnick, W. S., Benjet, C., Kurowski, C. O., & Apostoleris, N. H. (1997). Predictors of parent involvement in children's schooling. *Journal of Educational Psychology*, 89, 538-548.
- Hanafin, J. & Lynch, A. (2002). Peripheral voices: Parental involvement, social class, and educational disadvantage. *British Journal of Sociology of Education*, 23(1), 35-49.
- Harris, A. & Goodall, J. (2007). *Engaging parents in raising achievement: Do parents know they matter?* Research report, University of Warwick.
- Hill, N. E., & Tyson, D. F. (2009). Parental involvement in middle school: A meta-analytic assessment of the strategies that promote achievement. *Developmental Psychology*, 45(3), 740-763.
- Hoover-Dempsey, K. V., Walker, J. M. T., Sandler, H. M., Whetsel, D., Green, C. L., Wilkins, A. S., & Closson, K. (2005). Why do parents become involved? Research findings and implications. *The Elementary School Journal*, 106, 105-130.
- Jeynes, H. W. (2011). *Parental Involvement and Academic Success*. New York: Taylor & Francis Group.
- Kaplan, T. N. (2013). Multiple Dimensions of Parental Involvement and Its Links to Young Adolescent Self-Evaluation and Academic Achievement. *Psychology in the Schools*, 50(6), 634-649.
- Njeru, M. (2015). Parents as Participants in their Children's Learning: A Tall Order for Parents in Rural Kenya, *Journal of Adolescent & Adult Literacy*, 58(5), 368-371.
- Patrikakou, E. N. (2008). Power of Parent Involvement: Evidence, Ideas, and Tools for success. Academic Development Institute.
- Pushor, D. (2007). *Parent Engagement: Creating a Shared World*. Paper prepared for the Ontario Education Research Symposium, Toronto, Canada.
- UNESCO (2012). *Youth and skills: Putting education to work*. EFA global monitoring Report, UNESCO.

UNESCO (2005). *Education for All Global Monitoring Report: The Quality Imperative*. Paris, UNESCO.

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Analysis of Patient Safety Implementation by Nurses in Queen Latifa Hospital of Yogyakarta, Indonesia

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Abstract- Patient safety is an essential component of quality nursing care and a serious global public health issue. Every point in the process of care giving contains a certain degree of inherent unsafety. Queen Latifa Hospital is a type D hospital, the data of patient safety incident in 2016 showed 5 cases of adverse events and 2 cases of near misses. The aim of this study was to analyze the implementation of patient safety by nurses in this hospital. This type of research used in this study was mixed methods with descriptive approach in quantitative data and content analysis approach in qualitative data. The sampel of this study consists of 32 nurses for quantitative data with observation and 4 informants for qualitative data with indepth interviews. The observation results of patient safety implementation showed that 2 out of 6 patient safety goals have been optimally achieved. Identify patients correctly 84%, improve effective communication 91%, improve the safety of high-alert medications 100%, ensure safe surgery 100%, reduce the risk of health care associated infections 94%, reduce the risk of patient harm resulting from falls 81%. The result of indepth interviews supporting the quantitative data that patient safety has been implemented well in this hospital but not all the goals have been successfully achieved the optimal result. The obstacle of patient safety implementation is nurses habit factor. Documents and facilities related to patient safety goals are completely available in all units. The conclusion of this study is patient safety has well implemented by nurses in Queen Latifa Hospital but not all of the patient safety goals achieved optimal result.

Index Terms- patient safety, implementation, nurses, hospital

I. INTRODUCTION

Patient safety is a fundamental principle of health care. Every point in the process of care giving contains a certain degree of inherent unsafety. A number of countries have published studies showing that significant numbers of patients are harmed during health care, either resulting in increased length of stay in health care facilities, permanent injury or even death [1]. Developing a positive patient safety culture has been suggested as the important strategy to improve the quality of health care services and patient safety.

A total of 11379 inpatients were surveyed by IBEAS (Iberoamerican Study of Adverse Event), 1191 had at least one adverse event related to the care received rather than to the underlying conditions. The estimated point prevalence rate was 10.5%, with more than 28% of adverse event causing disability, 6% associated to the death of the patient and almost

60% were considered preventable [2]. Investigation of patient safety in developing and emerging countries has been infrequent and limited in scope. Establishing fundamental patient safety practices, integrating those process into routine health care are necessary prerequisites to measuring and monitoring progress towards safe patient care in developing and emerging countries [3].

Patient safety by Joint Commission International are defined by six major goals to identify patient correctly, improve effective communication, improve the safety of high-alert medications, ensure safe surgery, reduce the risk of health care associated infections, and reduce the risk of patient harm resulting from falls [4]. More positive patient safety is associated to fewer adverse events in hospitals [5]. The adverse event cases in Indonesia spread in various provinces in 2007, Jakarta had the highest number of adverse event cases than other provinces with 37.8%, Central Java 15.9%, Yogyakarta 13.9%, East Java 11.7%, Aceh 10.7%, West Java 2.8%, Bali 1.4% and South Sulawesi 0.7% [6].

Health care systems are complex organizations with inherent unpredictable risks that impact on safe delivery of patient care. These system must be managed by health care providers [7]. Nurses are the main group of health care providers in the hospital, they are generally closer to patients than other clinicians and spend most of their times in the patient care department. They have an important role in providing nursing health care to patients. Given the integral role which nurses play in promoting patient safety, further examination of the link between nursing work and patient safety is warranted [8]. They are the most likely to recognize workflow, physician plan or communication related to patient safety problems and identify possible solutions to the health problems [9].

Preliminary study, Queen Latifa Hospital is a type D Hospital, the data of patient safety incident in 2016 showed the 5 cases of adverse events and 2 cases of near misses. Therefore, the aim of this study was to analyze the implementation of patient safety goals by nurses in Queen Latifa hospital. The study sought to answer the following research questions: how the implementation of six patient safety goals are implemented, what are the obstacles of the implementation of patient safety in hospital, and how are the patient safety training and monitoring carried out.

In the context of this study, patient safety implementation were defined as the following goals: identify patient correctly, improve effective communication, improve the safety of high-alert medications, ensure safe surgery, reduce the risk of health care associated infections, and reduce the risk of patient harm resulting from falls.

I. METHODS

This type of research used in this study was mixed methods. Mixed methods research is the use of quantitative and qualitative methods in a single study or series which is increasingly used by health researchers, especially within health service. Descriptive approach used in quantitative data and content analysis approach used in qualitative data. The sampel of this study consists of 32 nurses for quantitative data with observation and 4 informants for qualitative data with indepth interviews.

Patient safety implementation was observed by using the patient safety observation sheets by Joint Commission International (JCI). The research instruments are patient safety observation sheets from JCI, observation checklists for availability documents and facilities, indepth interviews guide lists, stationary and voice recorder.

II. RESULTS

Table 1. Distribution of Gender, education level, and length of work Nurses at Queen Latifa Hospital of Yogyakarta (n:32)

Variable	Frequency	(%)
a Gender		
Male	11	35
Female	21	65
Total	32	100
b Education Level		
Diploma III of Nursing	29	91
Bachelor of Nursing	3	9
Total	32	100
c Length of work		
≥five years	12	38
<five years	20	62
Total	32	100

Based on Table 1, it can be seen that out of 32 nurses who were respondents in this study had respondents with male sex 11 nurses (35%) and female 21 nurses (65%). The education level of respondents shows 29 nurses (91%) are educated as diploma III of nursing, and 3 nurses (9%) are educated as bachelor of nursing. Most of respondents are work for less than five years 20 nurses (62%), and 12 nurses (38%) work more than five years.

Quantitative Data Result

This research conducted at Queen Latifa Hospital from February to April 2017. A total of 32 respondents were observed in this research. The observation consists of the implementation of patient safety goals, availability documents and facilities supporting to the implementation of patient safety.

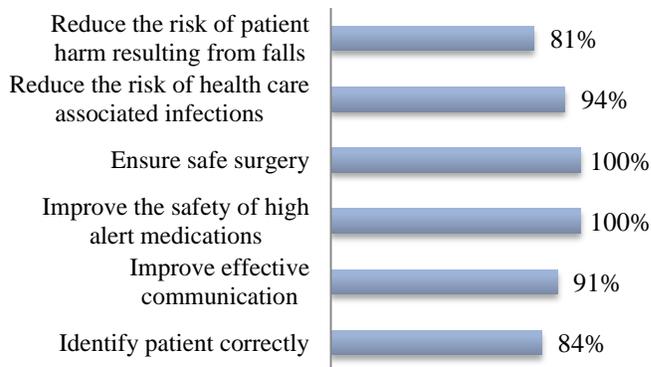


Figure 1. Observation results of Patient Safety Implementation in Queen Latifa Hospital

Based on Figure 1, it can be seen the percentage of nurses observation results. The observation consists of six patient safety goals implementation by nurses in Queen Latifa Hospital. There are two out of six patient safety goals are achive maximum result or 100%, those are the third and fourth goal, improve the safety of high-alert medications and ensure safe surgery. Meanwhile, identify patient correctly 84%, improve effective communication 91%, reduce the risk of health care associated infections 94% and reduce the risk of patient harm resulting from falls 81%. All of patient safety goals implemented over 80%.

Table 2. Availability of documents associated to patient safety goals in Queen Latifa Hospital of Yogyakarta

Document	Availability
Goal 1 Documents related to patient identification	Available
Goal 2 Documents related to improve effective communication	Available
Goal 3 Documents related to improve the safety of high-alert medications	Available
Goal 4 Documents related to ensure safe surgery	Available
Goal 5 Documents related to reduce the risk of health care associated infections	Available
Goal 6 Documents related reduce the risk of patient harm resulting from falls	Available

Based on table 3, it can be seen that all documents associated to the patient safety goals are available in all wards and units in this hospital. The documents are contains the procedures and standards of patient safety implementation to identify patient clearly, improve effective communication, improve the safety of high-alert medications, ensure safe surgery, reduce the risk of health care associated infections and reduce the risk of patient harm resulting from falls.

Table 3. Availability of facilities associated to patient safety implementation in Queen Latifa Hospital of Yogyakarta

Facilities	Availability
Patient ID bands	Yes, including patient ID bands for allergic and patient risk of fall
High-alert medications storage	Yes, available in pharmacy department
High-alert and LASA labels	Yes, Available in all wards
Sink	Yes, Available in all units
Water	Yes, Available in all units
Handsoap	Yes, Available in all wards
Hand towel	Yes, Available in all wards
Handrub	Yes, Available in all wards
Bed Side Rail	Yes, Available in all wards but some of side rails are not usable
Wheelchair	Yes, Available in all wards

Based on table 4, it can be seen the facilities related to the patient safety implementation are available in all wards and units in this hospital such as patient ID bands, high-alert medications storage, high alert/LASA (Look Alike Sound Alike) labels, sink, water, handsoap, hand towel, handrub and wheelchair. Bed side rails are available but some of the siderail are not usable.

Qualitative Data Results

The indepth interviews conducted after the observations of patient safety completed. Four informants serving on the patient safety team were involved in the indepth interviews. They answered four major questions about how the implementation of patient safety goals, what are the obstacles of patient safety implementation, and how are the training and monitoring of patient safety carried out.

The data analysis resulted in emerging four main themes: patient safety has been implemented well but not all the goals have been successfully achieved the optimal result, the obstacles of patient safety implementation are habits and consciousness of the nurses are not yet properly formed, patient safety training has conducted irregularly, hospital monitored the implementation of patient safety every months.

III. DISCUSSION

Nurses are ideally placed to drive the patient safety within health care process because of their unique proximity to patients. There have been some attempts to look at the links between nursing care and quality outcomes, but relatively little on the connection between nursing and patient safety [10].

Joint Commission International listed six patient safety goals to be the international standard of hospital accreditation. This research observed all the following patient safety goals: identify patient correctly, improve effective communication, improve the safety of high-alert medications, ensure safe surgery, reduce the risk of health care associated infections and reduce the risk of patient harm from falls. All of the goals of patient safety have been implemented well by nurses in Queen Latifa Hospital. Two out of six patient safety goals have 100% successfully achieved. Those are third and fourth goal, improve the safety of high-alert medications and ensure

safe surgery. Four other goals have not optimally achieved the result, however the result achieved over 80%.

Goal 1 : Identify Patient Correctly

Ensuring accurate patient identification is central to preventing medical errors [11]. Patient identification errors during the medication administration process can be fatal [12]. This research shows that hospital has implemented patient identification but there were five nurses did not identify the patient correctly. They did not identify the patients with two patient identities. It because of habit and the role model within environment has not formed properly. Patient identity bands for high risk of fall and allergic are available in the hospital. The yellow color band signed to high risk of fall and red color to allergic.

Goal 2 : Improve effective communication

The quality of communication in interactions between nurses and patients has a major influence on patient safety. To support the development of effective nursing communication in health care process, a good understanding of what constitutes effective communication is helpful [13]. In addition to the communication undertaken with other health care providers, the communication between nurses has long been seen as an important to the planning and evaluation of patientcare [14]. Communication factors appear to play not only a vital role in delegation effectiveness, but also a leading factor in the success of nursing teams.

Nurse has implemented the effective communication to patients and among clinicians. It can be seen that only three nurses have not implemented the goal correctly. Queen Latifa hospital using SBAR (situation, background, assessment, and recommendation) communication tool reporting in a paper format. SBAR communication tool describes a systematic and focused mechanism for the communication of pertinent patient information. Nurses would fill out only certain section of the SBAR form.

Goal 3: Improve the safety of high-alert medications

All participants in this research have implemented this goal correctly. Nurses have been stored high-alert medications at pharmacy department, and labelling all the high-alert medications to improve the safety high-alert medications. This finding consistent to the recent study that improving medication safety, particularly for high-alert medications, remains a major concern of health care professionals. Most errors do not harm patients, but incorrect administration of high-alert medications can result in serious consequences. Many recommended practices have been proposed to decrease medication errors, including avoiding mistakes by storing high-alert medications in specific ways [15].

Goal 4: Ensure Safe Surgery

Nurses in this hospital have implemented procedures and correct site surgery process. They using WHO surgical safety checklist as one of their surgery procedures to ensure safe surgery. It consistent to the related study that the implementation of WHO surgical safety checklist reduced in hospital 30-day mortality [16]. Effective implementation consists of three components; complementary strategies, active involvement and effective communication among all members of the perioperative team.

These findings are consistent to the WHO correct site marking guide. The correct site surgery process is the procedure consist of Preoperative verification process to reduce the risk of patient and procedure misidentification by ensuring that all of the relevant document and diagnostic studies are available, Marking the operative site to identify unambiguously the intended site of incision for insertion, and "Time out" immediately before starting the procedure to conduct a final verification of the correct patient [17].

Goal 5: Reduce the risk of health care associated infections
Hand hygiene has long been known as one of the key to reduce health care associated infections. A recent study described a multifaceted improvement initiative that achieved sustained hand hygiene improvement among health care personnel, and significant reduction in healthcare associated infections. Proper performance of hand hygiene at key moments during patient care is the most important to preventing health care associated infections (HAIs), with increasing awareness the societal impact caused by HAIs has come the realization that hand hygiene implementations are crucial to reducing the burden of HAIs [18].

Implementation of hand hygiene in Queen Latifa Hospital has been implemented well by nurses, but not all the nurses did it correctly. Availability of hand sanitizer, hand soap handrub and hand towel are important to support the implementation.

Goal 6: Reduce the risk of patient harm from falls

Falls are leading patient safety incident event in general hospitals[19]. Patient falls in hospitals have been a focus of outcomes research to assess the variation in patient safety across hospitals and explore whether nurse staffing maybe associated with safety[20]. Nurses has implemented the procedures to reduce the risk of patient harm from falls, patients signed by the yellow identity band, side rails are available in all beds but some of them are not usable. This last goal gets the lowest result, 6 nurses did not implemented the goal properly, some of them did not put the bed side rail correctly.

Nurses who perceived supervisor, feedback and communication about errors, teamwork across hospital units, and hospital handoffs and transitions had more overall perceptions of patient safety. Furthermore nurses who had more years experience and were working in teaching hospitals had more perception of patient safety culture [21]. Nurse managers should routinely complete baseline assessment of delegation, communication, and teamwork practices on their individual units [22].

Giving a training to nurses is an important thing to improves nurses' knowledge and self-awareness in health care process. It consistent to the recent study from Bawelle (2013) that socialization affected to increase nurse knowledge and nurses attitudes on implementing patient safety. This hospital has train the nurses but the training was not continuously conducted.

IV. CONCLUSION

1. The observation results of patient safety implementation by nurses in Queen Latifa Hospital showed two out of six

patient safety goals have 100% successfully achieved. Those are third and fourth goal, improve the safety of high-alert medications and ensure safe surgery. Meanwhile four other goals, Identify patient correctly 84%, Improve effective communication 91%, reduce the risk of health care associated infections 94% and reduce the risk of patient harm resulting from falls 81%. All of patient safety goals implemented over 80%.

2. Patient safety has well implemented by nurses in Queen Latifa Hospital of Yogyakarta but not optimally achieved to all patient safety goals. It because of the nurse habit factor as the main constraint of the patient safety implementation.
3. Documents and facilities associated to patient safety goals implementation are completely available in all units and wards.

V. RECOMMENDATION

1. The results can be used as the information to develop similar researches about patient safety implementation
2. Hospital provides regularly patient safety training for all clinicians especially nurses.
3. Nurses improves their abilities and knowledge to develop the habit and self awareness.
4. Further researchers is warranted to analyze the patient safety implementation with different method to get deep information.

REFERENCES

- [1] Safety, W. P., & World Health Organization. (2011). *Patient safety curriculum guide: Multiprofessional edition*.
- [2] Aranaz-Andres, J. M., Aibar-Remon, C., Restrepo, F. R., Urroz, O., ... & Gonseth-Garcia, J. (2011). Prevalence of Adverse Event in The Hospitals of Five Latin American Countries: Results of the Iberoamerican Study of Adverse Events (IBEAS). *BMJ Quality & Safety in Health Care*, Bmjqs-2011
- [3] Carpenter, K. B., et al. (2010). Measures of Patient safety in developing and emerging countries: a review of the literature. *Quality and Safety in Health Care* 19.1: 48-54
- [4] Joint Commission International and Joint Commission on Accreditation of Healthcare Organizations. (2016). Joint Commission International Accreditation Standards for Hospitals. *Joint Commission Resources*
- [5] Mardon, R. E., Khanna, K., Sorra, J., Dyer, N., & Famolaro, T. (2010). Exploring relationships between hospital patient safety culture and adverse events. *Journal of patient safety*, 6(4), 226-232.
- [6] Komite Keselamatan Pasien Rumah Sakit. (2008). Pedoman Pelaporan Insiden Keselamatan Pasien (IKP)
- [7] Leape, L., et al. 2009. Transforming Healthcare: a safety imperative. *Quality and Safety in Health Care*. 18.6: 424-428
- [8] Ramanujam, R., Abrahamson, K., & Anderson, J. G. (2008) Influence of Workplace Demands on Nurses' Perception of Patient Safety. *Nursing & Health Sciences*, 10(2), 144-150.
- [9] Thompson, P., Navara, M. B., & Antonson, N. (2005). Patient safety: the four domains of nursing leadership. *Nursing Economics*, 23(6), 331
- [10] Richardson, A., & Storr, J. (2010). Patient safety: a literature review on the impact of nursing empowerment, leadership and collaboration. *International nursing review*, 57(1), 12-21.
- [11] Morrison, A. P., Tanasijevic, M. J., Goonan, E. M., Lobo, M. M., Bates, M. M., Lipsitz, S. R., ... & Melanson, S. E. (2010). Reduction in specimen labelling errors after implementation of a positive patient identification system in phlebotomy. *American Journal of Clinical Pathology*, 133(6), 870-877.

- [12] Marquard, J. L., Henneman, P. L., He, Z., Jo, J., Fisher, D. L., & Henneman, E. A. (2011). Nurses' Behaviors And Visual Scanning Patterns May Reduce Patient Identification Errors. *Journal of Experimental Psychology: Applied*, 17(3), 247.
- [13] O'hagan, S., Manias, E., Elder, C., Pill, J., Woodward-Korn, R., McNamara, T., ... & McColl, G. (2014). What counts as a effective communication in nursing? Evidence from nurse educators' and clinician' feedback on nurse interactions with simulated patients. *Journal of Advanced Nursing*, 1344-1355
- [14] Matic, J., Davidson, P. M., & Salamonson, Y. (2011). bringing patient safety to the forefront through structured computerisation during clinical handover. *Journal of clinical nursing*, 20(1-2), 184-189.
- [15] Hsiao, G. Y., Chen, I. J., Yu, S., Wei, I. L., Fang, Y. Y., & Tang, F. I. (2010). Nurses' Knowledge of High-Alert Medications: instrument development and validation. *Journal of Advanced Nursing*, 66 (1), 177-190
- [16] Van Klei, W. A., Hoff, R. G., Van Aarnhem, E. E. H. L., Simmermacher, R. K. J., Regli, L. P. E., Kappen, T. H., ... & Peelen, L. M. (2012). Effects of the introduction of the WHO "Surgical Safety Checklist" on in-hospital mortality: a cohort study. *Annals of surgery*, 255(1), 44-49.
- [17] Abdellatif, A., Bagian, J. P., Barajas, E. R., Cohen, M., Cousins, D., Denham, C. R., ... & Horvath, D. (2007). Performance of Correct Procedure at Correct Body Site. *Joint Commission Journal on Quality and Patient Safety*, 33(7), 443-446.
- [18] Pincock, T., Bernstein, P., Warthman, S., & Holst, E. (2012). Bundling hand hygiene interventions and measurement to decrease health-care associated infections. *American Journal of Infection Control*, 40 (4), S18-S27
- [19] US Department Of Veterans Affairs. National Center for Patient Safety 2004 Falls Toolkit. <http://www4.va.gov/npcs/SafetyTopics/fallstoolkit/index.html>. Accessed February 2017.
- [20] Lake, E. T., Shang, J., Klaus, S., & Dunton, N. E. (2010). Patient falls: Association with hospital Magnet status and nursing unit staffing. *Research in nursing & health*, 33(5), 413-425.
- [21] Ammouri, A. A., Tailakh, A. K., Muliira, J. K., Geethakrishnan, R., & Al Kindi, S. N. (2015). Patient safety culture among nurses. *International nursing review*, 62(1), 102-110
- [22] Gravlin, G., & Bittner, N. P. (2010). Nurses' and nursing assistants' reports of missed care and delegation. *Journal of Nursing Administration*, 40(7/8), 329-335.

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Avoidance of Academic Dishonesty in Selected Secondary Schools of Jimma Towne

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Abstract- Academic dishonesty, academic misconduct or academic fraud is any type of cheating that occurs in relation to formal academic exercises. This study primarily focused on cheating of examination in the classrooms through application of different techniques, mostly disguised ones. Qualitative research activity, employing interview and classroom observations as its basic tools of data gatherings were used on sources of the study. Two secondary schools (Jiren and Jimma Secondary schools) were study sites involved in the exploit where purposefully selected students of grade nine and ten with their classroom teachers chosen as resourceful informants. Finding of this study clearly indicated that cheating is common problem of all schools where it became more comprehensive and intricate. Most of the respondents clearly indicated that side copying of examination results, tossing of written answers of the exam, collaboration and mischief with invigilators, enforcing invigilators to cooperate, exchanging of answer sheets willingly or forcefully from active ones, mobile transfer or text and use of sitting arrangements for cheating as major ones. It was underlined that cheating was found as major challenge of the town and the country which is now uncontrollable at secondary school level. Consequently, cheating is envisaged as major mechanism of receiving excellent grade points without any effort and difficulty. Collaborative effort of education offices, judiciary, schools and parents to minimize or curb the problem is recommended where all stakeholders of the government and public affairs work together by advising, guiding and teaching the new generation about badness of cheating, its ethical and moral failure to pass on development of self confidence and self assertions.

Index Terms- Academic dishonesty, cheating, examination, practices, outcome

I. INTRODUCTION

Background: Cheating in high schools is growing globally in an alarming and at an exponential rate. There is also a great difference in students' perceptions and the reality of their own ethical behavior which may nowadays highly obscured within their personality development. In USA, a survey was done in 2008 on 30,000 students in high school which was carried out by the Josephson Institute for Youth Ethics, where 62 percent of students polled said that they "copied another's homework two or more times in the past years" (EAY, 2008). Yet, on the same survey, 92 percent said they were "satisfied with their personal ethics and character" (*Ibid*). Hence, there is generally a discrepancy between actual behavior and self-image of

secondary school students' character that is internalized and in use through education system starting from K-1 level.

Consequently, different studies done in various countries revealed that there are a number of techniques, mechanisms and ways of cheating examinations to secure pass marks, better grade points or pass national examinations. A study done in the US indicated that online services that offer to prepare any kind of homework of high school and college level and take online tests for students were cheated (Fall, 2009). While administrators are often aware of such websites, they have been unsuccessful in curbing cheating in homework and non-proctored online tests, resorting to a recommendation by the Ohio Mathematics Association to derive at least 80% of the grade of online classes from proctored tests (Fall, 2009). While research on academic dishonesty in other countries is less extensive, anecdotal evidence suggests cheating could be even more common in all the countries of the globe. Hence, Ethiopia is one of the countries under jeopardy of examination cheating at all levels of education system where online transfer through mobile texts, bribery of the school administration and/or education offices to secure examinations and direct copy employing different cheating techniques in a classroom (disguised or forceful) are the common ones with not worth mentioning research undertakings on the issue.

Therefore, this research activity was entirely devoted in assessing practices and behaviors related to examination cheating and copy of assignments, homework and activities that have a result in the teaching learning actions. As Jimma is one of the cash crop areas of the country and known South Western Town connected with the central part highway to four major zones leading to South Sudan. It is also one of the famous commercial centers in the country where the expectation of the family and need of their children on education vary by large. By virtue of fortunate or unfortunate conditions, both the family and their children seek success or promotion from grade to other level/grade than acquiring the knowledge, skill and capability gained through education. Owing to the psychologically blend nature of parents and children's desire, different techniques of securing pass mark were devised even if where, how and when cheating for success in education happenstance was not mentioned in any literature in the world. Hence, the authors were inspired to explore sources of cheating examination and devise mechanisms of minimizing the problem leaving all the detailed social, economic, political and psychological hardships academic dishonesty may exert on the public.

Statement of the problem: As of the review made by Solomon Dibaba (The Ethiopian Herald– November 17, 2015),

quality education presupposes a number of factors including correlation with national development objectives, learners who are healthy, well-nourished and ready to participate and learn through the support of families and community members. The question of healthy learners' vis-à-vis support of the family is critical issue which is conversely related to success without healthy teaching-learning. Hence, education in Ethiopia suffered many challenges regarding the quality of human power production for employment. Most of the students in secondary/high schools depend on the other working hard for cheating to promote from class to the next level intended that it would be secured without any effort and loss of energy. The cheaters are/were seen as active, modern, considerate and discreet. Studying is/was taken as duty of 'faras – the fool'. Because of this, some students try to cling on others and count up ladder of grades without any background knowledge and understanding. This on the other way initiated individual students who are confident of themselves but scoring below the cheaters. Hence, cheating of examination was further communicated as best crosscut tactic to success. This condition is the worst stimulation that spoils culture of the community and the interest of the public towards work. To circumvent this situation from its source and device mechanisms to curb challenges of cheating, conducting detailed study is essential. The effects of cheating on students and community, controlling mechanisms of cheating and what cheaters make on invigilators were also investigated. Towards this end, the research tried to answer the following problems:

- What are the major enforcing factors leading to academic dishonesty/cheating?
- Are there different techniques and mechanisms of teaching employed by secondary school students?
- What are the effects of examination cheating on the students, parents and community?
- How can one minimize the hazard of examination teaching in secondary schools of the study areas?

Objectives of the study: - The major intent of this study is to explore sources, mechanisms and effects of academic dishonesty among secondary schools of Jimma town. Specifically, it was intended to:

- Identify the major enforcing factors leading to academic dishonesty/cheating;
- Assess the techniques and mechanisms of teaching employed by secondary school students;
- Examine to what extent examination cheating affects the students, parents and community circumstances;
- Find out methods of minimizing examination cheating in secondary schools of the study areas?

Significance of the study: - The finding of this study is a remarkable one for students with in school system adjusts themselves to individual effort than relying on others for academic success since they may be challenged in the work atmosphere and acquiring expected knowledge of the profession. The outcome of this study is also useful for policy makers and Ministry of Education to evaluate and examine invigilation strategies, student's interest to work independently in the

classrooms since many students presume that cheating is right to act during examination. The family of these students also benefits much since it paves way to assess, monitor and follow-up activities of their children. The finding is best input to conduct intervention schools, specifically secondary schools, since it is a step to join higher institutional settings or sacked out of the system. Finally, it may serve others as a springboard who wants to conduct similar research to further the study at national level.

Scope of the study: - The study is geographically delimited to Jimma Town Secondary Schools where only two government schools involved in the study. It is also conceptually restricted to academic dishonesty or cheating of examination, its strategies and psychosocial effects of cheating on the student, family and community. This may involve on the psychosocial aspects of examination cheating in the actual settings of school, home and community settings.

Limitation of the study: - research undertakings in the country were scarce where very few literatures used as sources. Moreover, we were too tight when conducting this research that calls for others intervention. Therefore, authors of this paper calls for interested researchers collect data from large number of respondents and across regions in the country. Better result may be secured if more study will be conducted on higher institutions since the challenge of examination cheating become erudite and widespread in all levels of educational system, through countries and globally.

II. METHODOLOGY

The study was designed to secure information from both teachers and students employing qualitative and quantitative methods. We used both methods to fit the evidence gap existing if using both approaches. The study sites identified were two public secondary schools of Jimma town on students' populations of grade nine and ten. Classes were clustered for convenience and giving equal chance of inclusion based on grouping of the schools to different blocks/rooms. All students assigned to different blocks got chance of being included in the study employing chronological methods of selection. From all the thirteen blocks, we have chosen four randomly from each school one each to grade nine and ten. To make the study manageable, we again selected two classrooms from each block from grades nine and ten. Finally, Forty Five and Forty Eight students from grades nine and ten were identified as respondents/informants of the study respectively. The tools carefully chosen to gather information from the respondents were interview, questionnaire and observation at natural settings. Data was gathered from teachers, especially from homeroom teachers, purposefully selected subject teachers and unit leaders. The subject teachers were from language, social and natural sciences that were presumed as effective invigilators. The instruments employed to gather information were interview, questionnaire and observation done in the natural settings. The questions are of closed (with yes, no, undecided alternatives) and open-ended questionnaire in which the respondents have free atmosphere to forward their opinions as they wish. The language selected was English while one respondent used Amharic script to explain her idea in brief. The questionnaire was distributed for a number

teachers and students where few of the respondents didn't return the paper back. The reason is not so clear for the researchers where the suspect might be fear of attack from students involving in examination cheating. Interview guide questions were semi-structured ones for easy communication. Interview was conducted with cautiously selected teachers and students that were managed in different setting to minimize dread. From all 93 students and 15 teachers requested to respond to questionnaire, 74 students and 9 teachers returned back the paper while others stayed as decay. The researchers used the result irrespective of its limitations by taking risk factors related to personal factors of the respondents. Permitted and incidental observations were done in different examination rooms as well to triangulate the result. The quantitative data was analyzed using percentage while qualitative data employed narratives and describing of evidences after categorization. Ethical considerations were given due emphasis since the study was done on human beings.

III. RESULTS AND DISCUSSION

Background: - Both teachers (nine) and students (74) returned the questionnaire and interview result done with thirteen key informants are presented sequentially supported with observation results in this chapter. Background information including bio-data of learners and teachers also stated with quantitative data tables successively.

IV. QUALITATIVE DATA ANALYSIS

Sources of cheating: - Concerning source of cheating, all respondents focus on the student's hatred to study the materials (notebooks, handouts, copy, short writings ...) and text books given to them. There are no better educational or other backgrounds that reinforce those children to study. Almost all of them use poor method of studying. Some of them as mentioned by the respondents were unenthusiastic to study what they have at hand when they are at home. Most of the students do not want use other references from libraries since they assume it as hardship. The teacher respondents mentioned the cause as lack of teachers' follow up, absence of the family purposeful coaching and the administrators' reluctance or unjustifiable attention of promotion, loose monitoring and evaluation of the students.

Different standard of living condition also create significant problem especially on the students coming from local area [rural]. They were obliged to go long journey and when they reach home may be assigned to different family duties or personal activities to help themselves while learning. Some of the rural and urban locale students were from poor family that their parents and siblings are dependent on those children, especially on residents of rural areas and the poor family background. They had shortage of time to read and studying materials that forced them to rely on other students who did their home works, assignments and concomitantly copying examinations from their friends.

The respondents indicated that relatively the affluent parents consider school as a place where their children comfort, entertainment, stay for their children or where children pass time or took it as a leisure areas. Even though they have ample time to

read, do and perform school activities; and prefer not to bother, waste times on study their lessons. Students of such a type only strive to promote from a class to next level commissioning simple technique (cheating) that could be gained easily without stamina. These students involve on academic dishonesty to deceive their parents, score better result and make reputation of academic honor in the classrooms through cheating. When parents see results of their children, got astonished, appreciate and encourage them to do the something again without identifying how they obtain this grade. Because, most parents try avoiding failure [detaining] of their children that made parents not question them if they score pass marks in the way they prefer to academic success.

Major leading factors instigating students to cheating –

As of the result of data obtained indicate, about 80% of the respondents specify that social problem is one of the major factors to be considered in addition to economic disparity (95%). The educational levels of the parents show great impact on the study habit of the child as well. If parents are of educated class they attend and follow their children to do their home works, initiate them to study, asks them what they have learnt daily, and the like. The availability of infrastructure has also its own impact on the study habits of the students. If there is no light, a place to study like library and reading materials [dictionary, journals, etc.] are not available, students didn't get any conducive environment that in turn makes them to motivate them to study. Attending class regularly also becomes hard for those students who are unable to get daily bread, sheltering, cloth, exercise books and other materials from their respective families since these all are the basic materials needed for a person to learn.

All respondents agree on the loose follow up of the parents. Those parents of the children have to look and follow up what their children are performing. Some students take their exercise books from home by pretending as if they went to schools but go to cinema, film or watch sports and indoor games in restaurants and bars. Some students waste their precious time in gambling houses, wondering on streets and defying people walking along roads, force schoolgirls to stay with them by quitting their class etc.

54-61 % of the respondents agree on the problem of understanding the school subjects. Some students are unable to understand what a teacher taught them since they don't have any base from the elementary grade through junior class up to secondary school level. So they were undoubtedly liable for cheating as the only mechanism to compensate the inability of understanding /grasping the subject matter. In connection to this, another source as elaborated by about 81% of the respondents among the nine teachers, who responded to the questionnaire, the students' admiration and acceptance of cheating as a hobby. Even though most of the students know that cheating is misconduct they took it as daily routine, best communication of the booster and feeling of proud attaching it to success employing cheating tactics. But, they are psychologically offended, feel bad when thinking about their did, anxious and full of complexity.

Most exam cheaters try to take or copy one or two answers from the one who sits beside them without identifying that whether the answer is correct or not. The extent of cheating during examination is heightened nowadays since it preoccupied psychological makeup of students. The one who acquainted to

cheating may score more result that made others who didn't practice it to involve in such a thing to get more result. Because of this, one of the respondent said the "examination cheating is a contagious one". Many innocent students involved in cheating because of its contagiousness that really become uncontrollable ethical depreciation of this generation. Associating to this view, about 51% of the respondents underlined that the students do not want to waste their time, energy, material, effort, etc. since cheating is the easiest apparatus to get academic success. Therefore, some invigilators get stressed on the problem created on them by gangsters or boyfriend of certain cheating girl students if they strictly watch them during exam.

No one among the respondents believed that there may exist problem on the teachers side during the preparation of exam. But many students complain on the preparation of exam even though it is not well treated or identified as such. If the exam is too hard for the students it may force them to find another method to succeed. This area needs special attention and study since it is one of the greatest bridge between teachers and students.

Other sources among the given choices were laissez-faire teachers and slothful students are the one to be mentioned in the compound. About 77% of the respondents agreed on this issue. They reason out stating that there are some teachers who need cheap popularity from students. Those teachers distribute question papers, and simply went out and stand on the gate or read fictions by finding appropriate places to sit than controlling cheating. Few teachers even initiate students to practice cheating as they indicated on open ended question. As some of the respondents reason out, it is just possible, because these teachers reach this profession through cheating strategy and they try to trace on their previous activities. By extending their narration, some students pampered and practice cheating at elementary level and some teachers do not want to strictly follow and correct those children since they know what they did in Teacher Training Institutions and/or Higher Institutions.

As known, cheating is one of the worst problems that ESLCE Office of Ministry of Education faced where they strive to curb this situation devising different mechanisms to end cheating. But the cheaters also establish more stylish strategies to win academic and professional /job/ success through academic dishonesty. So, few teachers were/are the factors of cheating in one-way or another from the initial stage of Elementary and Secondary Schools and through higher institutions. The other basic fault of teachers mentioned was that almost half of the students in this school pass from grade to grade by mere begging and there exist lack of uniformity to have similar stand against those bulks of beggars. This difference seen among teachers made a gap and they become swift to avoid this unnecessary intimacy with students and families. Because of this, some families wonder from one teacher's house to the other to beg marks for their children, that spoils good work habit and work culture of the society.

On the other hand, the environment of Jimma is not initiating the children to learn since it is cash crop producing area that most of them earn some amount of money for enjoyment. They easily secure necessary material to satisfy their 'motives'. So, they lack interest to learn that consequently lead them to the lack of interest to study. No one wants to put his/her effort to

succeed except very few. In fact there is discrepancy between students in grasping what they are taught. There are students with low aptitude and highest learning inclination. There are also students with middle grasping level and great enthusiasm of schooling. But what astonishes the respondents on giving their opinion on this question was that those students who are academically weak and poor during continuous assessment score wonderful points while those who are found at the medium level score less than the idle ones. This condition initiates those medium students to use other mechanism to succeed and score high points in exams as believed by about 77% of the respondents.

The other associated effect of cheating when on the active and medium students was that when they evaluate themselves 'score below the cheaters' get into misbehaving, ill-mannered, withdraw, missing class, loss interest to study, abused, develop hatred towards subject teachers and school, reject education, etc. Because of these undesirable characters of cheating, these students prefer to perform other duties rather than utilizing their innate talent on education. Mood oscillation might develop among those hardworking students towards their environment consciously or unconsciously that becomes dangerous in their late life which was underlined as strong bad counter effect of cheating by most respondents. Literature by Ehrlich and Ernestine indicated the following supporting the outcome of this study. *Cheating is an epidemic that infects schools and colleges across the county. Academic integrity is, of course, a core value in every educational institution. Without it, learning can never be assured* (Ehrlich and Ernestine, 2013). Moral failure is also one of the effects that those hardworking students face when they score below their weak classmate that deteriorates their understanding to education.

About 43% of the respondents focus on gang students and weakness of administrative staff by giving their opinion briefly. As stressed by some respondents, almost all schools administrative bodies didn't give any attention to conditions apparent during exam. Principals and few unit leaders didn't respond when those physically weak teachers were insulted on the public for the reason that of their strict follows up during invigilation. There is also loose coordination between the administrative body and teachers on taking action against cheaters since the administrators want number of promoted students for statistical consumption for competition ignoring the notion of quality of education. Sometimes they assume themselves as the only bodies that strive to favour students while the teachers are assumed as the body stood to attack students. Consequently, carelessness of some teachers becomes common because of the insensitive nature of school administration to take action *against* those cheaters and there is also fear of attack from those cliques of cheaters outside of the school campus.

Some teachers complain that there is management incapability at school and at home that aggravates the condition and made the children to go out of the norm of the society. Some students do not participate as they want in schools, especially during exams since there is fear from all directions. In the same talk, some families of the students leave their children unprincipled and astray. These children/students act and do what they think well in their daily life, especially in their adolescent

age that needs proper attention and care from both sides (family and education offices). In support of this result Ehrlich and Ernestine (2013) discussed that *the issue of cheating is fundamentally one of character. Character is most readily molded during times of transition, and adolescence is prime among them. High school and college are, therefore, particularly important places for students to learn that when they cheat in their academic work, they are not only cheating fellow students and their institution; they are cheating themselves.*

Interviewed teachers and students underlined that 'students' sit for a meeting before the starting time of each exam to create conducive environment by discussing on current information and design mechanisms to reach everybody in the class with the help of "gochas (smart)". If as a chance invigilators who is strictly follow his students come to their invigilation room they all say "offa", "iski, innsayawalen ... (pap, we will show him if...)", which are the implications or signs of bad temper. When careless and laissez-faire teacher went to their invigilation room they say "yaa, chisu teacher ... (yah, dazzling teacher ...)". This is what cheaters say publicly and sometimes if an attentive teacher passes by the gate to the next; most students swallow their saliva and tremble up to the last step of his passage to the next gate and whisper to each other by saying "isey, tegelagelni ... (great! We're unbound)". This was/is common always which was practiced among most students which show how far cheating was internalized, deep-rooted and got popularity in secondary schools.

Other points raised on this occasion as sources of cheating were problems created beyond the capability of the learners and teachers; i.e., the insufficient seats and rooms. The teachers become unable controlling all the students at the same time; especially, eye control is very tough to manage. There are very few blocks with limited classes built before 20 years to accept around 200 students at the moment while now it gives service for about 2500 students without any addition of classes or buildings. Every class was/is full of students up to the blackboard and most respondents claim that there might not be a space for a teacher to foot on in the near future. On the other hand, in addition to lack of material incentives, most students lack moral and psychological support from the family. Consequently a study done by Smith, Davy and Sterling (1999) is in accordance to this study indicating that *Cheating in academics has a host of effects on students, on teachers, on individual schools, and on the educational system itself.* This in turn has great impact on the student's success to win job after completion of 10th grade. For the reason pertinent to these situations most students who completed 10th grade were misdirected, unemployed, join in to unfitting jobs like gambling, stealing, street, and prostitutions.

Materials used when cheating: - regarding the materials those students used in cheating are many in number as most of the respondents mentioned in addition to the choices given on the questionnaire. All respondents agree on the copying of answers from their neighbors especially from the one who simply fills the answer without any knowledge of the question. Since it is too hard to control all the students who are sitting in a crowded class, everybody can copy from each other in the sense that eye control is unthinkable. Sometimes, when students from different classes come together in one room each one of them strive to copy from the other who is sitting at the side of him/her. This shows that

almost all students participate in the activity of cheating in one way or another as most of the respondents forwarded and as the writers observed.

Other materials that almost half of the students use is shorthand notes "aterera", by forcing the brilliant "gochas" to help them or show them what they need. So the students take out their notebooks secretly and copy from it as about 77% of the respondents agree. Sometimes other students make cover for who copy from notebooks. For example, by lowering their jackets, making space in between them on their bench, by one asks question from one side and the others turn pages of their notes. In the same talking, about 63% of the respondents agree on the force applied by these cheaters on the brilliant students to distribute or give the answers on small pieces of papers for the class.

Some students especially, girls write short notes on their skirt, thigh, and hands up to their elbow and copy from it when necessary. Since these areas are sensitive and shame to look for the invigilator sometimes they get ashamed and leave the area. In most cases the cheaters refuse to give the "atereras (short notes)" to the teacher even when they were caught. So it becomes too difficult for some teachers to control and manage the situation. In addition to the material mentioned above the students prepare favorable conditions before the invigilator inter the exam room. As almost all respondents agree the students write on the blackboard, tables, walls, floor and sometimes on ceilings. They draw pictures and write parts of them lesson by non-erasable ink or print and they quickly copy the answers from their drawing with in a fraction of minutes.

Methods applied in cheating: - Those cheaters try their best to achieve the desired goal. Among the methods employed: hiding necessary materials they prepared in their pocket, beneath the table, put inside the question paper, between their thighs, put notes between them [the examinee], by receiving answer paper from their neighbor and so forth. In accordance to the study result, Whitley (1998) indicated that *Methods of secretly signaling the right answer to friends are quite varied, ranging from coded sneezes or pencil tapping to high-pitched noises beyond the hearing range of most teachers.* As mentioned above clever students write answers on a piece of paper and toss it directly to the one they need to help by put out of the site of the invigilator using hand, elastics or throwing. Sometimes, they give to the nearby student to send out it to some or all colleagues. In other occasions they put the answer papers in to their pens and give it to the person they want to assist. Students who accomplished the work earlier were also obliged to toss in answer papers through windows and gates. Some students also see through the gates by requesting for answers from outside trying to cover their faces between their palms. They also communicate by finger sign even though it is not formal. Some students exchange their question papers beyond the vision of the invigilator. These cheaters sometimes forcefully snatch question papers from the expected ones (intelligent). Some students even didn't write their names until they get something from others. As some respondents mentioned, when a student asks question, the invigilator goes to the other side where students on the other corners do their best to get assistance from colleagues. On the other hand, there is an agreement among the students examined in one room; i.e., one brilliant student asks the teacher to read for

him, e.g. Question number 4, choice B. This means, the students all know that the answer for question number 4 is B.

Mechanisms employed during invigilation: - most of the respondents disagree on the possibilities given and adds their own opinions. Somehow, 61% of them agreed on the choice of assigning the students to put all the materials they have in their hands in front of the class. But some of them claim that, even though, those students were/are told to do so, they put or hide pieces of written materials under their desk, on the floor, under their foot or in their pocket etc. About 54% of them agree on strict follow-up of each and every activity of the students in the class as much as possible. But one respondent disagree on this idea saying it seems impractical since it becomes impossible to follow each and every step of all the students attention and eye movements. About 46% of the respondents accept signing on the answer papers of these cheaters as a remedy. When one tries to copy from whatever the material it could be or from his neighbor, if the invigilators considered the attempt as theft, he signs on it and inform to the subject teacher. Sometimes the subject teachers have pre-information on this aspect. On the contrary, one respondent criticized this attempt as unsuccessful attempt since it create discrepancy among the cheaters themselves. This is in the case that some teachers take proper measure against cheaters to instruct them not to practice such thing again; or e.g., by subtracting some points, by verbal warning, etc. while others assume the signing of teachers as for a fun. This shows that there is no uniformity among teachers and administrators to take measure against cheaters to minimize the situation. Different measures taken against those cheaters aggravate the condition rather than minimizing it. There are some respondents who prefer changing of a place for the one who tries to cheat as best means. But the one who opposes all the choices given comment on this view also. As he mentioned, It would be just possible to take this action; but for how many students in a class could we change place?" By extending his rationalization, the respondent claimed that *if we change places for 35 – 40 students in a class which hold about 45 to 60 students; it will be time consuming or simply wastage of time more willingly than invigilating. It seems also disturbing them rather than giving exam.* In addition to the disturbance created on the students, the invigilator himself may be confused by call in and changing place for such immense flocks of cheaters.

As observed by the writer during his invigilation period of 10th graders National Assessment Examination (NAE) about 50 – 70% of the students who sat for the exam strived copy from each other or endeavor cheat by copying from notebooks and from shorthand notes prepared for this purpose. Therefore the problem was/is as it is. Some of them believe that attaching the notes or every material the students used to cheat with their exam papers and hand it to the subject teachers is one method to be underlined. As raised above some teachers simply saw and threw the 'aterera' in their garbage rather than taking any measure against perpetrators as one respondent pinpointed. In relation to this result New York Times magazine (2012) stated the following. *A recent graduate said that near the end of her senior year, a teacher caught one of the student's friends taking a math test with a sheet of formulas held in her lap. But knowing that the girl had been accepted into an Ivy League school, the teacher let*

the student off with a warning because he did not want to jeopardize her enrollment. This created problem on energetic invigilators when students observe the points not deducted, cheating is/was defused the working students since cheaters proudly carry on performing their unethical career as they did previously without any hesitation. This vividly shows that there is huge gap between teachers to avoid this social lax. The other respondent emphasized on the tearing out of all the materials caught or s/he discovered in the hands of the students cheaters and throwing it through the window would teach them not reiterate again. Other respondent focused on ordering all the students not to cheat from each other or not to use any material they have in their hands or pockets before distributing the exam paper. But the problem as the one who doesn't accept the possibilities mentioned on the questionnaire raised his discourse saying it seems impractical and doesn't pass from lip service or axiom.

V. SUMMARY

Based on the data collected using questionnaire and observation the following results were drawn as summary:

- Concerning identified source of cheating –
 - Lack of educational background from lower level including poor study habit and reluctance to study what they learnt.
 - Lack of material and moral incentive (poor motivation in education).
 - The environment is not conducive to properly attend classes since cash crop producing area which lessen personal performance except cheating to fill hole
 - Over crowdedness resulted from shortage of class and seats
 - Inadequate follow-up from parents, teachers, school management and public
 - Some teachers are motivating the students to cheat (beg for marks for relatives, own children)
 - Loose coordination of school administrators and teachers
 - Economic discrepancy in standard of living among students where they involve on daily labor activity quitting class and compensate it by copying from friends;
 - The need to get easily accessed result /success
 - Ability difference among the students leads them to cheat which is not compensated by additional classes or tutorial support
- Concerning methods used in cheating
 - They writes on black boards, tables, floors, walls, and on ceilings
 - Toss in a piece of paper that has answers
 - Look and copy from neighboring students and pass it to the row and column
 - Exchanging the examination paper or answer sheet

- One asking question and others cheat
- Requesting the teacher to read the answer. E.g., question 12, choice B where the whole class confirmed that answer for the sated number is B.
- Effects of cheating on hard working students
 - Loss of interest to study
 - Missing classes and performing other duties
 - Since the cheaters score high, they strive also to cheat instead of exerting efforts to work and compete
 - Withdrawal, hopelessness, delinquency and other behavioral problem
- Problems arise on invigilators
 - Encroachment from student cheaters
 - Poor attention and support from school administration to take comparable measures against cheaters
 - Interference of family and appeasement due to attentiveness in their work

VI. CONCLUSION

Parents and community have great role to play in the management of children at school and home environment. But we can see from the respondents' view that many parents didn't follow and check activities of their children, what they did and perform in the school, and didn't care about the behavioral change their children show in the school settings. In addition to the family's resistance to follow the behavioral changes the children show, there are different situations, which influence the pupil to act and behave in different ways. Among these Socio-economic factors, age level, sex, intelligence and cultural situations are the prominent.

Some students practice cheating to fill the gap created due to their negligence, poor study habits, getting benefit without effort and liaises-fairness. Others practice cheating only to get promotion from grade to grade without grasping basic knowledge necessary for that level of study. Some students cheat since they reach the level they are now in the same manner. And others cheat since they didn't want to work; to invest their labor and squeeze their brainpower while easy method is on operation.

Because of this fact, nowadays, cheating becomes evident culture among school community in all levels of education system beginning from the primary education through high schools and Universities. Teaching become obviously worthless as long as cheating exists that becomes common problem of almost all schools of the country even though the extent may vary. The impact it has on the community is huge, and was/is a burden on the government and the country. There exists also adverse effect on the result of Ethiopian School Leaving Certificate (ESLC) and nowadays National Exam (grade 10) and/or Entrance Exams (12th grade) as forwarded by some teachers from all corners of the country. This is a reality and truth that we can't deny as a whole.

As indicated, Jimma is one of the popular areas known in its coffee production. Because of this cash crop enticement, children earn huge amount of money during harvest time and

stay in the towns and around coffee producing localities abandoning the class. The number of absentees from November to January is the highest in both the high schools. They all come when tests, quizzes and final exams are supposed to be given to cheat from those students who are attending the class. Every student copy from his/her neighbor without any clarification of the correctness of the answer they copy.

The great challenge identified in this study from the community's side was the educational capability of the parents. Educational background of the parents and community play significant role on the study habit and the follow-up of the children. Most of the parents who are educated ask their children's performance, activities, assignments and home works. Most parents are lenient and some are laissez-fair to control their children and to advice them to correct their wrong and unmannered act.

Ambition of the students towards education is/was one of the influencing motives, which initiate them to do and perform their duty differently in contrast to educational ethics. Students, who develop strong initiation and interest read, prepare and involve in all education affairs while the easily benefiting ones devise techniques of cheating exams camouflaging the invigilators or through any means and techniques of cheating. They use different mechanisms and devise techniques to cheat to for promotion from class to the next class.

The major issue leading these students to cheating were/are:

- Benefit they achieve without investing any effort
- Internalizing behavior of cheating exam as easy practice
- Compensation for their weakness and academic failure
- Erroneous generalization they developed about securing job after schooling (they believe that job winning here is based on similar capability of deceitful diplomacy)

The unavailability of infrastructure has also negative impact on the study habits of the students as observation result of the study indicated. There were limited numbers of libraries in Jimma and most of them had very few reference materials, Journals, magazines, leaflets, and pamphlets. So, there was great scarcity of reading room, materials to read to broaden their capacity and knowledge of what is learnt. Even the existing materials were out dated, very old, ragged and scrambled which are not convenient to read since badly smelling. In addition to the lack of libraries, different facilities like study rooms, recreation places and the public libraries were limited to individuals that didn't accommodate more than ten students at the same time.

Other environment that prepares suitable conditions for cheating is the over crowdedness of pupil in a class. About 80-120 students were/are congested in a small room by sharing one desk for four (sometimes with five) students which was only allowed for two students. In the same way, because of the large number of students assigned in a classroom during examination, they are intentionally or unknowingly practicing to copy from the one who are sitting beside them. Gradually, these habits develops through time and inculcate cheating behavior in the mind of many students irrespective of the difference the students have in socio-economic, sex, age, and ability to understand the subject matter.

Some students develop hatred on some subjects since they didn't like the teacher; because, the multiplicity of problems they encountered. Some teachers make unnecessary contact with their students depending on their personal interest and motives, which is most of the time out of ethics. Other teachers are of deviant behavior that need special counseling and advise to correct their bad characteristics. Some of them didn't know what evaluation is and when they were assigned to invigilate, they leave the class astray and stand on the gate as if waiting for the supervisors while the students are doing whatever they like. In this case every student is free to copy from friends, notebooks, etc, without any fear since the teacher is their bodyguard. Others catch cheaters and hand their papers to the subject teachers or the office. But, most subject teachers were/are indulgent and never punish those cheaters which created greatest gap between effective teachers and the laissez-fairs. Because of this misbehavior and lax existing among teachers and officers, many school children exercised cheating, develop bad behavior, hate negligent subject teachers, leaders and the school itself.

There was/is a gap in communication between number of teachers and students in the case that some teachers inter in to their respective classes, explain and write what they have for the day and simply went out of the classroom. This condition repeats itself and it becomes the only interaction the teacher and his/her students had/have. The harsh and unnecessary communication starts to appear during exam time. When ladies didn't succeed in cheating, few teachers improperly channel their link with them and arrange immoral communication. In addition to the above incessant interaction between few teachers and schoolgirls, some boys and ladies beg or sometimes forcefully try to get additional points from teachers. Therefore, these mentioned gangs either pass from class by cheating or mere begging or by frustrating subject teachers.

The administrators and unit leaders in the school try to pretend as if they were/are the only sympathetic persons for their schoolboys and girls. They approach some students wrongly and whisper about the crime of the teachers if strictly follows the students. When some gang students insult and encroach upon the rights of the physically weak teachers, they turn their way by sowing their back as if they didn't hear the sayings. When those teachers indict the gangs of their awkward and nonsense approaches, the administration resist taking correct measure against the gangs. The school administrations mostly disagree about the students involving on cheating in a class. Instead of identifying the problem behind the real situation of repeating in a class, they try to relate the circumstance to the weakness of the subject teachers. This became apparent after competition for statistics of promoting large number.

There is no proper guideline on how teachers pave the way in classroom and how to direct their students from concerned bodies. Inspection is of one shot that supervisors come to schools to lighten up and carry out their own business with school administration and go back to their work as if they were visitors. Therefore, one can see no change in every dimension in schools before and after inspectors return. It was/is not as shameful that if naming them as 'fault finders' of the school activity than providing remedy and correction for the problem exists in the school in general and examination cheating

in particular. There was/is no or little knowledge about the guidance and counseling services in both schools. In some other schools the administrative bodies perceive the counseling service as part-time work and force them to teach related subjects. In real fact some administrators especially school directors that were none professionals in leadership didn't care of correcting school challenges like academic dishonesty, student's misbehavior, teaching laxity and education lethargy.

On the other hand the students develop deep behavioral change in their lifetime. Some of them show defiant behavior while others characterize disobedience in the school, to the family and community entirely. When conditions are converted into conducive environment, these students in the study area could cause harm their teachers on the street, in recreation centers and around the schools. This is the result of loose control and follow-up of the parents, schools, community and the public that might highly affect the entire system of education in the country. The authors concluded the following as a means in minimizing or avoiding cheating of examination.

- Controlling mechanisms in schools
 - Reporting to office
 - Minimizing the number of students to be examined in a class
 - Letting cheaters sit alone (use separate chairs for the deviant ones)
 - Reporting to the subject teacher
 - Subtracting some points from what they get as punishment
 - Integrated position of staff members to control those cheaters
 - Invigilating those active students in separate classes
 - Preparing questions of different orders (mix-up orders of questions or coding)
- Other techniques suggested
 - Initiation of student's hard work (motivation, encouragement)
 - Strong support on how to study
 - Assist the students by furnishing them with at least basic facilities [texts, conducive learning environment]
 - Giving them proper guidance and counseling services at all levels
 - Identifying those students with special needs and helping them individually (plan for individualized education for severe ones as additional class)
 - Identify the interest and inclination of the students and try to adjust the curriculum, teaching method, assessment styles for the students
 - Awareness raising and continuous advice for the students on the impact of cheating
 - Refreshment trainings and workshops for teachers on the devastating nature of examination teaching, control mechanisms and motivational techniques.

VII. RECOMMENDATIONS

Based on the finding of this study and conclusions draw, the following recommendations were stated as immediate and ultimate targets. In all Secondary schools of the country in general and Jimma town in particular, students were/are supposed to be evaluated only by exams. The examinations they sit for were mid-semester exam, final exam

national exams (NAE, Entrance Exam) once a semester or year that determines future life of the learners. The notion of continuous assessment was a mere practice among many teachers because of its tidiness and tiresome effort it might require from teachers. Even assignments were copy-paste nowadays where only few students do and other copy directly or modify if they believe the teacher is active in reading the paper. Hence, school teachers and family are advised to attentively follow and monitor works of their children on daily basis. The better the family and teachers follow students in home and schools; the better is performance of the students adding their effort to succeed.

The impact cheating brings on the individual, community and state was/is underlined; that devastates the quality of education throughout the country that should be tackled and avoided by concerned bodies' integrative effort. These bodies are school management, teachers, parents, education offices and policy makers at the top including Ministry of Education. Association of parents play significant role if capacitated by MoE and education agencies.

Finally, to alter the existing social lax in to acceptable work condition and support the production of competitive generation to win life. There has to be policy guideline that could effectively work from KG to Tertiary level of education where all professionals abide to the rule and regulations of invigilation, assessment and follow-up. It has also a view in improving work behavior of the community in schools and out of schools in making educational activities profitable. Avoiding this social

deterioration and building work mood on our students mind is the behavior to be inculcated in the long run.

REFERENCES

- [1] Ehrlich, T. and Ernestine, F. (2013). Cheating In Schools and Colleges: What to Do About It
- [2] Maclean, Phil (Fall 2009). "Cheating goes high tech". Ohiomatyc News. Archived from the original (PDF) on 2013-11-10
- [3] The New York Times (September 25, 2012). Stuyvesant Students Describe the How and the Why of Cheating
- [4] Report Card on the Ethics of American Youth, 2008. Josephson Institute. Retrieved 14 November 2012.
- [5] Smith, B. Davy, A. and Easterling, F. (2004). Honor Codes and Other Contextual Influences
- [6] Solomon Dibaba (The Ethiopian herald, November 17, 2015). Ethiopia: Quality Education in Ethiopia - Prospects, Challenges.
- [7] Whitley, B. (1998). Factors Associated with Cheating Among College Students: A Review", Research in Higher Education V. 39, no. 3.

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Constraints and Opportunities in the Coffee Supply Chain: Value Chain Analysis from Coffee Farmers to Exporters- Case of some selected Districts of Ilu Aba Bor Administrative Zone, Oromia, Ethiopia

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Abstract- Identification of the constraints and opportunities in the coffee supply chain from Ilu Aba Bor administrative zone to exporters in Addis Ababa was the main purpose of the study. The respondents- farmers, traders, millers were randomly selected and interview was used as data collection instrument. As per the findings, poor quality in coffee drying (drying red coffee beans on floor), collecting and mixing of better quality coffee with the poor one were some of the major challenges faced in the coffee supply chain. The opportunities are the availability of huge production of coffee product and the conducive climatic condition of the area. Concerned government body is supposed to monitor the illegal work of local traders regarding mixing better quality coffee beans with the poor one that has dropped market demand at the Ethiopian Commodity Exchange level. Furthermore, this poor work has also declined the quantity of coffee to be exported for international markets and the amount to be earned from export. In addition, farmers and collectors should get training regarding how to collect and dry coffee without quality deterioration.

Index Terms- Coffee, value chain, farmers, exporters, Ilu Aba Bora, Oromia, Ethiopia

I. INTRODUCTION

Background of the Study

Nowadays, due to globalization and internationalization of trade, competition becomes more and more vigorous. To remain competent enough and gain from competition, firm/country need to identify and focus on areas that can enhance its competitiveness. Beyond being the origin and home of organic coffee Ethiopia is exporting coffee to the World market including Germany, Saudi Arabia, France, Belgium, United States, Sudan, Italy, Japan, Sweden, United Kingdom, South Korea, Jordan, and Australia.

Nevertheless, the country had generated about 25% of the country's total export earnings from exporting coffee (Abu & Teddy, 2013). As a result there is a need to conduct strength, weakness; opportunity and threat (SWOT) analysis to get a clear understanding of the coffee supply chain in Ethiopia that enable the country become competent in the global market. In this regard, the competency can be attained by reducing weaknesses, adapting to threats and exploiting opportunities with the strengths the country held in the supply chain.

In order to identify the Ethiopian coffee supply competitive advantage, coffee value chain analysis were carried out as products pass through all activities of the chain in sequence and at each activity the product gains some value (Porter, 1985).

Though Ethiopia has got foreign currency from coffee export, there are some drawbacks when compared to other exporting countries and at the same time there are great variations on the amount of revenue generated per sack by different regions/zones in Ethiopia. For instance, according to the fiscal year 2011/12 coffee export performance report by Ethiopian coffee exporter association, the share of Ilu Aba Bor coffee export is neither significant nor researched. Moreover, the coffee products marketed to Ethiopian commodity exchange (ECX) trend is fluctuating very much since 2003 to 2013¹.

Statement of the Problems

Ethiopia, the birth place of coffee, stands seventh in the World and first in Africa in coffee production. By 2011/12, the country had produced approximately 500,000 metric tonnes of coffee. Although she has been taking part in exporting coffee to the World market, half of the total production is supposed consumed locally. Ethiopia, like other African countries, export agricultural commodity. Coffee is one and the chief among them to generate foreign currency- which in turn help to purchase and import abroad produce such as electronics, machineries and equipments. On the contrary, recently, the coffee price have been shown down scale which resulted in reduction of revenue for the nation in general and coffee farmers in particular.

In addition, when come to specific area, Ilu Aba Bor administrative zone had played insignificant role in exporting coffee to foreign markets and even its market share at Ethiopian commodity exchange is very less. As preliminary discussion was revealed, quality is the dominant factor and it motivated me to identify how it was happened in the coffee supply chain. Hence, this study was focused in the above mentioned zone and followed by research questions.

Research Questions

- ✓ What are the actors involved in the coffee supply chain in Ilu Aba Bor administrative zone?

¹ Ilu Aba Bor zone agricultural office, 2014

- ✓ What are the constraints and opportunities exist at each coffee value chain actors in the zone?

Objectives of the Study

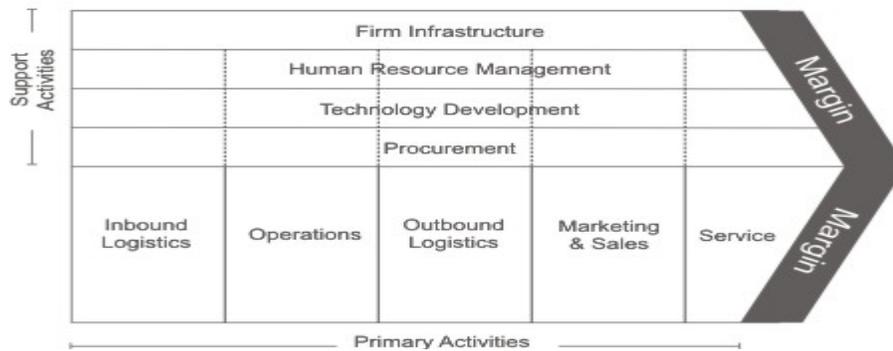
- To identify the actors involved in the coffee supply chain in Ilu Aba Bor administrative zone.
- To identify major constraints and opportunities existing at each level of value chain actors in the zone

II. LITERATURE REVIEW

Theoretical Framework

A value chain is a chain of activities. The activities in the value chain may include purchasing activities, manufacturing/processing the product, distribution and marketing activities (Lynch,2003). Porter described a chain of activities common to all businesses, and he divided them into primary and support activities as shown in figure 1 below.

Figure 1: Porter's Generic Value Chain



Source: Porter (1985)

Primary Activities

Primary activities relate directly to the physical creation, sale, maintenance and support of a product or service. They consist of the following: Inbound logistics, i.e.all the processes related to receiving, storing, and distributing inputs internally. In this regard,supplier relationships are a key factor in creating value. The other is operations, i.e. transformation activities that change inputs into outputs that are sold to customers. Here, the operational systems create value. Outbound logistics are activities regarding delivering product or service to customer. These are things like collection, storage, and distribution systems, and they may be internal or external to the organization. Marketing and sales are the processes used to persuade clients to purchase from you instead of your competitors. The benefits you offer, and how well you communicate them, are sources of value. Service-are the activities related to maintaining the value of your product or service to your customers, once it's been purchased.

Support Activities

These activities support the primary functions above.Companies use these primary and support activities as building blocks to create a valuable product or service.

Importance of Value Chain Analysis

The aim of the value chain framework is to maximize value creation while minimizing costs. In addition, all decisions made at one step in the process have consequences for the following steps and often such decisions may be irreversible. The value chain framework of porter is an interdependent system or network of activities and when the system is managed carefully, the linkages can be a vital source of competitive advantage (Pathania, 2001).The value chain mapping and analysis is also required to create value that exceeds the cost of providing the product or service and generates a profit margin. Porter used the word 'margin' for the difference between the total value and the

cost of performing the value activities (Figure 1). Here, value is referred to as the price that the customer is willing to pay for a certain offering (Macmillan et al, 2000). Other scholars have used the word 'added value' instead of margin in order to describe the same (Lynch, 2003).

Moreover, the benefits of implementing various supply chain managements (SCM) improvements are quantified; bottlenecks and high-/low-cost value processes are isolated. Value chain mapping and analysis also provide an assessment of competency in core areas. The analysis entails a thorough examination of how each part might contribute towards added value in the company and how this may differ from the competition.

Eventually, the value chain is very important because it is a very flexible strategy tool for looking at your business, your competitors and the respective places in the industry's value system. The value chain can be also used to diagnose and create competitive advantages on both cost and differentiation (Simister, 2011).

III. METHODOLOGY

Research Design

Descriptive survey research design was employed for conducting this study as the study is believed to be helpful in obtaining pertinent and precise information and that also help to draw valid conclusion about the events or activities of a target population.

Sources of Data

The study was based on primary and secondary sources. The literature review totally depends on secondary sources while the analysis depends on primary sources specifically interview. In addition to primary sources, analysis hub on secondary

sources of data which had obtained from relevant literature on coffee supply chain.

Target Population

The target population of the study comprised of coffee producers/farmers, coffee wholesalers (including ECX), coffee farmer union, trade and marketing office of Ilu Aba Bor administrative zone, and coffee millers or processors.

Sampling Techniques and Sample Size

Simple random sampling was used to collect data from coffee farmers, traders and coffee farmer union. Ethiopian commodity exchange(ECX) at head office, addis abeba, and bedelle town were contacted. Ten coffee farmers from each of the four districts (totally forty farmers), ten wholesalers, four millers, two ECX(beddele and addis ababa), one unions and three farmer cooperatives were contacted.

Data Collection Instruments

Semi-structured interview was used as data gathering instrument to secure important and in-depth information from

coffee farmer unions, ECX, and trade and marketing agency of Ilu Aba Bor administrative zone.

Methods of Data Analysis

After the collected data edited and coded, it was entered into computer software called statistical package for social science (SPSS). Data also depicted using figures.

IV. RESULTS AND DISCUSSION

Coffee Value Chain Actors

The actors participating in the coffee value chain are farmers (grow the coffee crop for living- to use money obtained from sale of coffee for basic needs), middlemen/intermediaries(for collection of coffee from farmers and supply to domestic/local market, exporter or Ethiopian commodity exchange), unions or cooperatives associations, processors(hullers and wet mills),exporting firms and local roasting firms.The chain was depicted as in figure 2 below but it was not straight as seen because sometimes famers sell to wholesalers and the like.

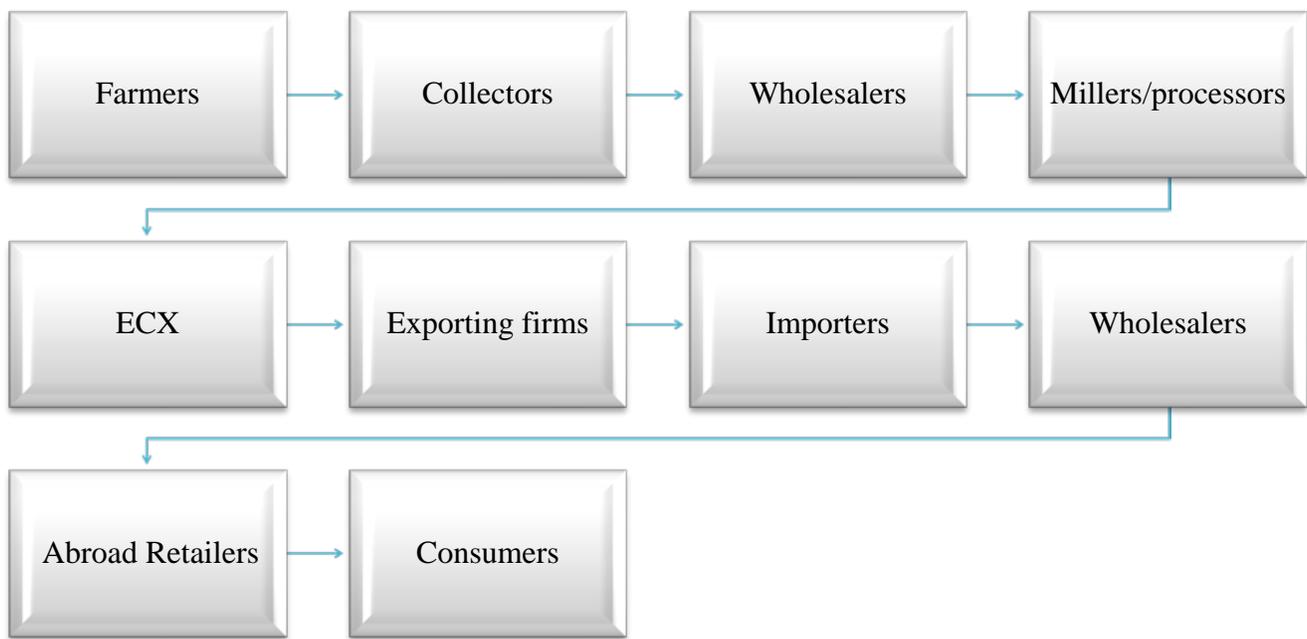


Figure 2: Coffee value chain actors (source: researchers)

Coffee Value Chain actors, Constraints and Opportunities

Coffee Production

Coffee production in Ethiopia is practiced using four different systems of cultivation: forest coffee, semi-forest, garden system and shadow-giving trees. The majority of Ethiopia's coffee comes from small plantations, which make up about 160,000 hectares or 40% of the country's entire coffee-growing area.

There are also about a further 20,000 hectares of coffee plantation, either with or without shadow-giving trees. The coffee seedlings are cultivated from seed or cuttings and, after

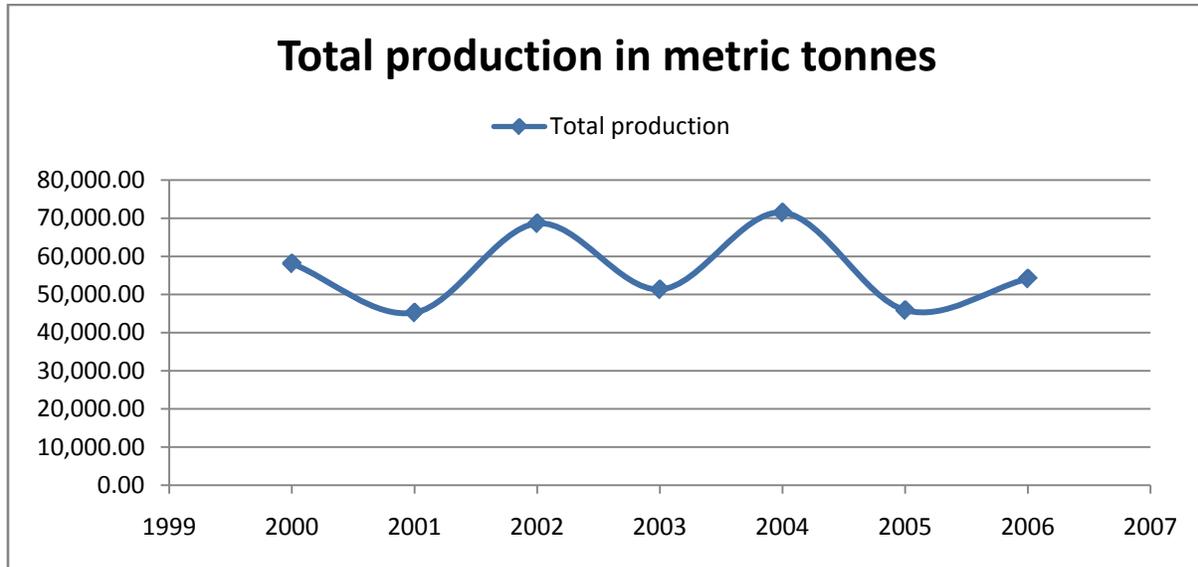
being planted, are kept free of weeds for three to four years, before they begin to bear. During this time, particularly under the garden system, other plants will be bedded in between the young shrubs. In well-tended plantations the shrubs will be pruned annually to remove superfluous shoots. In normal soil, the coffee plant gives its best yields during the first 20 years of its life. In the following 20 years, the quality of the cherries and the yield gradually decline.

In Ilu Aba Bor zone,197,102 hectar of land was covered by coffee plant. There are twenty woredas engaged in coffee production in the zone. Those woredas were categorized into three based on their production level: the well known woredas

are Didesa, Chora, Yayu, Hurumu, Doreny, Mettu, Bilonpha, Algesachi, Becho alle, and Nanno. The second ranks are Didu, Darimu, Beddele, Gechi and Allu. And the third levels are Bure, Doboana, Dega, Meko and Chewaka.

One hundred fifty nine thousand nine hundred ninety one (159,991) farmers and ten (10) investors are engaged in coffee farming in the zone. From the total hectares of lands permitted for investors to invest in coffee farming, only 43.57 percent were used (Source: Ilu Aba Bor zone agricultural office, 2014).

Figure 3: Coffee production in metric tonnes in the I/A/B zone(2008-20014 years)



Source: Iluababora zone agricultural office, 2006 E.C

As depicted on the figure 3, there is low total production by 2001 or 2009, 2003 or 2011 and 2005/2013 while 2002/2010 and 2004/2012 are a good production years.

➤ **Coffee Production and Constraints**

Virtually all Ethiopian coffee farmers never use fertilizers except on commercial farms. The Ministry of Agriculture (MOA) doesn't encourage the practice of applying fertilizer in coffee farmlands. Use of pesticides on coffee farms is also inadequate, that is, there are only a limited number of farmers who use pesticides despite the presence of Coffee Berry Disease (CBD), Coffee Wilt Disease (CWD), and root rot disease. In other words, there is high incidence of Coffee Berry Disease and shortage of improved cultivators.

Poor harvest and post-harvest practices have been reducing coffee quality, and there is a weak linkage between research, extension services and producers. Environmental degradation is a serious concern in the coffee growing areas of the south-western parts of Ethiopia, threatening its coffee genetic resources (Gole, 2003). Quality losses also occur in poor post-harvest on-farm processing, including weak storage infrastructure and contamination with other products. Handling during coffee harvesting and storing, processing and warehousing; inability to take care of the coffee plantation properly; inability to control the moisture content of the coffee and mixing high quality coffee with low quality. Lack of sufficient standard coffee processing machine in the major coffee producing areas due to lack of capacity and awareness, or sometimes improper installation of coffee processing machine, lack of proper place for coffee

processing, inadequate inspection and supervision of responsible bodies in the assembling, processing or preparation of coffee during harvesting. This may be due to negligence or lack of sufficient awareness. Lack of proper regulatory and controlling system on coffee harvesting, assembling, storing, transporting and processing activities; there is poor management and handling of coffee by farmers and lack of proper storage with adequate facilities.

➤ **Coffee Trading and constraints**

Primary coffee collectors, locally licensed coffee traders, purchase coffee from individual farmers and play an essential role of bringing coffee from very remote areas to the market. As they have no warehouses of their own, they immediately transfer the coffee to suppliers/wholesalers and 597 coffee suppliers were found in the Ilu Aba Bor administrative zone. Suppliers/wholesalers acquire red coffee cherries from collectors or producers and process their coffee before bringing it to auction. They are not allowed to export on their own account. Some have storage facilities as well as their own hullers. Primary societies made up of different local peasant associations play an important role in organizing farmers. Many cooperatives own washing stations and warehouses. Currently, there are 570 coffee traders, 24 coffee farmers' cooperative associations and three unions in the zone.

There is a delay in unloading coffee at Ethiopian Commodity exchange-which creates additional costs. There is also short supply of coffee or low economics of scale for traders.

➤ **Processing and constraints**

Wet Processing

Once the cherries are harvested, they are immediately pulped, fermented in tanks and then finally washed in clean water to remove the mucilage. By 2014 there were 67 coffee washing stations (1 owned by cooperative work associations, 1 by union, and 65 by private owners) in the study zone. Historically, over 90% of Ethiopian coffee was sun-dried. However, since washed coffee sells at significant premiums over sun-dried coffee, the government has encouraged cooperatives and traders to invest in machinery to raise the output of washed coffee.

Dry Processing

After harvesting, coffee cherries are processed by either dry or wet processing. For unwashed Arabica (or sun-dried coffee), the cherries are dried on mats, concrete, or cement floors immediately after they have been picked. After drying to a moisture content of about 11.5%, the outer layer of the cherries is removed by hulling and the green bean obtained is ready for marketing. Smallholder producers mainly use sun drying methods for coffee processing and a few use hand pulpers to semi-wash their coffee.

Besides, the following are some additional challenges faced by farmers, processors and middlemen. Here, coffee is dried on the ground due to the farmers' inability to construct drying beds because the costs of erecting them are too high. Many smallholder farmers do not own or have access to hand pulpers. The washing stations are also few and the average distances to nearest pulpers or washing station is roughly ten kilometres. This raises the transports costs and hinders immediate processing, a key requirement for wet processed coffee. High levels of river pollution are also a major problem near coffee pulping and washing stations.

➤ **Coffee Marketing and constraints**

In Ethiopia coffee marketing is between producers who sell to their cooperatives or to private traders.

All traders involved are licensed by the State to undertake certain functions.

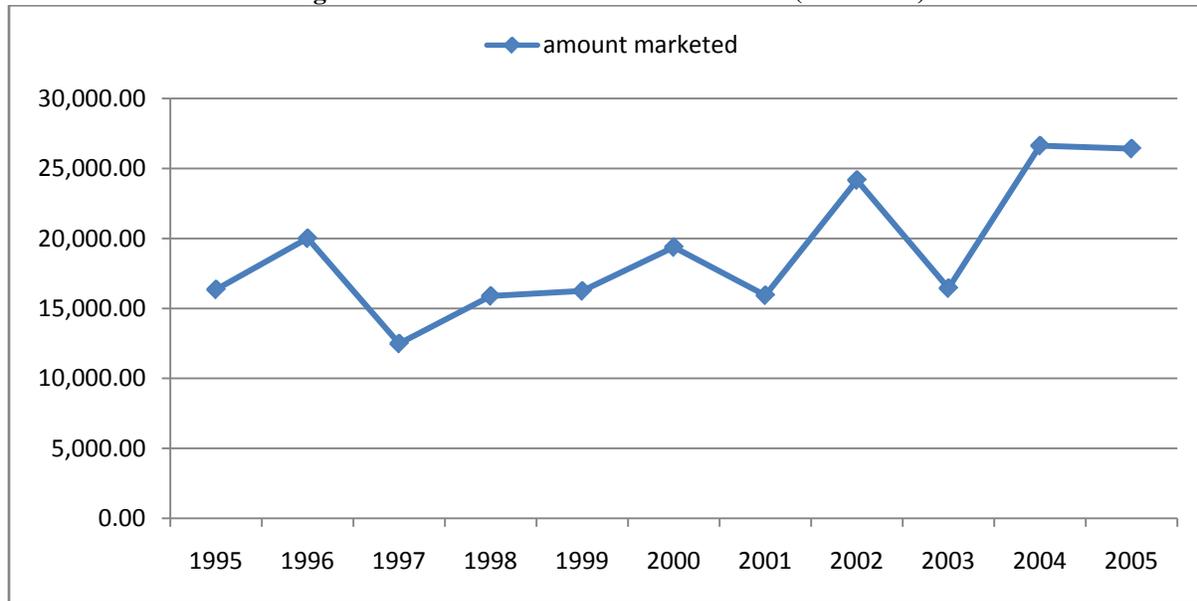
As such, the buyers (Sebsabies) may only buy directly from the farmers and may only sell on the coffee to the wholesalers (Akrabies). Akrabies for their part may only buy from the Sebsabies and then deliver the coffee for auction. They may not, however, export directly. Export is the privilege of a few special exporters with the corresponding licence. The cooperatives have become less relevant since the coffee crisis, as some of them are bankrupt and others do not possess sufficient capital to buy up larger quantities of coffee. After the breakdown of the coffee agreement they initially played an important role in fixing a minimum price. The private traders had to offer more than this price in order to buy the coffee. Today, since the cooperatives can no longer guarantee that they will buy up the harvest; private traders are in a position to demand lower prices.

Where possible, the farmers in Ethiopia prefer to sell the cherries for wet-processing as higher prices may be obtained. The sale of "fresh" cherries is, however, only possible during a short period during the harvest, when prices are low across the board. Dry cherries on the other hand may be sold all year round. Many farmers are, however, forced to sell their coffee directly after harvest, to get cash.

Financial pressure and a lack of information on market prices often allow the buyers to get the produce at low prices. Almost half of the small farmer's annual cash income comes from the sale of coffee and work directly related to it. The buyers in turn sell the coffee to the wholesalers, who bring the coffee to Addis Ababa, where the beans are examined by the state-run Coffee and Tea Authority and quality-approved. Samples of those coffees which are suitable for export are sent to the auction house, where they are tested and bid for by the exporters. Lower quality coffee goes to the domestic market.

Exporters themselves do not act as buyers and must be Ethiopian. Foreigners may neither bid at auction nor act directly as exporters. The exporters clean, sort and blend the coffee and prepare it for export. The coffee must be submitted again to the Coffee and Tea Authority which releases it for export after a final examination. For this, the coffee is packed in labelled standard 60 kg sacks. The exporters sell the coffee to international importers, who then sell the coffee on to the roasters in the destination countries. Ethiopian coffee goes predominantly to Japan (21%), Germany (20%), Saudi Arabia (14%), USA (8%) and France (6%).

Figure 4: I/A/Bora coffee marketed at ECX (2003-2013)



Source: Ilu AbaBor zone agricultural office, 2014

From the figure 4 it is observable that the coffee marketed at Ethiopian Commodity Exchange is increasing even if there is ups and downs in the coffee supply to ECX. Government of Ethiopia (GOE) established the Ethiopia commodity Exchange (ECX) to handle the marketing of agricultural commodities such as coffee, sesame, and beans. Almost all coffee is sold on the Ethiopian Commodity Exchange floor either directly through organized coffee producer's cooperatives or middle men. Ethiopian Commodity Exchange, a public market facilitating institution, was established in 2008. The rationale for establishing ECX was to eliminate the huge number of middlemen involved in coffee distribution and to enable coffee farmers to benefit from prevailing market prices. Coffee sold through Ethiopian Commodity Exchange is considered as commodity coffee and will not get the possible premiums of being organic coffee. Ethiopia mainly exports green beans with only a very small amount of roasted beans.

Ethiopian coffee, more than two-third is unwashed or sun dried while less than one-third is washed. Unwashed coffee commands a lower price than washed coffee. ECX undertake Coffee grading using a laboratory. Grading is conducted by analysing two aspects of the coffee bean: First, the raw green beans are visually evaluated for defects, and second ECX uses taste testers to identify sensory aspects of a roasted bean, including the aroma, taste, acidity, and other flavours.

V. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Zonal production volumes can be increased through new plantings and/or intensification (higher productivity) of coffee as the climatic conditions in the area is conducive. Corrective measures in improving coffee quality could increase the proportion of coffee selling at significant premiums. Particularly, sales volume of coffee can be enhanced if washed/semi-washed coffee or certified coffee beans presented

for market at different levels. Provision of credit facilities for purchase of washing stations/equipment would address current shortages of wet processing facilities that force farmers to walk long distances and thus discourage wet processing.

There is an increasing coffee production supply in the country and many actors in the supply chain. But, Ethiopia is very slow in expanding and diversifying (in quality and form) its coffee exports which is affected by world coffee price movements. There is less transparent and efficient operations in coffee marketing. Coffee quality problems due to handling from harvest to the final point of sale are still need solution. Almost all coffee exports are raw, there is little or no export of roasted coffee in Ethiopia that has additional value added, and is less promoted in the world market.

Recommendations

There is a need for coffee quality inspection and certification activities, and allowing and promoting private sector investors to participate in coffee plantations and processing. Promoting best agricultural practices in harvesting and post-harvesting will increase the availability, quality, and consistency of supply in Ethiopia in the short term. Trainings in low productivity areas will help farmers collect sufficient coffees to have leveraging negotiation power with collectors and traders, thereby capturing better prices along the value chain.

REFERENCES

- [1] Abu, T. & Teddy, T. (2013), Assessments of Commodity and Trade Issues, by USDA Staff GAIN Report Number: ET- 1302, *Ethiopia annual coffee report*.
- [2] Ethiopian coffee exporter association; coffee export performance report: 2011/12 fiscal year.
- [3] Gole, T.W. (2003). Conservation and use of coffee genetic resources in Ethiopia: challenges and opportunities in the context of current global situations, Retrieved 13 May 2014, from www.zef.de/module/register/experts

- [4] International Coffee Organization (2014), World coffee trade (1963 –2013): A review of the markets, challenges and opportunities facing the sector. London, United Kingdom.
- [5] Lynch, R. (2003), Corporate Strategy 3rd edition, Prentice Hall Financial Times.
- [6] Macmillan, H. andTampoe, M. (2000), Strategic Management, Oxford University Press
- [7] Pathania,J.G.(2001) Global parents, local partners: A value-chain analysis of collaborative strategies of media firms in India,*Journal of Media Economics*, Vol. 14, No. 3, p. 169-187.
- [8] Porter, M. E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. New York. Free Press.
- [9] Porter (nd).*Understanding how value is created within organizations*. Accessed on 10 April 2014, fromhttp://www.mindtools.com/pages/article/newSTR_66.htm
- [10] Simister, P. (2011),*Advantages & Disadvantages of Value Chain Analysis*. Accessed on 15 April 2014, from <http://www.differentiateyourbusiness.co.uk>

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Realization of Supply Chain Reference Architecture

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Abstract— In today’s global economy, businesses collaborate across multiple organizations that include customers and vendors in multiple geographies due to business growth and mergers and acquisitions. In general, larger companies have a greater number of systems with an average of 3.5 order capture and 3.3 order fulfillment systems [1]. This has led to a system landscape where there are multiple software applications that are implemented to serve both standard and customer specific business processes for a specific organization. This necessitates organization to embark upon the practice of Enterprise Architecture (EA) to organize the logic for business process and IT infrastructure reflecting the integration and standardization requirement of company’s operating model. [2]

However, there is a gap between the architecture and the solution domain. This paper explores how this gap can be bridged using right tools & techniques, a shared meta-data model and realize the architecture by orchestrating the solution based on Service Oriented Architecture (SOA). This paper also explains how this approach enables the business to realize supply chain reference architecture like Supply-chain operations reference-model (SCOR). This enables organization to adopt industry standard supply chain reference architecture with the benefit of monitoring the performance metrics.

Keywords—Supply chain reference architecture, SCOR, Orchestration, Service Oriented Architecture

I. INTRODUCTION

Traditionally companies were focused only on one organization where each function had its own source of data and systems – either off-line spreadsheets or an ERP system. Traditional ERP systems started facilitating collaboration at a transaction and operations level. However, these systems proved inadequate due to their tight integration of underlying system process and silo system processes are connected to realize the organization specific business processes instead of top-down approach. Collaboration has become a necessity as businesses started sourcing components from vendors or outsourcing some operations to vendors.

The modern virtual enterprises work on Boundaryless Information Flow™ [3] across multiple organizations that extends to customers and vendors. Modern ERP serving these virtual enterprises need to be built on top down architecture where the industry standard business processes are realized by application services encapsulating the system processes and support, round tripping between business and IT. This is achieved by orchestrating loosely coupled application services

using Service Oriented Architecture (SOA) to realize the business processes. This allows the system to natively support collaboration as these are built on business processes rather than silo system processes.

II. NEED OF ORCHESTRATION

The following are the characteristics of a modern ERP system that enables realization of industry standard supply chain processes through orchestration:

- Multiple company Business process
- Multiple Enterprise Visibility
- Business rule driven
- Strong collaboration tools.
- Highly flexible and agile.
- Users should be able to see information from multiple sources and be able to respond to events across those sources.

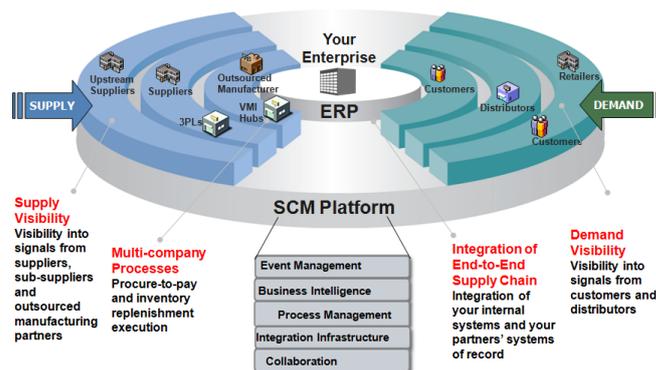


Fig. 1 Modern ERP platform

Orchestration realizes the virtual enterprise value chain by a system designed to operate in a virtual way using SOA. It enables users to manage the processes and the stake holders across different organizations in a uniform way to deliver a consistent user experience while operating over heterogeneous, virtual enterprises.

Orchestration enables building a composite application business process for a set of interacting services, not just by bespoke development, but using a composition or business process modelling language, such as Business Process Execution Language (BPEL) of information and control through the individual services. Thus, the design and development of services is agile, and may be performed by developers under the close guidance of business analysts. [4]

III. ROLE OF REFERENCE ARCHITECTURE

Enterprise, as part of architectural continuum adopts the best practices and architectural style of Reference architecture specific to their industry which governs solution being realized.

Reference architecture is general in nature to some level of abstraction and provides concepts, components and their relationship used to direct/guide and constrain the instantiation of (repeated) concrete solutions. [5]

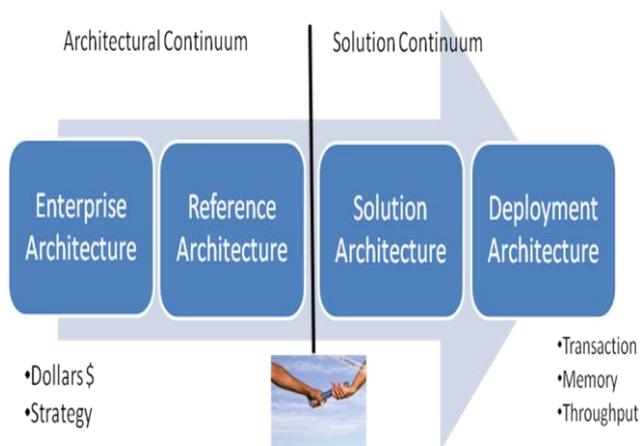


Fig. 2 Enterprise Continuum

Below are the leading Supply chain Reference Architecture in the market:

TABLE 1: SUPPLY CHAIN REFERENCE ARCHITECTURE

SCOR	Supply-chain operations reference-model (SCOR) is a process reference model for supply chain management. This supply chain framework links business processes, performance metrics, practices and people skills into a unified structure. The SCOR describes supply chains using process modeling building blocks and contains more than 150 key indicators that measure the performance of supply chain operations.
VRM	Value Reference Model (VRM) is a unified reference model covers the entire enterprise: Corporate, Product Supply and Customer domains supported by an extensive list of Input/Outputs, Metrics and Practices.
APQC -PCF	Process Classification Framework (PCF) is a high-level, industry-neutral enterprise process model that allows organizations to see their business processes from a cross-industry viewpoint. The PCF organizes operations and management processes into 12 enterprise-level categories, including process groups, and over 1,000 processes and associated activities.

IV. CHALLENGES IN REALIZING SUPPLY CHAIN REFERENCE ARCHITECTURE

Below are the challenges in adopting the Industry Reference Architectures to an enterprise’s own Organization-Specific Architectures that govern the solution being realized.

- 1) Architecture model address what are the best practices for a process where as the solution model addresses how to implement process.
- 2) Architecture model are efficient at Strategic level whereas solution model is efficient at tactical level.
- 3) Architecture and solution modeling languages are not common.
- 4) Meta-data model not shared between Architecture and Solution modeling tools.

The above reasons lead to a gap between the Architecture and Solution being realized during implementation.

V. PROPOSED MODEL TO REALIZE SUPPLY CHAIN REFERENCE ARCHITECTURE

A solution to the above challenges is to bridge the gap between the architecture and solution domain using right tools & techniques, a shared meta-data model and realize the architecture by orchestrating the solution based on Service Oriented Architecture (SOA).

Supply chain Reference Architecture can be classified based on their meta-data model level of details and entity they represent and relationship between them as follows: -

TABLE 2: SUPPLY CHAIN REFERENCE ARCHITECTURE LEVEL TYPE

No	Level		
	High	Medium	Low
1	Strategic	Tactical	Operational
2	Business Capability	Business Process	Physical Process

TABLE 3: SUPPLY CHAIN REFERENCE ARCHITECTURE ENTITY TYPE [6]

No	Entity		
	Conceptual	Logical	Physical
1	Owners View	Designers View	Builders View
2	Models of the Business	Models of the System	Technology Constrained Model

Below is the model to select fit for purpose tools & technique appropriate to realize the supply chain reference Architecture based on their meta-data model level & entity: -

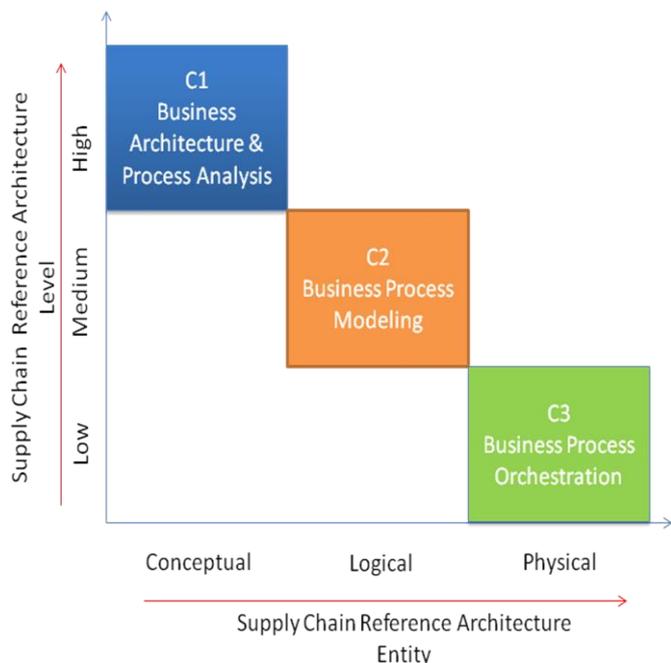


Fig. 3 Proposed Model to realize Supply Chain Reference Architecture

Fig. 3 shows the proposed model to realize the Supply chain Reference Architecture by mapping the right tools and techniques based on their metadata level and entity.

Below table provide the details of tools and technique for the combination of Supply chain Reference Architecture level and entity.

TABLE 4: TOOLS AND TECHNIQUE FOR COMBINATION OF SUPPLY CHAIN REFERENCE ARCHITECTURE LEVEL AND ENTITY

Level – Entity Combination	Tool	Technique	Notation
C1 High-Conceptual	BPA Suite	Business Architecture & Business Process Analysis (BPA)	Business Motivation Model (BMM), Strategy Map, Value Chain
C2 Medium-Logical	BPM Suite	Business Process Modelling (BPM)	Business Process Modelling Notation (BPMN)
C3 Low-Physical	SOA Suite	Business Process Orchestration	Business Process Execution Language (BPEL)

A. Applying proposed model to SCOR

Supply-chain operations reference-model (SCOR) is the industry leading architecture reference model for supply

chain to reuse the build blocks namely plan, source, make, deliver and return with further drill down based on the level.

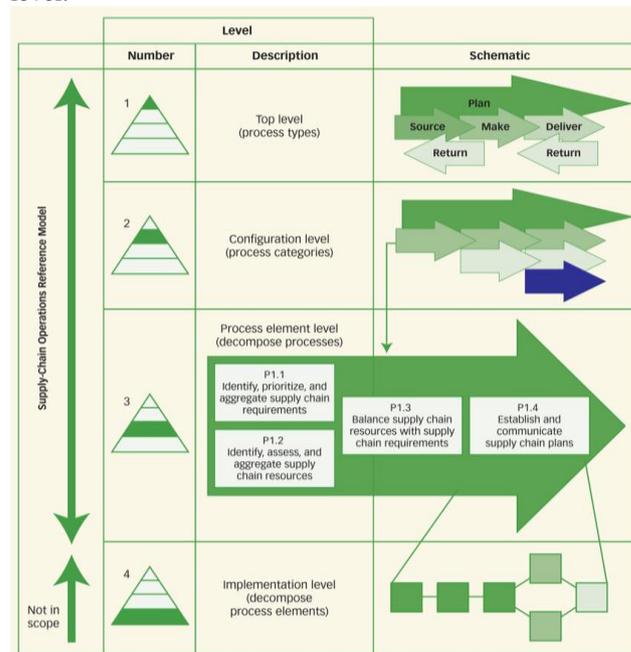


Fig. 4 Supply-chain operations reference-model

SCOR reference architecture meta-data model level can be mapped to proposed model as follows:

TABLE 5: MAPPING OF SCOR META DATA MODEL

SCOR Level-Entity	Proposed Model Combination		
	C1 High-Conceptual	C2 Medium-Logical	C3 Low-Physical
1	Top Level (Process Type)		
2	Configuration Level (Process Category)		
3		Process element Level (Decompose Process)	
4			Implementation Level (decompose process element)

Below diagram depict the fit for purpose tools and techniques by applying the suggested model to realize the SCOR reference architecture.

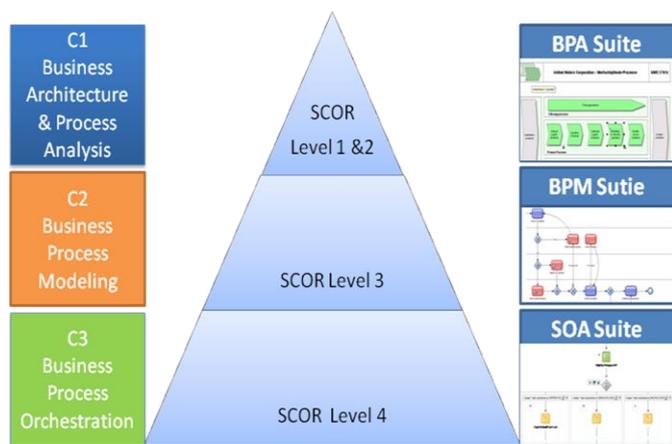


Fig. 5 Proposed Model to realize SCOR

SCOR Level 4 is an implementation level which realizes the business services modelled using BPM in SCOR Level 3 by orchestrating the application services encapsulating the legacy and (Commercial of the shelf) COTS application components using SOA.

SCOR Metrics attached to the BPA & BPM model of SCOR Level 1, 2 & 3 can be measured as the architecture being realized using SOA orchestration.

Below table provide the details of tools and technique for realizing the SCOR reference architecture: -

TABLE 6 TOOLS AND TECHNIQUE FOR REALIZING SCOR

SCOR Level – Entity	Proposed Model Combination	Tool	Technique
Level 1 & 2 Process Type & Category	C1 Business Architecture and Business Process Analysis	BPA Suite	<ul style="list-style-type: none"> • Conceptual Hierarchical Modeling • Process Catalog, and Value Chains • KPI Metrics Reporting
Level 3 Process Element	C2 Business Process Modelling	BP Suite	<ul style="list-style-type: none"> • Abstract Business Process • Business Process Modeling Notation (BPMN)
Level 4 Implementation	C3 Business Process Orchestration	SOA Suite	<ul style="list-style-type: none"> • Apps integration • Business Process Execution Language (BPEL) • Round-tripping with BPM

VI. CONCLUSIONS

The modern agile ERP application provides challenge of grounded upon standard business process recommended by industry supply reference models with realization of loosely

coupled application services. The solution is to select right tools & techniques with shared metadata between the two domains and realize the architecture by orchestrating the solution based on Service Oriented Architecture (SOA) as recommended.

- This will enable organizations to adopt Supply chain reference Architectures like SCOR, VRM, APQC-PCF to an enterprise’s own Organization-Specific Architectures which governs the solution being realized without re-inventing the wheel.
- This will in turn benefit organization in agility by loosely coupled application services and better control by inferring the KPI metrics from realized transaction.

ACKNOWLEDGMENT

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REFERENCES

- [1] Supply Chain Management Review 2013 Order Fulfillment Survey, Nov’13 issue p45
- [2] Jeanne W. Ross, Peter Weil, David C. Robertson, “Enterprise Architecture as Strategy”
- [3] The Open Group
- [4] The Open Group Services Integration Maturity Model (OSIMM)
- [5] Steven J Ring, Role of Reference Architecture, MITRE, p10
- [6] John A. Zachman, Conceptual, Logical, Physical: It is Simple

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Differently Abled Entrepreneurs-A Philosophical Change in the Socio-Economic Development of Socially Disadvantaged

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Abstract- Persons with disabilities make up an estimated 15 per cent of the world population, over one billion—80% of who live in developing countries (WHO report). They frequently experience discrimination and face barriers to participation in all aspects of society, in accessing education, employment, health care, social recognition and transportation. Some persons with disabilities face multiple barriers to their participation, due to discrimination on the basis of other grounds, including race, colour, sex, language, religion, political or other opinion, national, ethnic, indigenous or social origin, property, birth and age. As a result, persons with disabilities are at a high risk of poverty, which in itself increases the likelihood of having a disability. Given that persons with disabilities represent a significant portion of the world population, the world's largest minority and are more likely to live in poverty than their non-disabled peers, their inclusion in all development activities is essential, if internationally agreed development goals, including the Millennium Development Goals (MDGs) are to be achieved in an equitable manner. The Convention on the Rights of Persons with Disabilities (CRPD) and its Optional Protocol (OP) 2 provide the normative framework for Member States to address the rights of persons with disabilities and to ensure that they are included in all development efforts. Differently-abled entrepreneurs, as a new and emerging group of entrepreneurs and a new breed of entrepreneurs, and act as a catalytic force for the socio-economic development of socially disadvantaged.

Index Terms- Disabled, Differently-Abled, Differently-Abled Entrepreneurs.

I. INTRODUCTION

Disability is part of the human condition temporarily or permanently. Almost everyone will be temporarily or permanently impaired at some point in life by birth disorders, accidents, old age, natural calamities and wars, those who survive to old age will experience increasing difficulties in functioning and living. Most extended families have a disabled member, and many non-disabled people take responsibility for supporting and caring for their relatives and friends with disabilities (World Report on Disability) one third of families in India is directly or indirectly affected with some sort of disability. Disability and moral, political issues related with disability become more acute as the demographics of societies

change, increasing number of accidents and increasing number of old age people. The main issue related with disability is the social (community) inclusion of disabled population, and how best to include and support people with disabilities in the political, social and economic realm of development in the modern world. The concept and attitude of society towards disability have changed since the 1970's, growing tendency to see disability as a human right issue, once people with disabilities segregated from community to special schools and residential institutions and now the change is visible from community exclusion to the best integrated social inclusion and community participation.

The policy has now shifted from social exclusion to social inclusion through educational and vocational freedom. Development in the field of modern medicine and medically focused solutions have given way to more interactive approaches recognizing that people are disabled by environmental factors as well as their bodies (Social Model of Disability). National and international initiatives such as the United Nations Standard Rules on the Equalisation of opportunities of Persons with Disabilities - have incorporated the human rights of people with disabilities, culminating in 2006 with the adoption of The United Nations Convention on the Rights of Persons with Disabilities, (UNCRPD).

Disability is complex, dynamic, multidimensional and contested phenomenon. Disability is a part of human condition. Almost everyone will be temporarily or permanently impaired at some point in life. Disability has two dimension effect, the onset of disability may increase the risk of poverty and poverty may increase the risk of disability. Disability and poverty are complex, dynamic and intricately linked phenomena. (Sen-2009). It is the two way causation between disability and poverty, the main problem defining and measuring disability is the lack of apt statistical information and availability of empirical evidence. Furthermore the difference is greatly between developed and developing countries. In developed countries multiple data sources are available and descriptive statistics on various aspects of social and economic wellbeing of persons with disabilities is commonly compiled and published, also have longitudinal panel surveys for empirical analysis of the linkage between disability and poverty. In developing countries descriptive statistics are rare, fragmented and sporadic and lacking of longitudinal surveys.

According to World Health Organisation (WHO), disability can be defined as, “an umbrella term, covering impairments, activity limitations, and participation restriction. Impairment is a problem in the body function or structure. An activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situation. Thus disability is a complex phenomenon, reflecting an interaction between features of a person’s body and features of the society in which he or she lives”.

The National Disability Strategy defines disability as, “the reduction in the ability to carry out daily activities, or the exercise of a right or fundamental freedom on an equal basis with others, due to overlapping environmental, social or behavioral barriers in addition to visible, physical impairment or invisible physical, emotional or intellectual impairment”.

The Pre-amble to the Convention on the Rights of Persons with Disabilities (CRPD) acknowledges that disability is, “ an evolving concept” and also stress that “ disability resulting from the interaction between persons with impairments and attitudinal and environmental barriers that hinder their full and effective participation in society on equal basis with others”. Disability is not an attribute of the person, progress on improving Social Participation can be made by addressing the barriers which hinder persons with disability in their day to day life.

The Concept and Models of Disability

The disability experience resulting from the interaction of health conditions, personal factors and environmental conditions or factors varies greatly. Persons with disabilities are diverse and heterogeneous. The concept and perception of disability varies according to the purpose and views. The models of disability, the concepts and views are different.

The medical model of disability.

Medical model of disability relies on a pure medical definition of disability. This model equates the physical or mental impairment from a disease or disorder with the disability that the person experiences. Under the concept the person with disability is viewed as the “problem” and in need of cure and treatment. Medical model of disability pay way to social marginalisation and segregated from the society to special schools, sheltered homes and workshops, special transport etc... The persons with disability are considered as unsolved problem in the society.

The charity model of disability.

Charity model of disability views the person with disability as the problem and dependent on the sympathy of others to provide assistance in a charity or welfare mode.

The social model of disability

Social model in which people are viewed as being disabled by society rather than by their bodies, give emphasis on promoting social change that empowers and incorporates the experience of person with disabilities, asking society itself to adapt. The social model emphasis , institutional, environmental and attitudinal discriminations as the real basis for disability. Thus it is the society at large which disables the person with

disabilities through discrimination, denial of rights, negligence, sympathy, creation of barriers and economic dependency.

The right based model of disability.

A new and modern approach builds on the insight of the social model to promote creation of communities, which accept diversities and differences, and have a non-discriminating environment in terms of inclusion in all aspects of the life of society.

The bio-psycho-social model. (Comprehensive Model)

Bio-psycho-social model is developed by International Classification of Functioning, Disability and Health (ICF). A conceptual frame work is adopted to define the Bio-Psycho-Social model, in which disability as a dynamic interaction between health conditions and contextual factors, both personal and environmental. This model of disability represents a workable compromise between medical and social models.

Related Literature of the Study

Entrepreneurship, entrepreneur, enterprise are complex phenomenon in the modern competitive world order. Entrepreneurship is the quality of an entrepreneur, entrepreneurs are persons with high achievement motivation, innovative capacity, and ability to identify and explore new opportunities. Enterprise is the outcome or result of entrepreneurship by an entrepreneur or entrepreneurs. Entrepreneurs have potential ability to contribute much to the society and economy. Entrepreneurs are highly motivated, enthusiastic personalities with complex nature, and it is very difficult to explain all of their behavior with one or more theoretical base. The entrepreneurial process, functions and activities associated with identification and exploitation of existing opportunities (Bygrave & Hofer, 1991; Shane and Venkataraman, 2000), has studied considerably, and an interesting topic of academicians and researchers. It is widely accepted that the entrepreneurial process and various function are the vital component in the economic growth of a country, society and even a market place. (Rechard Cantillon, 1755; Schumpeter, 1950; burmol, 1968; Kirzner, 1973; Mark Casson, 1981; Stevenson & Sahlman, 1987; Gartner, 1990; Reynolds et al., 1994;), So it is necessary to have an in depth study and analysis of entrepreneurial traits, personalities, skills, attitudes, circumstances to their development and the changes they are made to the society. Research has shown that certain psychological and sociological factors or characters are the determinants of entrepreneurial characters.

Entrepreneurs are highly motivated, enthusiastic personalities with complex nature, and it is very difficult to explain all of their behavior with one or two theoretical base, the most important theory of entrepreneurship’s psychological root was put forward in the early 1960s by David McClelland, who found that people who pursued entrepreneurial- trait careers, were high in need for achievement (n Ach), the psychological need to achieve. People with high need achievement, have the penchant to take risks, but only reasonable and calculate ones, these calculated risks stimulate them to greater profit. Thomas Begley & David Boyd, in the mid-1980s identified five dimensions unique to Entrepreneurs. In order to understand, the concept of entrepreneurs better, we should have a definite vision about a

person with entrepreneurial trait. A composite list of entrepreneurial traits and qualities, first developed by John Hornday, and identified sixteen innate qualities necessary for the successful performance of an entrepreneur. Many researchers have proved that there are certain traits or innate qualities that an entrepreneur possesses, which lead to the success of a business. Personality traits, need for achievement and locus of control are the main characteristics associated with entrepreneurial inclination (Landstrom,1998), entrepreneurs have higher internal locus of control than other population (Rauch & Froese, 2000), free and easy access to resources enhances the individual's ability to detect and act upon discovered opportunities (Davidson & Honing, 2003), is the opinion about identification and exploration of new business opportunities. Locus of Control (LoC) had negative influence on entrepreneurial inclination (Mohas, Singh & Kishore, 2007), at the same time, Knowledge benefits can be reaped through, the knowledge of how to create new goods and services, and a better way to do so, (Murphy, Liao & Welsch, 2006).

person with the following traits or qualities should help the better understanding to the concept of an entrepreneur, Vision-ability to dream and ability to implement, Knowledge- sound, conceptual knowledge about the world, Desire to success- strong desire to succeed in life, Independence-Independent in work and decision making, Optimism-optimistic in all concern, Value addition-Desire to improve and optimization of resources, Leadership-became a leader in all respect, Hard-working- are work holistic, Risk-taking ability- most integral element and nature of an entrepreneur.

This work seeks to improve our knowledge by making the following contributions, guided by the concept of Differently-abled entrepreneurs, as a new and emerging group of entrepreneurs and a new breed of entrepreneurs, and act as a catalytic force for the economic development of every country. Given the absence of explicit theoretical framework or literature studies on differently-abled entrepreneurs, It is an attempt to make a theoretical contribution to the academic debate on Differently-abled entrepreneurs. This study refines the existing notions of entrepreneurship studies that have been used in previous entrepreneurship studies of Abled bodies (Women entrepreneurs, Ethnic entrepreneurs, Edu-entrepreneurs, Social entrepreneurs)

This research work examines the behavioral and cultural differences among Differently-abled entrepreneurs, with particular emphasis on how and what extent the entrepreneurial opportunities are identified and used for the economic and social wellbeing of disabled population. The previous research studies of entrepreneurship should focus on the identification and exploitation of opportunities (Venkataraman,1997; Shane and Venkataraman,2000; Litt et al,2000; and Ardichvili et al,2003), there has been little empirical and exploratory works in the area of Differently-abled entrepreneurs. This study makes an attempt to empirical and conceptual contribution by investigating this new area of research, Differently-abled entrepreneurs.

The present study focused as an integrated development approach of entrepreneurship, A new ideology and a way of overall development through the intersection between disability and entrepreneurship development. By which, a disabled body became an Abled one through the social participation, economic

independence, employment generation, and overall development of society. The concept of Differently-abled Entrepreneurs are a change agent to promote social participation, ranging from health and rehabilitation to education, self-employment, employment generation, economic and sustainable development, and a social engineer for over all social change in India.

There is a vast body of research in the diverse areas of entrepreneurship. However, the nature of this research have been highly diverse. There is a lack of an agreed definition and theory of entrepreneurship, and a concern of what entrepreneurship constitute as a field of study (Garner,1990; 2001; low 20001.) Entrepreneurship is heterogeneous; and involves the creation of new business (Gartner, 1990; Reynolds; et al.,1994) business inheritance (Chaganti and Schneer, 1994.), Westhead and Cowling, 1998) and the purchase of established business (Cooper and Dunkelberg, as a person bearing risk (Cantillon, 1755). The central function of an entrepreneur independently of any particular social framework (Hebert and Link,1988.). An entrepreneur, who undertake uncertainty and risk, pure profit with regard to entrepreneurship is bearing the cost of uncertainty (Frank Knight, 1921). Entrepreneur as an innovator with an unusual will and energy, clarity of innovation and ability to act (Maxweber, 1930). Entrepreneurship is defined as the carrying out of new combinations called "enterprise" the individuals whose function is to carry them out are called "entrepreneurs", the entrepreneur is the bearer of the "mechanism for change" (Jose Schumpeter, 1934). The central concept of entrepreneurship is alertness (Kirzner, 1973.) The essence of entrepreneurship is being different (Mark Casson,1982). The underlying process in entrepreneurship is the identification of opportunity and ends with harvesting the fruits on one's labours (Stevenson and Sahalman,19870). Eight themes expressed by the participants that constituted the nature of entrepreneurship, innovation, organisation, creation, creating value profit / non-profit, growth, uniqueness, and the owner-manager. (Gartner,1990). An entrepreneur as one who always searches for change, responds to it, and exploit it as an opportunity, "innovation is the specific tool of entrepreneurship,(Peter Drucker).

The more efficient entrepreneurs who receives a surplus reward over and above the managerial wages,(Francis A.Walker,). The entrepreneurial process involves all the functions, activities and actions associated with the perceiving of opportunities to pursue them, (Bygrave and Hofes, 1991).

Significance of the Study

There is a widespread superstitions that the disabled are incompetents – even criminals-culturally, spiritually, morally, mentally, martially, physically, psychically and must be segregated for the good of society. This ghetto philosophy which validates man's inhumanity to man is the cornerstone of current social cruelty to the victims of underserved handicaps. Many of them are actual or potential geniuses in several fields especially in the field of entrepreneurship development. The modern society has enough facilities and scientific knowledge about retardation, crippling and cretinism to shoot down these myths. In a big democratic polity like India should succeed by social legitimating, literacy and mobilization of resources to equip them to compete with modern developed society. The inner strengths, self-confidence, enthusiasm, initiative prove to the world that no

job or opportunity is difficult for the Differently-Abled, provided they are properly trained and given an opportunity. Six to seven percent of the population in India is disabled according to the census begin from February 9, 2011. The 2001 census found 21 million persons with disability that is 2.13 percent of the total population. There is a lack of political will in understanding seriousness of disability issues which has led to inadequate allocation of resources for the disabled in the country. With a small national budget allocation, no wonder the various measures which the government and the society have taken for the welfare of the disabled touch only the fringe of the problem. The plight of the blind, the deaf, the mute, the mentally challenged and the orthopedically handicapped continues to be distressing. Mainly because of the bulk of them are poor, enjoying no political clout, there needs come quite low in the order of priorities of the government. Whatever Government facilities that are available for the disabled are in the nature of mere crumbs.

The outcomes of the World Summit for Social Development, held in Copenhagen from 6 to 12 March 1995, and of the twenty-fourth special session of the General Assembly entitled "World Summit for Social Development and beyond achieving social development for all in a globalizing world", held at Geneva from 26 June to 1 July 2000, The World Programme of Action concerning Disabled Persons, and the Standard Rules on the Equalization of Opportunities for Persons with Disabilities and the Convention on the Rights of Persons with Disabilities, in which persons with disabilities are recognized as both development agents and beneficiaries in all aspects of development, Recalling further its previous resolutions concerning persons with disabilities and further promotion of equalization of opportunities and mainstreaming of disability in the development agenda and the relevant resolutions adopted by the General Assembly, Welcoming the fact that, since the opening for signature on 30 March 2007 of the Convention on the Rights of Persons with Disabilities and the Optional Protocol thereto, one hundred and forty-seven States have signed and ninety-seven States and one regional integration organization have ratified the Convention and ninety States have signed and sixty States have ratified the Optional Protocol, and encouraging all States that have not yet done so to consider signing and ratifying the Convention and the Optional Protocol, Acknowledging that the majority of the 690 million persons with disabilities in the world live in conditions of poverty, and in this regard recognizing the critical need to address the impact of poverty on persons with disabilities, Noting that persons with disabilities make up an estimated 10 per cent of the world's population, of whom 80 per cent live in developing countries, and recognizing the important role of international cooperation in supporting national efforts to mainstream disability in the development agenda, in particular for developing countries.

Around 10 per cent of the world's population, or 650 million people, live with a disability. There are the world's largest minority. This figure is increasing through population growth, medical advances and the ageing process. Eight per cent of the persons with disabilities live in developing countries. Disability rates are significantly higher among groups with lower educational attainment in various countries. Women report higher incidents of disability than men. The World Bank estimates that 20 per cent of the world's poorest people have

some kind of disability. And tend to be regarded in their own communities as the most disadvantaged. Women with disabilities are recognized to be multiply disadvantaged. Mortality of children with disabilities may be as high as 80 per cent in developing countries. Comparative studies on disability legislation show that only 45 countries have anti-discrimination and other disability-specific Laws.

The number of handicapped people in India increases by about 5 million every year. Majority of them cannot hope for medical, educational and vocational aid. According to the report of National Statistical Survey (NSS) disability transition in India is predicted to be most rapid. Between 1990 and 2020, there is predicted to be a halving of disability due to communicable diseases, a doubling of disability due to accidents and injuries, and more than 40 per cent in the share of disability due to non-communicable diseases such as cardiovascular and stroke. At present six to seven per cent of the total population in India is a person with Differently-Abled. The study is more significant in the social, cultural, educational and economic dimensions.

II. NATIONAL HANDICAPPED AND FINANCE DEVELOPMENT CORPORATION

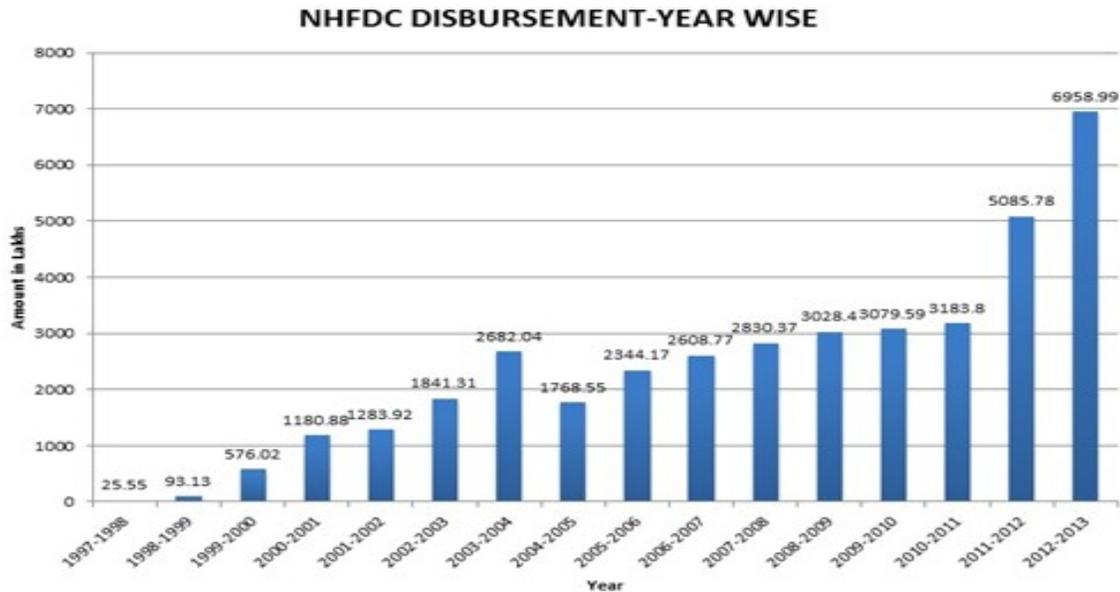
National Handicapped and Finance Development Corporation is the apex institution in the field of financial support to handicapped people for entrepreneurship development. The institution provides number of programs for the entrepreneurship development among Differently-Abled people. The financial support, the entrepreneurial development programs and various awareness programs for the development of economic development and self independency of disabled people through entrepreneurship development and venture creation.

The institution specialised in the field entrepreneurship with the support of Government of India and other Non-Governmental Agencies. The institution extends its activities through. The above data shows the amount sanctioned by the institution from 1997 to 2014, to the entrepreneurship development to the disabled people, in the initial period amount dispersed was only 22.55 Lakhs, In the period 2013-14 the total disbursement was rupees 7581.94 Lakhs, but the actual amount sanctioned during the same period was 8018.51, an average increase of 347.4 Lakhs every year. The figure also depicts that, this institution plays an important role for the development of Differently-Abled people in India.

National Handicapped and Finance Development Corporation plays an important role for the financial assistance and conducting of Entrepreneurship Development Programs among Differently-Abled people. National Handicapped and Finance Development Corporation is primarily lend money through State Channelising Agencies (SCA) and Banks for setting up small business ventures in trading and service sectors, for the purchase of vehicle for commercial activity, for setting up of small Industrial units, for self employment and for agricultural activities. The amount of money lend for these purposes is extended from 5 Lakhs to 25 Lakhs with nominal interest.

National Handicapped and Finance Development Corporation's main function is to provide training programs to differently-abled persons, mainly Entrepreneurship Development

Programs through various training centers. The main objective of the program is to develop entrepreneurial capabilities among the differently-abled persons and thereby developing traditional and technical skill and make every differently-abled person self-sufficient, economically independent person and thereby pursuing their income generating activity.



Source: NHDFC annual report 2014.

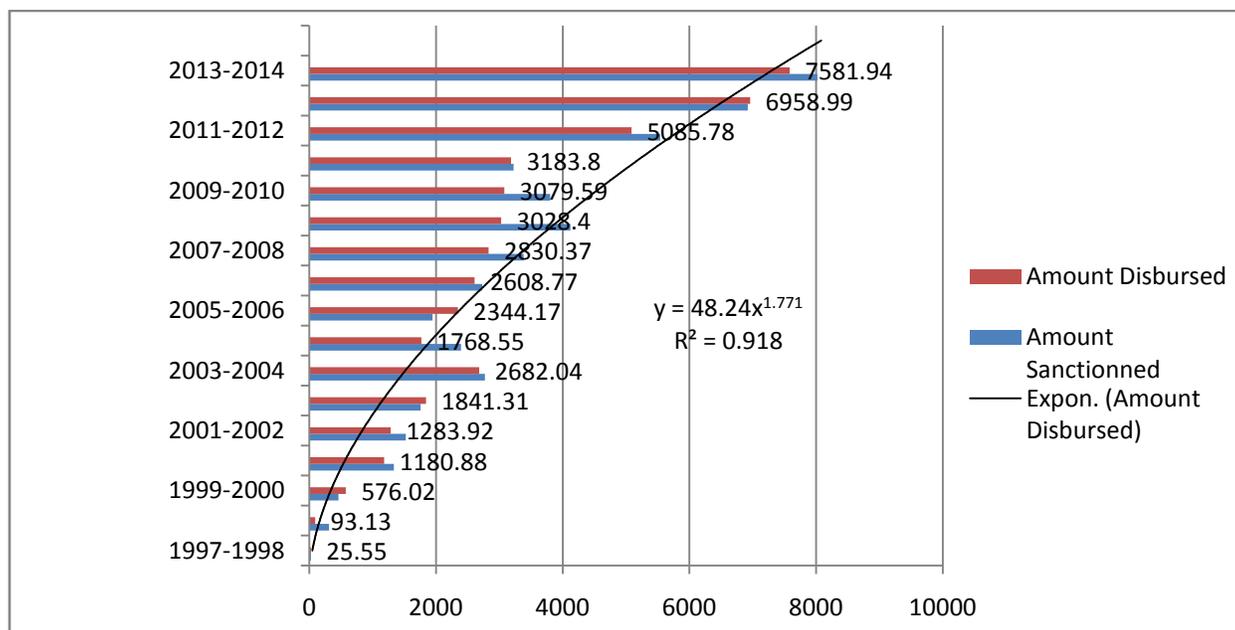
National Handicapped Finance Development Corporation is the prime lending agent in the government sector to the handicapped people through commercial banks and approved agents. The main lending purpose is to encourage the handicapped people through starting new business ventures. The institution is also an agent to providing Entrepreneurship Development Programs among the groups. The following table depicts the year wise achievement and amount disbursed among the Differently-Abled People.

YEARWISE ACHIEVEMENTS

Table.1: Loan sanctioned/disbursed (including Micro Finance Scheme) as on 31.03.2014

SL NO	Years	Amount Sanctioned (Rs. in Lakh)	Number of Beneficiaries	Amount Disbursed (Rs. in Lakh)	Number of Beneficiaries
1	1997-1998	25.55	11	25.55	11
2	1998-1999	312.6	811	93.13	230
3	1999-2000	458.82	801	576.02	1164
4	2000-2001	1334.23	3330	1180.88	2645
5	2001-2002	1522.6	4075	1283.92	2933
6	2002-2003	1756.12	4702	1841.31	4498
7	2003-2004	2772.93	5635	2682.04	5565
8	2004-2005	2394.06	4754	1768.55	3282
9	2005-2006	1945.18	3951	2344.17	4765
10	2006-2007	2728.17	5034	2608.77	4831
11	2007-2008	3381.62	5416	2830.37	5498
12	2008-2009	4121.82	8159	3028.4	5950
13	2009-2010	3801.67	6443	3079.59	6032
14	2010-2011	3225.66	6007	3183.8	6356
15	2011-2012	5537.98	10704	5085.78	10625
16	2012-2013	6921.5	13253	6958.99	13296
17	2013-2014	8018.51	13371	7581.94	13307
Total		50259.02	96457	46153.21	90988

Source: NHDFC annual report 2014.



Source: NHDFC annual report 2014.

Projects Sanctioned & Disbursement made through BANKS

Amount of grant allowed and distributed by various Banks and institutions during the period of 2011 to 2014 march totaled to Rs. 4597.19 Lakhs and the number of beneficiaries was 9064, (Rs. 589.74 (2011-12), Rs. 2142.95 (2012-13), Rs. 1864.5 (2013-2014),

Projects Sanctioned & Disbursement made through BANKS (2011-2014).

Name of Banks	Amount Sanctioned	Amount Disbursed	Number of Beneficiaries
<i>Year (2011-2012)</i>			
Allahabad U.P. Gramin Bank	50.00	50.00	100
Aryavart Gramin Bank	50.00	50.00	100
Baroda UP Gramin Bank	100.00	100.00	200
KashiGomtiSamyukt Gramin Bank	75.00	75.00	150
Purvanchal Gramin Bank	50.00	50.00	100
Shreyas Gramin Bank	50.00	50.00	100
Sarva UP Gramin Bank	50.00	50.00	100
Prathama Bank	35.00	35.00	70
Punjab and Sind Bank, UP	4.50	4.50	1
Gurgaon Gramin Bank	500.00	500.00	1000
Haryana Gramin Bank	200.00	200.00	400
Uttaranchal Gramin Bank	700.00	700.00	1400
<i>Year (2012-2013)</i>			
Saurashtra Gramin Bank	75.50	75.50	151
Gurgaon Gramin Bank	81.50	81.50	132
Haryana Gramin Bank	102.00	102.00	204
Allahabad U.P. Gramin Bank	253.50	253.50	507
Aryavart Gramin Bank	500.41	500.41	999
Baroda UP Gramin Bank	400.00	400.00	800
Ballia Etawah Gramin Bank	21.63	21.63	56
KashiGomtiSamyukt Gramin Bank	375.00	375.00	750
Purvanchal Gramin Bank	100.91	100.91	207
Prathama Bank	3.50	3.50	1
Uttaranchal Gramin Bank	200.00	200.00	400
Dena Gujarat Gramin Bank	5.00	5.00	10

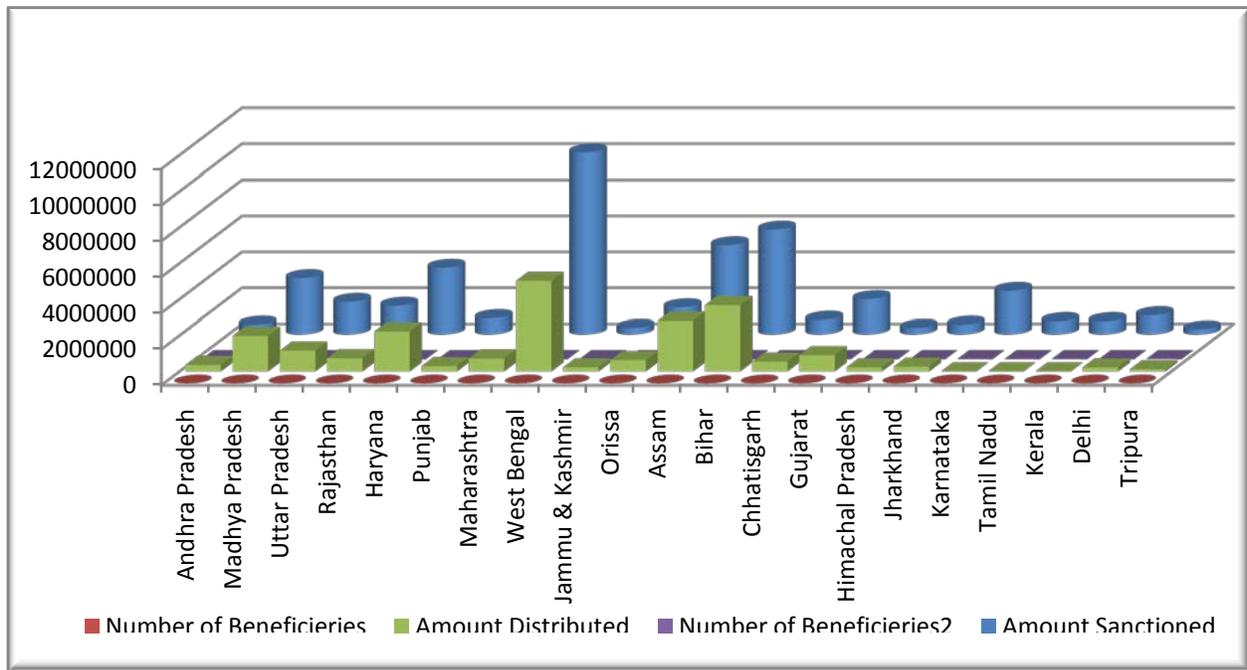
VidharbhaKshetriyaGramin Bank	24.00	24.00	48
<i>Year (2013-2014)</i>			
Gurgaon Gramin Bank	6.25	6.25	5
Allahabad U.P. Gramin Bank	50.00	50.00	100
Baroda UP Gramin Bank	50.00	50.00	100
Gramin Bank of Aryavart	326.80	326.80	654
ShreyasGramin Bank	13.84	13.84	20
Bank of Baroda	51.50	51.50	103
Andhra Bank	30.79	26.93	3
IDBI Bank	46.00	46.00	92
Punjab National Bank	18.42	18.42	1
Total	4601.05	4597.19	9064

Source: Annual report of NHDFC (2013-2014)

EDP GRANT SANCTIONED & DISBURSEMENT MADE FOR THE YEAR (2013-2014)

SL NO	State	Amount Sanctioned (in Rs.)	Number of Beneficiaries	Amount Disbursed (in Rs.)	Number of Trainees
1	Andhra Pradesh	540000.00	60	360000.00	60
2	Madhya Pradesh	3120000.00	330	1980000.00	330
3	Uttar Pradesh	1800000.00	200	1165000.00	200
4	Rajasthan	1584000.00	162	733000.00	162
5	Haryana	3700000.00	500	2225000.00	500
6	Punjab	900000.00	85	296000.00	85
7	Maharashtra	1080000.00	120	720000.00	120
8	West Bengal	10101750.00	1234	5014875.00	1234
9	Jammu & Kashmir	360000.00	40	230000.00	40
10	Orissa	1500000.00	140	630000.00	140
11	Assam	4959750.00	616	2808875.00	616
12	Bihar	5827500.00	750	3663750.00	750
13	Chhatisgarh	810000.00	90	540000.00	90
14	Gujarat	1959100.00	188	909548.50	188
15	Himachal Pradesh	360000.00	40	230000.00	40
16	Jharkhand	540000.00	60	270000.00	60
17	Karnataka	2415508.56	300	0	120
18	Tamil Nadu	735508.56	180	0	0
19	Kerala	735508.56	180	0	0
20	Delhi	1062160.00	130	225000.00	130
21	Tripura	288000.00	24	119000.00	24
	Total	44378785.68	5429	22120048.50	4889

Source: Annual Report of NHDFC (2013-2014).



National Handicapped Developed Finance Corporation plays very important role for the entrepreneurship development program among handicapped people, and providing financial assistance to set up small business ventures in trading and service sectors, to the purchase of vehicle for commercial activities, to set up small industrial units, to agricultural and self-employment, the amount of assistance is extended from 5 lakh to 25 lakh.

The objective of the NHDFC is to provide training to differently-abled persons and make them capable and self-dependent through proper training in the field of traditional and technical occupation and entrepreneurship development. The main objective is make every differently-abled person self-sufficient, economically independent person and thereby pursuing their income generating activity, and expecting such professionally managed venture and creating of equal number of employment opportunity for skilled and semi-skilled workers and add to the wealth of the nation.

III. DISCUSSION

This article seeks to improve our knowledge by making the following contributions, guided by the concept of Differently-abled entrepreneurs, as a new and emerging group of entrepreneurs and a new breed of entrepreneurs, and act as a catalytic force for the economic development of every country. Given the absence of explicit theoretical framework or literature studies on differently-abled entrepreneurs, it is an attempt to provide a theoretical contribution to the academic debate on differently-abled entrepreneurs. This study refines the existing notions of entrepreneurship studies that have been used in previous entrepreneurship studies of abled bodies (Women

entrepreneurs, Ethnic entrepreneurs, Edu-entrepreneurs, Social entrepreneurs and Holistic entrepreneurs). Differently-Abled Entrepreneur is a changing philosophical concept in the context of disabled and abled by equipping every disabled body as an abled one through entrepreneurship development.

REFERENCES

- [1] Ramaswamy M.C, 'The disabled-Where do they stand', Southern Economist, Volume No.-37, No: 3, June, 1998, Page no:3.
- [2] Kothari C R, Research Methodology, New Delhi, New Age International(p) Ltd.,2000 .
- [3] Reports of WHO, UNDP, UNICEF.
- [4] 2011 CENSUS AND 2001CENSUS DATA
- [5] Report of the World Summit for Social Development, Copenhagen, 6-12 March 1995 (United Nations publication, Sales No.E.96.IV.8), chap. I,
- [6] Resolution 1, annexes I and II. General Assembly resolution S-24/2, annex.3 A/37/351/Add.1 and rr.1, annex, sect. VIII, recommendation I (IV), adopted by the General Assembly by its resolution 37/52.
- [7] General Assembly resolution 48/96, annex.
- [8] General Assembly Resolution 61/106, annex I.

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Access to Antenatal Care Services under NRHM Framework: An Assessment in Nalbari District of Assam

Jutirani Devi

Research Scholar

Abstract- Due to the poor maternal health condition, India was unable to reach the MDG-4 and MDG-5 within the time period. Antenatal Care (ANC) service is one of the major parts of maternal health service. With the implementation of NRHM, and announcement of Janani Suraksha Yojana (JSY) and Janani Suraksha Yojana (JSSK) within the framework of NRHM, Govt. of India has also given special recognition for upgrading the condition of maternal health. Here, in this study, an attempt has been made to assess the ANC services under NRHM with the implementation of the provisions of JSY and JSSK in Nalbari district of Assam, the highest ranking district in the state, providing health services under NRHM.

Index Terms- Maternal Health, Antenatal Care, NRHM, JSY, JSSK.

I. INTRODUCTION

“**H**ealth is a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity.”¹

The term human health generally comprises the health of both male and female. Men and Women are two indispensable halves of humanity. Woman's development forms the grassroots of social development. But it seems that health is one of the neglected fields in our social life, where the women section of the society becomes more vulnerable having an additional responsibility of reproduction and motherhood. This negligence towards health directly has an impact on the development of women, development of society, and at the same time, it lessens the position of women also. Therefore, it becomes the utmost responsibility of the state and other organizations to take special care of women. Keeping in mind these things, in the Alma-Ata Conference, 1978, organized under the auspices of WHO, almost 166 countries have pledged for “Health for All” by 2000 A.D. aiming at proper distribution of the resources for health and access of essential health care to all. The International Conference on Population and Development (ICPD) held in Cairo in 1994 has given emphasis on women's reproductive health and it has influenced many countries of the world to formulate policies on this part. Again, the Beijing World Conference on Women, 1995, also highlighted the need to ensure universal access to appropriate, affordable and quality health care to women.

Women health is now a growing concern which basically relates to Reproductive and Maternal Health. WHO defined maternity health as “the care of a pregnant woman, her safe delivery, her post-natal examination, the care of her newly born infant and maintenance of lactation. In the wider sense, it begins much earlier in measures aimed to promote the health and well-being of the young people who are potential parents, and to help them develop the right approach to family life and to the place of the family in the community. It should also include guidance in parent craft and in problems associated with infertility and family planning.”²

United Nations, in its Human Development Report (UNDP), has emphasised on reducing Maternal Mortality Ratio (MMR) and Infant Mortality Rate (IMR) as the key indicators to assess of human development. MMR and IMR are the two important concerns related to maternal health. With the growing international concern on women health and being a member state of UN, India has also adopted the Millennium Development Goals (MDGs) as explained by UN that was to be fulfilled by 2015. IMR and MMR come as the MDG-4 and MDG-5. But, due to the poor maternal health condition, India was unable to reach its goal within the time period. Antenatal Care (ANC) service is one of the major parts of maternal health service. With the implementation of NRHM in 2005, and announcement of Janani Suraksha Yojana (JSY) in 2005 and Janani Shishu Suraksha Yojana (JSSK) in 2011 as the schemes within the framework of NRHM, Govt. of India has also given special recognition and care for women for upgrading the condition of maternal health.

II. NRHM: A HEALTH PROGRAMME IN INDIA

NRHM 2005-2012 was launched in 18 states that were identified as low-performing states in the field of health care with poor public health indicators and weak infrastructure to provide effective healthcare to rural population throughout the country. The main goal of NRHM is to provide equitable, affordable, accountable and effective primary healthcare for rural people and to make it accessible especially for poor women and children and to reduce Infant Mortality Rate (IMR), Maternal Mortality Ratio (MMR), Total Fertility Rate (TFR) which are certain key indicators of women's Reproductive and Child Health (RCH) by promoting newborn care, immunization, antenatal care, institutional delivery and post-natal care.

¹ World Health Organisation. 1946. Preamble- WHO Constitution. Geneva: WHO.

² World Health Organization. 1952. Expert Committee on Maternity Care: First Report- A Preliminary Survey. Technical Report Series No. 51. Geneva: WHO. p.3

Antenatal care is the primary stage relating to maternal health services followed by delivery care and postnatal care. All the stages are equally important and equal areas of concern that need specific care for the protection of women health as a whole. NRHM has also taken various initiatives to protect maternal health providing antenatal care services under its framework. Janani Suraksha Yojana (JSY) and Janani Shishu Suraksha Karyakram (JSSK) are the two important schemes under this mission. JSY is a safe motherhood intervention under NRHM being implemented with the objective of reducing maternal and neo natal mortality by promoting institutional delivery among poor pregnant women. For this, compulsory registration of pregnancy with four antenatal checkups has implanted as the provision under this scheme. Further, a new initiative has taken in the name of JSSK to provide completely free and cashless services to pregnant women including normal deliveries and caesarean operations and sick new born (up to 30 days after birth) in Govt. Hospitals and accredited Pvt. Hospitals in both rural and urban areas. As ANC services, JSSK provides free drugs and consumables, free diagnostics tests such as blood test, urine test, ultrasound etc.

Within the framework of NRHM, Assam, one of the 18 Low Performing States, has also initiated several schemes for the improvement of the health condition of Assam. The present study on the assessment of ANC services in Nalbari district of Assam is based on the implementation of the following initiatives by the Govt. of Assam.

A. Janani Suraksha Yojana (JSY)

JSY is a safe motherhood intervention under NRHM being implemented with the objective of reducing maternal and neo natal mortality by promoting institutional delivery among poor pregnant women. The scheme provides cash assistance to mothers who have delivered in Govt., health institutions and accredited private hospitals. A mother from rural area get Rs. 1400/- and mother from urban area get Rs. 1000/- as a cash assistance through this scheme.

B. Janani Shishu Suraksha Karyakram (JSSK)

Implemented from February, 2012 JSSK is a National initiative to make available better health facilities for women and child. The new initiative of JSSK would provide completely free and cashless services to pregnant women including normal deliveries and caesarean operations and sick new born (up to 30 days after birth) in Govt. Hospitals and accredited Pvt. Hospitals in both rural and urban areas. Entitlements for pregnant women: Free and cashless delivery, free caesarean section, free drugs and consumables, free diagnostics tests such as blood test, urine test etc.

C. Mamoni

Cash assistance to pregnant women for nutritional support @ Rs. 1000/- is to be given in two instalments under the scheme named "Mamoni". JSY is a program of the Government of Assam that encourages pregnant women to undergo minimum 4 ante-natal checkups which identify danger signs during pregnancy (needing treatment) and offer proper medical care. Under this scheme, at the time of registration, every pregnant woman receives a booklet on tips on safe motherhood and newborn care titled 'Mamoni'. During subsequent ANC check-

up, the pregnant women are provided with an amount of Rs. 1000/- (in two instalments, first for 2nd ANC and second for 3rd ANC) for expenses related to nutritional food and supplements. Every Govt., health institution offers these services for the women who have registered in their place. The source of fund is given by Assam Bikash Yojana, State Govt., sponsored schemes under Health & Family Welfare Department.

D. Distribution of free Iron tablets

Anaemia is characterized by a low level of haemoglobin in blood. Anaemia usually results from a nutritional deficiency of iron, folic, vitamin B12, or some other nutrients. It may become an underlying cause of maternal mortality and prenatal mortality. In India, 100 Iron and Folic Acid (IFA) tablets are provided by free to pregnant women in order to prevent anaemia during pregnancy.

E. Village Health and Nutrition Day (VHND)

The main objectives of Village Health and Nutrition Day are to ensure safe motherhood, child care and awareness generation among the rural masses right at the village level. On that day, routine immunization of children aged between 0-9 months and vaccination of pregnant women are done at the village itself. These services are also available at the Sub-centres. Organized on a pre-determined and publicized date every month, the VHND allows people to get in touch with health workers and discuss health related issues. ASHA organizes VHND in her village in a Wednesday once in a month in cooperation with the Village Health & Sanitation Committee where in ANMs delivers the services.

Thus, the Govt. of Assam has started various initiatives for the protection and promotion of reproductive and maternal health in the name of different schemes which become popular during the last decade. Janani Suraksha Yojana (JSY) is one of the vital steps under the framework of NRHM to increase institutional delivery providing ANC services to reduce MMR followed by Janani Shishu Suraksha Karyakram (JSSK) as a companion to it.

III. OBJECTIVES

1. Understand the functioning of JSY and JSSK as Antenatal Care Services under NRHM.
2. Examine women's access to Antenatal Care Service.
3. Find out the problems in realizing of the provisions of JSY and JSSK.
4. Provide some solutions through research for proper implementation of NRHM and its schemes.

IV. METHODOLOGY

The study was carried out in Nalbari District of Assam which is basically a rural district only with 2.39% urban population according to the Census Report, 2001, GOI. It is the lowest among all the districts of Assam in terms of urban population and highest in terms of rural population comprising 97.61%. According to Assam Human Development Report, 2003, in 2001, Nalbari district occupied 16th and 17th position in Human Development Index (HDI) and Gender Development

Index (GDI) respectively.³ The district has achieved a milestone in the state for securing 1st Rank for two consecutive years in 2014-15 and 2015-16 for best performance in 16 Dashboard Monitoring Indicators (as per GOI norms) and keeping its constituency till the current year 2016-17 up to January'17.⁴ NRHM, being a rural based health mission, covers the rural health sector under its dimensions. That is the reason for selecting this particular district as the study area to make comprehensive study as a whole.

Having geographical area of 1052 sq. Km., 996.56 sq. Km. comes under rural areas, with 6, 88,909 (89.28%) of rural population out of total population of 771,639 in the district. There are 7 development blocks, 65 Gaon Panchatats, 7 Anchalik Panchatyats, 1 Zila Parishad, 1 Town Committee and 1 Municipal Board. The number of villages in the district is 456.⁵ The health infrastructure comprises of 1 District Hospital (DH), 10 Community Health Centres (CHCs), 47 Primary Health Centres (PHCs) and 121 Sub Centres (SC).⁶ But it will not be possible to study all the beneficiaries and health institutions for which sampling method will be adopted for primary data collection.

For primary data collection, field survey has been conducted. For survey, women beneficiaries were taken on the basis of purposive sampling who got pregnant and delivered within five years. For understanding the health condition of women as vulnerable group, emphasis was given on women from BPL category, are vulnerable in terms of their socio-economic condition too. From seven CD Blocks, 158 respondents were interviewed. As Barkhetri is the biggest Block in terms of population and geographical area, highest respondents were taken from that block which was 30 in number. Interview was conducted through previously structured questionnaire. Further, discussion was made with health provider, i.e. Doctor, ANM, ASHA, Employees under NRHM, AWW and PRI members working with the Mission.

Considering the nature of the topic, the research is a descriptive and analytical both. Both secondary and primary data were for this research. Secondary data were collected from a survey of literature from books, journals, articles, newspapers, internet sources etc. Primary data were collected from field survey, Govt. Reports, NRHM Reports, Statistical Handbooks, DLHS-3, NFHS-4, DCHB 2011 etc. For data analysis, both qualitative and quantitative methods have been used.

V. DATA ANALYSIS

Collection of data and its analysis is a popular method in social science research. During this study data was collected from different areas or villages of Nalbari district on the basis of survey conducted during 2015 to 2017 (March). Applying both the methods of qualitative and quantitative and using of tables and figures, analysis and interpretation of data has been done to find out the result of this study.

³ Assam Human Development Report. 2003.

⁴ Progress Report on Health. NHM. Nalbari. Assam.

⁵ Census of India 2011. Govt. of India.

⁶ Assam Rural Health Statistics. 2016.

A. Access to Antenatal Care Services:

Antenatal is the first step for motherhood. To receive basic, professional antenatal care is the basic criteria for safe motherhood. During antenatal care, health professionals should monitor pregnancy for signs of complications, detect and treat pre-existing and concurrent problems of pregnancy, and should provide advice or counselling on preventive care, diet during pregnancy, delivery care and postnatal care during pregnancy. The ANC package comprises of physical checks, checking position and growth of foetus, measuring blood pressure might check of pregnant women, blood test to check the haemoglobin level (Hb level) giving IFA tablets and giving Tetanus Toxoid (T.T) injection at periodic intervals during the time of pregnancy. NRHM, under the scheme of JSY has mentioned at least 4 antenatal check-ups for the completion of ANC during first trimester, 4th-6th month, 7th-8th month and in the 9th month of pregnancy respectively. The complete course of ANC is necessary to safeguard a woman from pregnancy related complications and warning them about possible delivery complications. The accessibility and availability of the ANC services in Nalbari district can be discussed as follows:

Table I: Access to ANC services

Services	No. of Respondents	%
Registered Pregnancy	157	99.4
Registration Card Received	157	99.4
Consulted Anyone for ANC	157	99.4

The study on the respondents regarding their access to ANC services has revealed that out of 158 respondents, 157 respondents consisting of 99.4% reported registering their pregnancy with ANM, the same respondents reported having registration card from ANM and consulted with a doctor or nurse or ANM for ANC check-up. Only one (1) respondent found not being able to avail the ANC services due to the support of her to go for ANC check-up as for them no necessity of it.

As already mentioned, out of 158 respondents, one respondent has not availed the ANC services. Hence, the next analysis regarding ANC has done on 157 respondents considering it as total sample.

Table II: Registration of ANC within First Trimester

Registration of ANC	No. of Respondents	%
Within First Trimester	146	93
After 3 months	11	7
Total	157	100

Among the 157 registered women for ANC, result showed that 146 women constituting 93% have registered their pregnancy within 3 months with ANM and 11 respondents constituting 7% have registered after 3 months. NRHM has been giving emphasis on 3 ANC is necessary during the pregnancy of 9 months. As Assam comes under Low performing States (LPS),

JSY has given emphasis on at least 4 ANC check-up for the pregnant mothers. It was found that 88 respondents constituting 56.1% have approached 3 times check-ups for ANC, 27 respondents constituting 17.2% have availed 4 times ANC check-ups and 28 respondents constituting 17.8% have availed more than 4 times check-ups during their pregnancy. Despite this positive attitude of women regarding ANC, it was found that 14 respondents constituting 8.9% have availed less than 3 ANC check-up. While asked the reason for less than 3 ANCs, 5 respondents mentioned about their unawareness regarding times of complete ANC, 2 of them shared about their communication problem to reach the health facility, 5 of them informed that they did not go as they did not face any problem and 2 of them mentioned about their loss of wages as they were the daily labourer. Yet, it can be seen that the trend of seeking ANC among pregnant women has started within the study area.

ANM is the main personnel behind ANC who takes the responsibilities under NRHM. This study shows that 76 respondents constituting 48.4% went to Doctors for ANC, 55 respondents constituting 35% went ANM and 26 respondents constituting 16.6% have approached both the doctors and ANM. Regarding their place of ANC visit, it was found that all the pregnant women visited govt. health institutions at least once, while 9 of them has gone to private hospitals too.

It was observed that 154 respondents constituting 98.1% were measured their weight by health providers, 155 respondents constituting 98.7% reported about the checking of blood pressure during ANC, 152 respondents (96.8%) have done their urine test

at least once, 150 of them (95.5%) have done blood test at least once, 147 respondents constituting 93.6% reported that their abdomen were checked during pregnancy, and 132 respondents constituting 84.1% have done ultrasound at least once. Data revealed that only 8 respondents constituting 5.1% have done X-Ray during ANC check-up 141 respondents constituting 89.8% were advised for hospital delivery and 152 respondents constituting 96.8 were advised for nutrition's diet during pregnancy. To prevent anaemia and to keep haemoglobin level stable, consumption of IFA tablet is necessary. 155 respondents constituting 98.7% reported about their consumption of IFA during pregnancy. But unfortunately, maximum numbers of women are not aware about consumption of IFA for 100 days and they cannot remember their completion of course regarding IFA tablet. Almost 83% of women reported availability of IFA tablet for free either from ASHA or from PHCs or sub-centres, But still they cannot remember whether it was for 100 days or not as they are unaware of it, 154 respondents constituting 98.1% have received TT vaccination, other 2 respondent have received TT booster as the last child has not completed 2 years of age during pregnancy. Among the 3 respondents who died not received TT vaccination, one reported that she was that she was not informed by ASHA, while the other two could member whether they have received or not. 153 respondents constituting 97.5% got their expected delivery date from the health providers as a part of ANC. These can be shown through the following diagram:

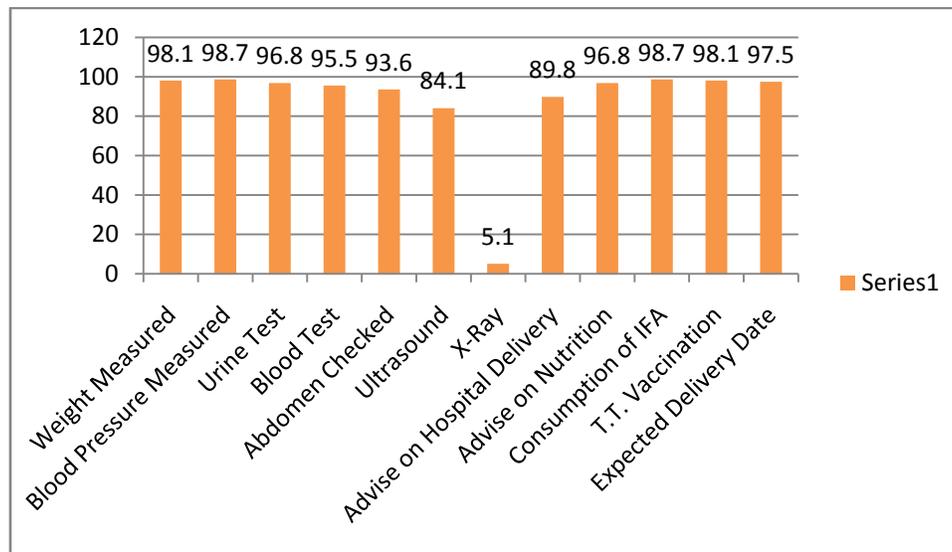


Figure 1: Access to ANC Services

156 respondents constituting 99.4% were assisted either by ASHA or by family members during ANC visit 82 respondents Constituting 52.2% reported that they were informed where to go if any pregnancy complications occur and 75 of them constituting 47.8% were not aware about it as they were not informed by anyone. 154 respondents informed that ASHA visited them during last 6 months of their pregnancy at home, while 3 respondents reported that that ASHA did not visit as they have consulted with doctors from private nursing home. During ANC check-up, 139 respondents were advised for breastfeeding

the newborn, 86 respondents were advised how to keep the newborn warm, 101 were advised for cleanliness and only 33 respondents were counselled not to do heavy works, like-climbing steps not to lift heavy things, keep themselves outside from any other heavy works. 5 respondents reported that they did not get any counselling regarding these.

As regard to maintenance of privacy during check-up, 87 respondents constituting 55.4% mentioned that privacy was maintained during check-up. On the other hand, 70 respondents constituting 44.6% have mentioned that there was no privacy in

the govt. hospitals. There was no special room for the pregnant women and hence they have to stand in a 'queue' to consult with the doctor. Even in the CHCs and DH, the specialized doctors have to take the burden the burden of other patients too and hence it creates problems in maintaining their privacy. As a result of this, consulting certain problems freely with doctor is not possible sometimes.

With the implementation of JSY and JSSK, the whole process of maternal health service was made free for all women especially in low performing state (LPS). Assam, as a low performing state, should provide it to the women under NRHM.

Despite this, it was revealed from the women during their 3 phases of maternal stage, have to pay for different services in difference health institutions.

Regarding expenditure during ANC, a shocking data was found which revealed that despite the provision of free ANC services to women 107 respondents including 4 availing Pvt. Facility, constituting 68.2% have to pay in various services. The following figure will show the details of their expenditure during ANC:

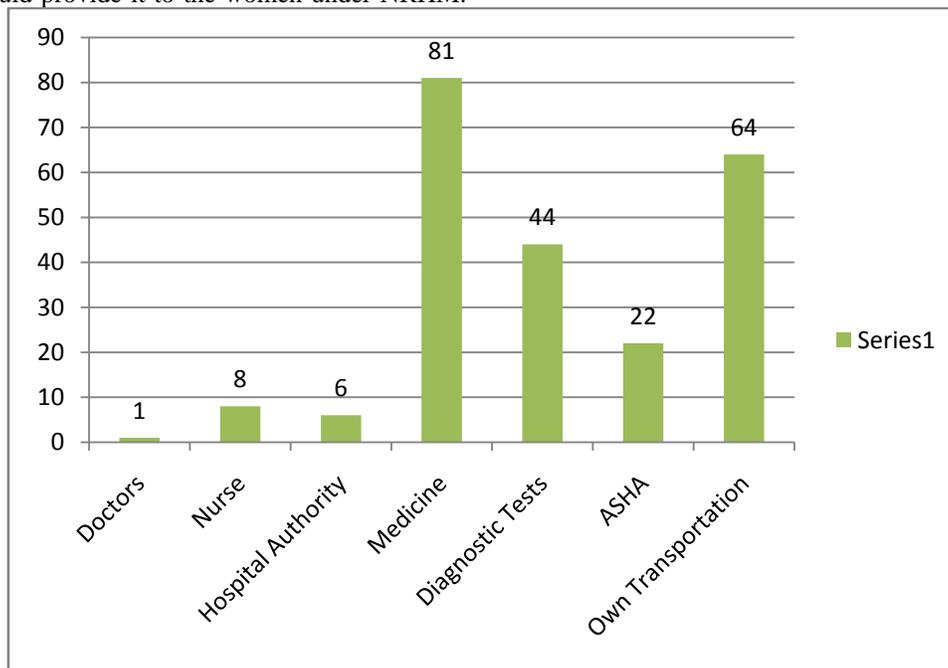


Figure 2: Expenditure in different Services

It was reported that among the 107 respondents paid for ANC, 66 respondents constituting 61.7 have done the expenditure of less than Rs. 2000/-, 33 respondents constituting 30.8% spent Rs. 2000/- to Rs. 5000/- and 8 respondents constituting 7.5% spent more than Rs. 5000/- for ANC. For these expenditures, 80 respondents managed it from their husbands income, 21 respondents managed it borrowing from micro finance group on interest, 17 respondents have taken loan from Bandhan Bank 7 of them have managed taking help from others, like- parental family, relatives or neighbours and 15 respondents incurred the cost of ANC from their own earning.

Pregnant women should have proper diet inclusive of all nutritious value. It was found that 122 respondents constituting 77.2% have maintained nutritional diet during pregnancy increasing the amount of food along with some added supplements like – milk, fruit, juice, Horlicks, vitamin etc. 36 respondents constituting 22.8% were unable to maintain proper diet during pregnancy due to eating problem, unable to buy food

because of financial problems and unaware of the necessity of proper diet.

Table III: Maintenance of Nutritional Diet

Maintenance of Diet	No. of Respondents	%
Diet Maintained	122	77.2
Not Maintained	36	22.8
Total	158	100

'Mamoni' is a scheme under JSY launched by govt. of Assam to give nutritional support to pregnant mother which is actually due during the time of their pregnancy. Figure-3 will show the status of beneficiaries of 'Mamoni' which comes as Rs. 1000/- in two instalments dividing Rs. 500/- each by check for ANC.

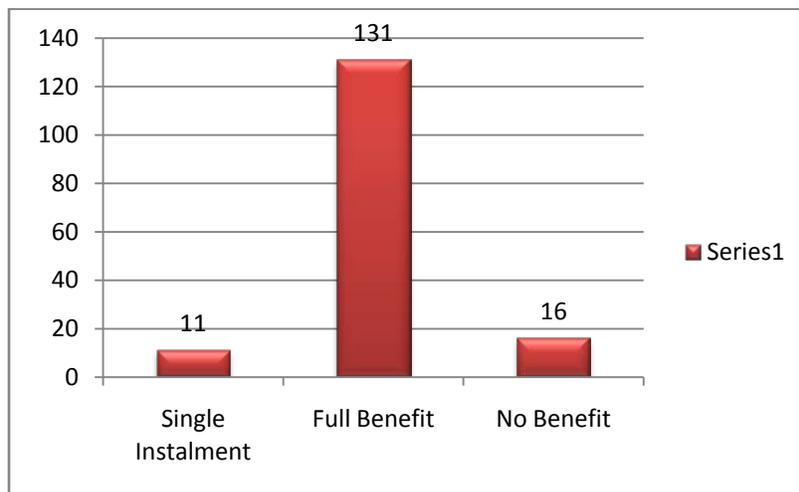


Figure 3: "Mamoni" Beneficiaries

Among the total respondent of 158, 157 respondents has availed the facility of ANC, hence are entitled to receive the amount under 'Mamoni'. It was reported that 131 respondents constituting 82.9% has received the full amount under 'Mamoni' for nutritious diet, 11 respondents constituting 7% received Rs. 500/- or only one instalment and 16 respondents constituting 10% did not get any amount under 'Mamoni'. Regarding the non-receiving of the amount under 'Mamoni', it was reported that maximum 7 respondents from Barkhetri Block did not received the amount including 1 respondent without ANC. One from Madhupur block reported that because of non-existing of

any Bank account for her, she did not receive the amount. Another one from Tihu Block reported that she did not receive the amount because she did not have her voter ID. Respondents from each the Block except Borigog-Banbhag mentioned that due to non-availability of fund as reported by ASHA to them, they did not get the amount at all or half paid. Respondents from all the blocks mentioned about giving bribe to ASHA for receiving their entitlement under 'Mamoni' which costs Rs. 30 to Rs. 500/- sometimes.

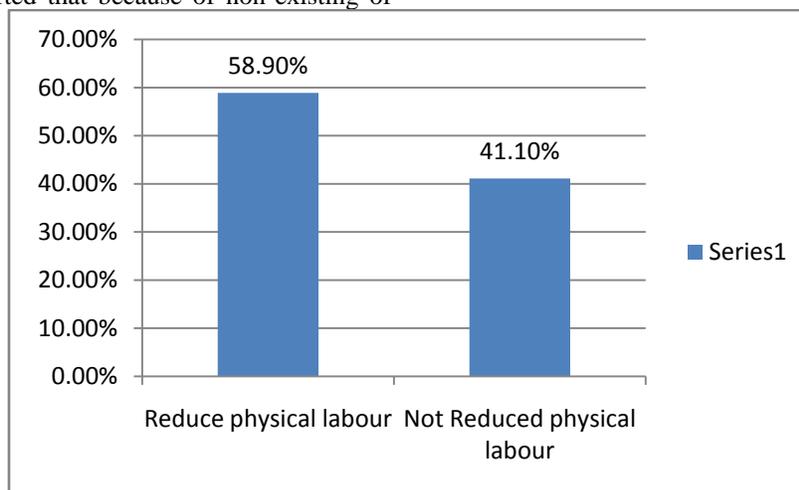


Figure 4: Status of Physical Labour during Pregnancy

Pregnant women should take rest at least for 10 hours in a day. Figure-4 shows that 93 respondents constituting 58.9% among the total respondents of 158, reduced their physical labour, while 65 respondents constituting 41.1% did not abstain from physical labour within and outside households 54 of the respondents who did not reduce physical labour was due to unavailability of any one to assist their work, 4 reported that they

were unaware that they were unaware of taking rest during pregnancy and 5 of them reported that they did not want to lose their daily wages taking rest, 2 nos. of respondents mentioned the as they did not face any problem during pregnancy they did not reduce their physical labour, 57 among 65 respondents who did not take rest mentioned that doing household work is the responsibility of every women.

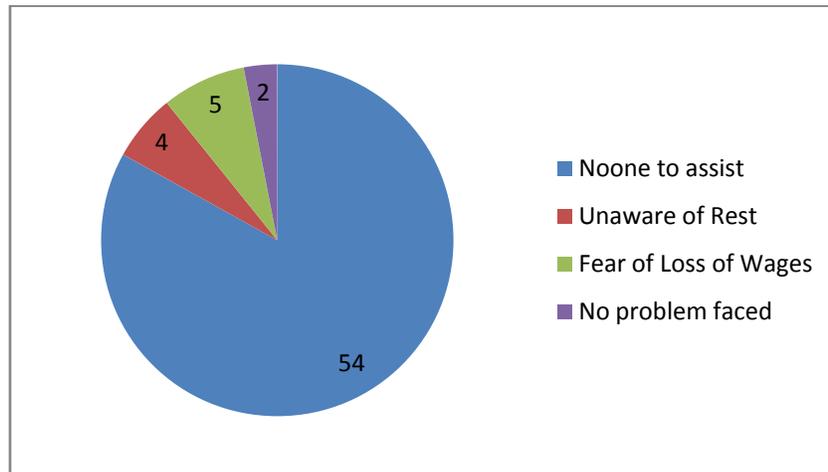


Figure 5: Reason of not taking Rest during ANC

From the services as discussed, during ANC by 157 respondents out of total 158 respondents, 101 respondents constituting 64.3% reported that they were satisfied with the ANC services provided by the health personnel. Maximum respondents were unaware of the facilities provided by the govt. under NRHM. A little improvement in public health care sector they have seen with the implementation of NRHM and they were happy with it. As the respondents were unaware of respondents were unaware of services, they could not measure the adequate application of different schemes under NRHM. On the other hand, 56 respondents constituting 35.7% were not satisfied with overall services during ANC. They were complaining regarding the role of ASHAS, hospital facilities, availability of drugs and manpower too.

VI. FINDINGS

From the above analysis, the key findings of the study can be extracted as follows:

1. Study showed 93% women registered their pregnancy in their first trimester which reflects the positive role playing by the grass-root level workers like- ASHA and ANM. ANM under NRHM has a performance based salary structure where registration of women within first trimester is one of the most important indicators. It was found that ANM insists the ASHAs to make sure the registration for ANC within the time period as mentioned under JSY.
2. During four antenatal checkups, JSY, under its provisions mentioned about BP check up, urine examination, weight measurement, and abdominal check up, HB test, T.T. vaccination and IFA consumption for the pregnant women. But study result showed only 35% out of the total respondents who completed 4 ANC checkups.
3. While JSY has made certain provisions for diagnostic tests during ANC checkups, JSSK has made are these tests free and zero cost facility. The research found that despite the implementation of JSSK, 68.2% respondents have to pay for different services during ANC. This expenditure varies which costs maximum of Rs. 5000/--

6000/-. Maximum 51.6% respondents have to pay for medicines followed by 28% for diagnostic tests including ultrasound.

4. Scarcity of manpower to run the laboratories, and lack of quality equipments along with some structural problems e.g. adjustment of manpower in some other areas or institutions resulted to unavailability of laboratory facilities for women during ANC.
5. Through only 15.2% respondents reported about availability of essential drugs in their nearby health institution, it was found that 51.6% respondents paid for medicines during ANC which is the highest category of expenditure. It reflects that the essential medicines to be provided freely to pregnant women under JSY were not fulfilled.
6. Giving emphasis on this indicator, Govt. of India, has decided to provide free delivery services to women through the implementation of JSY and JSSK under NRHM. Special provisions are made for the women from BPL categories that are more disadvantaged in terms of their socio-economic conditions and unable to afford quality health services for them. But, this study showed that 24.1% respondents took money on interest for ANC expenditure and others who had to spend for ANC checkups had incurred their expenditure from their savings.
7. Again, giving special emphasis on maternal health, JSY has included provisions on proper diet and rest for women during pregnancy under the scheme "Mamoni". A gap can be seen regarding the receiving of full assistance under Mamoni and maintenance of nutrition diet. The researcher found that a few respondents did not utilize the entitlement for them for having proper diet and they utilized it for the cause of their family as most of them belong to the lower economic background. So, for them, health comes later in comparison to other socio-economic problems.
8. Though accessibility of information is necessary, confidentiality should be maintained regarding personal health data as a part of medical ethics. It was reported that 44.6% respondents did not found privacy during their ANC while consulted with the doctors. For ANC

there were no separate room for the pregnant women. As there is a rush in the Govt. health institutions women have to consult everything in front of others and it becomes difficult for the doctors and other staffs to control the people from gathering surrounding the doctor's table. As a result of this, pregnant women get disturbed in consulting their problems with doctors and they cannot become satisfy with the services provided by the doctors. For doctors too, certain assessments, like- abdomen checkups during ANC become problematic which has an impact on detection of complication regarding maternal health of women.

It is essential to take special care during pregnancy as it is the primary stage of maternal health which may have an implication on overall health condition of a woman along with the newborn. The above analysis on the findings of the study reveals that despite these initiatives, the health sector is unable to provide full ANC services in the study area. The basic problems can be discussed as follows:

VII. PROBLEMS IN REALISING THE PROVISIONS OF JSY AND JSSK

It was found that there is a scarcity of doctors and other staffs in many parts of the district. As the public hospitals are over-crowded, doctors feel over-burdened. It creates problem in receiving health services in Govt. health facilities.

1. Irregular supply of medicines, non-functioning laboratory, poor quality of machines for diagnostic tests, less number of ambulances, scarcity of vehicles for referral services etc. have been hampering in the enjoyment of maternal and child health services under JSSK.
2. There is unavailability of usable staff quarters and that is why doctors and other staffs have stay outside the facilities. It resulted to unavailability of manpower that makes health services inaccessible during emergency.
3. The Health Information System is not strong under NRHM. People do not get information on the schemes, provisions and facilities under NRHM. It can be seen regarding the implementation of JSY which hampers in realisation of maternal health care services.
4. Lack of co-operation between NRHM and State Health Employees is visible in health delivery services. NRHM employees are demoralised sometimes by some other officials as they are contractual employees.
5. Again, there is a gap between the planning and execution of different provisions under NRHM. Planning in higher level and its implementation at ground level is mismatched which is one of the major defects of NRHM.
6. The major problem in implementing NRHM was found as huge corruption in each and every layer of the health system in the study area. It was found that despite the provision of free and zero cost delivery for women and free treatment for children under NRHM, women had to bribe or cut their entitlement as incentives. For this kind of expenditure, pregnant women are not interested to avail the facilities of the provided schemes.

VIII. SUGGESTIONS

From the above mentioned problems for implementing NRHM, it is clear that these problems and barriers can be removed with proper planning and execution of this Mission. For this, certain strategies have to be maintained:

1. Initiatives should be taken from the Govt. in contributing their development of socio-economic background through Public Distribution System and Panchayat & Rural Development. It will help them to concentrate on their health coming out from the basic necessities of life.
2. Opening of Bank Accounts should be made compulsory to receive the benefits of schemes like JSY and JSSK and the Mission should have to be strict and direct in disbursing the entitlements to the beneficiaries.
3. Infrastructure should have to be developed, emphasis should have to be given on work environment for the health personnel to maintain comfort, and laboratory should have to be well-equipped and organised with new and developed technology to attract the women towards Govt. health services.
4. Number of specialised doctors should have to be increased. Appointment of Lady Doctors in every health institutions should have to be made compulsory to remove some social and cultural barriers.
5. Monitoring system should be effective and transparent. To prove the accuracy of the survey reports, survey should have to be separately evaluated with confidentiality.
6. There should have to be the provision of rewarding the expecting mothers or becoming mothers for the best availing of ANC.
7. Behaviour of health provider matters a lot to understand the problems of women. Reproductive and maternal health is a closed area which people do not want to share with others. To extract actual information from women, health providers need to behave them softly, clearly, with caring attitude and respectfully.
8. Above all, lack of information is the main problem behind the implementation of the schemes under NRHM. Health Information System should have to be strengthened. Though, NRHM publishes some small publications on its schemes, these are not reachable to the women from every nook and corner. Again, using of medical terms makes it difficult to understand. Therefore, the language of these publications should have to be multi-lingual and easy to understand avoiding the medically recognised terms. For giving information to the women from remote backward areas, "door to door approach" can be done.

IX. CONCLUSION

Experience from the study on NRHM showed that NRHM is an important inclusion in the Indian Health Sector. The Mission in its Preamble itself has declared about improving the

availability, accessibility and quality of health services for the people in India with special focus on the poor, women and children from rural areas. Reproductive and Maternal Health is considered to be the key indicator to assess Women's Health. It is the responsibility of the state, government and other governmental organizations to ensure it for reducing MMR and IMR to reach the Millennium Development Goals (MDGs). For this, a proper care during pregnancy is vital for everyone. JSY and JSSK were implemented by the Govt. of India within the framework of NRHM to improve the quality of maternal health care with a view to its availability, accessibility and acceptability. Despite this, there are so many problems that women have been facing regarding the provisions of these schemes and its enjoyment due to the unavailability of infrastructure, manpower, unavailability of information and lack of co-ordination at different levels of the Mission. But these problems can be solved with an adequate strategy, active manpower, proper monitoring, technical support, involving different stakeholders and collaboration from every group of people living in the society with their strong mental and moral support.

REFERENCES

- [1] *Assam Human Development Report*, (2003). Guwahati: Planning & Development Department, Government of Assam.
- [2] Banerji, D. (July 23, 2005). Politics of Rural Health in India. *Economic and Political Weekly*. Vol. XL, No.30. EPW Publication.
- [3] Canmony, J. Cyril (2009), *Human Rights and Health Care*. New Delhi: Mittal Publication.
- [4] *Census of India 2011: Provisional Population Totals*, Paper 1 of 2011, Assam, Series 19, Guwahati: Director of Census Operations, Assam.

- [5] Dasgupta, M., Chen, L.C. and Krishnan, T.N. (1998). *Health, Poverty and Development in India*. OXFORD University Press.
- [6] Dongre, A. and Kapur. A. (October 19, 2013). How is Janani Suraksha Yojana Performing in Backward Districts of India? *Economic and Political Weekly*. Vol. XLVIII, No.42. EPW Publication.
- [7] Dutta, Akhil Ranjan (ed.). (2009). *Human Security in North-East India: Issues and Politics*. Guwahati: Anwesha.
- [8] Dutta, I. and Bawari, S. (2007). Health and Healthcare in Assam: A Status Report. Centre for Enquiry into Health and Allied Themes (CEHAT). Omeo Kumar Das Institute of Social Change and Development (OKDISCD).
- [9] Kishore, J. (2005). National Health Programs of India: National Policies and Legislations Related to Health. 5th Edition. New Delhi: Century Publications.
- [10] Mahanty, B. (February 23, 2013). Report of a Survey on National Rural Health Mission (NRHM) and Panchayats, *Mainstream*, Vol. LI, No. 10.
- [11] Nagla, Madhu. (2013). *Gender and Health*. Jaipur: Rawat Publications.
- [12] Progress Report on Health- Nalbari. 2012-13 to 2016-17. Nalbari: District Health Society-NHM.
- [13] Qadeer, Imrana. (2011). *Public Health in India- Critical Reflections*. Delhi: Daanish Books.
- [14] Sen, Sujata. (2012). *Gender Studies*. Dorling Kindersley (India) Pvt. Ltd., Pearson.
- [15] Taket, Ann. (2012). *Health Equity, Social Justice and Human Rights*. London: Routledge.
- [16] Wolff, Jonathan. (2012). *The Human Right to Health*. New York: W.W. Norton & Company.

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Reflection toward Reversed Verification System of Indonesian Corruption Acts

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Abstract- This study reviews 2 main issues. First, the meaning of corruption in Indonesia based on Law No. 20/2001 on the Amendment of Law No. 31/1999 on the Eradication of Corruption (Corruption acts law). Second, a reflection toward reversed verification system of Indonesian corruption acts. This normative study uses a legislative approach undertaken through an assessment of all written legal rules relating to the subject. This study provides to answers 2 principal issues. First, the meaning of corruption in the articles of Corruption Act which starts with the word "every person", which is given the meaning of an individual or including a corporation. Meanwhile, corporation means a collection of well-organized persons and/or assets, both legal entities and non-legal entities. Thus, corporations can be subject to a corruption case. Second, the rule of law in Indonesia determines, the reverse verification system in the settlement corruption is limited and balanced. That is, the defendant has rights and obligations, which is entitled to prove that he did not commit an act corruption and must provide information about all his property.

Index Terms- Reflection, Reversed Verification System, Criminal Court System, Corruption Acts, Corruption Acts Law.

I. INTRODUCTION

Corruption is an extraordinary crime regardless the social status of society. Anyone can get caught up in corruption. For example, the Public Prosecutor (JPU) of the Corruption Eradication Commission (KPK) read the corruption case indictment of e-ID card (e-KTP) procurement on Thursday, March 9th, 2017. In the indictment letter, there are 23 names of members of the House of Representatives Called involved in projects worth more than Rp 6 trillion. During the investigation, KPK has called hundreds of witnesses and elements of the House members. In accordance with the indictment, most of the DPR members have received hot money from the e-ID card project. There are 14 members and former members of DPR have returned the money to KPK, The amount about Rp 30 billion.

As matter of fact, e-KTP procurement project conducted during the Gamawan Fauzi (Minister of Home Affairs) allegedly harm the state finance of Rp 2 trillion more. In fact, the total value of the project is Rp 6 trillion. Allegedly, one-third of the value of the project has flowed into several parties (Habibi, 2017). If the 23 members of the People's Legislative Assembly were proven to be corrupt, then this shows that the crime of corruption does not recognize the person's social life, educational background, or religious background.

Discussing the criminal act of corruption, we can see the results of a survey in 2006 done by PERC (Political and Economic Risk Consultation Ltd) based in Hong Kong, which again put Indonesia as the first number on the most corrupt country in Asia (Ginting, 2006). This is a negative achievement in Indonesian law enforcement. Corruption is a very serious problem that must be addressed immediately. Corruption or better known as KKN (Corruption, Collusion, and Nepotism) in addition to causing losses in terms of state finances is also a moral disease that destroys the nation's moral life that must be immediately found the resolution.

In the contrary, the officials who have a high salary and have had all the facilities and wealth also misuse the power they have to acquire wealth proportionally. The development of corruption is marked by the leakage in the use of state/regional budget each year.

In the state administration, the development of corrupt acts since the 1960s to date has never ceased. In fact, increasing. The classification of corruption in the 1960s known as "wet position" is no longer relevant, because corruption has also hit the private sector, even bribes often starting from this sector (Romli, 2017). The habit of giving and accepting promises such as bonus or tribute among the people on a large scale, whether or not it has systematically marbled the prevailing social values and norms, and has grown a permissive attitude in the middle of our society, the attitude of the people who let something or things that should not be done because it is against the prevailing social norms.

Generally, KKN is done by those who have the power and financial ability, by using their power, intentions, and opportunities, they make a profit and use facilities that are not his rights. One of the popular statements has been made by a British statesman, Lord Acton, "*The power tends to corrupt, absolute power corrupts absolutely*".

In the other words, there are 4 corruption forms that characterize the outstanding structure, namely:

- 1) Shortcut corrupt, embezzlement of state money proposed to political gain or exploit businessman who want the issuance of the certain change laws.
- 2) Tribute corrupt, form of corruption that is possible because of strategic positions, such as project bubbles, employee selection, and the selection or selection of civil servants.
- 3) Tender corrupt, abusing of power aimed to get projects, facilities, or other conveniences.
- 4) Marketing Corrupt, related to security assurance, protection, and the affairs of internal turmoil and external factors.

Corruption is the deprivation of people's economic and social rights by a small number of individuals or groups in

society. From this, it can be seen also how KKN describes the low and the moral decay of a person. On the other hand, with such position, they should be a public figure and guide for the people. As a result, the right of the people to be protected and prospered is hampered and further away from expectations.

On the other hand, the classic problem always faced in practice is that law enforcement officers have difficulty in terms of proof of a person, whether or not they have committed a corruption act. In practice, criminal law enforcement officers find the difficulty and trouble to determine and look for evidence concerning the alleged corruption. On the other hand, the prosecutor, as the public prosecutor, is obliged to have valid evidence and be admitted to the proceedings in accordance with the indictment, so as to ensnare the perpetrator. On the other hand, the perpetrators of corruption, are very good at hiding the wealth obtained from the corruption and in many ways they are evasive from the indictment.

during corruption case development, criminal law enforcement officers use reverse verification system in solving the corruption acts. That is, the defendant is burdened with the obligation to prove her innocence. The prosecutor just filed an indictment. Furthermore, the defendant himself must prove if he is innocent or his actions are not criminal acts of corruption.

Based on the description as mentioned above, this study would focus on 2 subject matter, that is:

- A. How is the meaning of the formulation of criminal acts in Indonesia according to Law No. 20/2001 regarding the Amendment of Law No. 31/1999 concerning the Eradication of Corruption?
- B. How does the reflection toward reverse verification system of Indonesian corruption acts?

II. RESEARCH METHOD

This is a normative research by using legislation approach, which is done through the examination of all written legal regulations relating to the subject matter discussed and argued theoretically based on the concept of criminal law.

This research formulated based on 3 legal materials. First, the primary legal material in the form of positive law, namely legislation relating to the subject matter. Second, secondary legal material which includes books or other literature in criminal law and criminal procedure law and research results relating to this study. Third, tertiary legal material, ie the results of previously published research.

Legal material data processed by categorization as a selective class of law material classification. All legal materials are grouped according to universally determined, meticulous, and strict criteria agree with the subject matter. The next step is to analyze the legal material and be presented in a descriptive-analytic way, namely to examine concepts that include legal notions, legal norms and legal systems related to this research.

I. DISCUSSION

A. *The Sense of Indonesian Corruption Cases*

The corruption cases generally can be interpreted as an activity which is a manifestation of the actions of corruption in

the sense of all power or influence attached to a person who acts appropriately to enrich themselves or others or an agency that harms the state finance or economy. A corruption case could be seen from various aspects, namely literal, political, sociological, economic, and cultural.

Literally, corruption comes from the Latin "*curruptio*" derived from the word "*corrupter*". From the Dutch "*corruptie*" it is taken over into Indonesian "Korupsi (Corruption)" which means rottenness, ugliness, depravity, dishonesty, bribery, immoral (Prakoso & Suryati, 1986). Meanwhile, based on general public thought, corruption is an act related to the state finances that are illegally owned or haram (Leden, 1992). In addition, the law on combating corruption provides a broader understanding, that is, actions that are detrimental to state finances and which make government officials run ineffective, inefficient, unclean, and unprestigious.

Dealing with the statements above, it can be said that Corruption is a social symptom everywhere. History provided that almost every country is faced with the problem of corruption. It is no exaggeration if the notion of corruption is always evolving, depending on the changes and demands of the times and about the problem of how to overcome it. If corruption had once occurred in the private sector and government agencies, then corruption has now expanded to legislative and judicial institutions. Corruption is no longer done only by an employee whose salary is not sufficient for his family for a month but corruption has become a pervasive disease spread almost in all social walks.

In the other words, corruption can be viewed from a sociological, political, economic, and cultural point (Sukarton, 1986). Sociologically, Syed Husein Alatas (1986) views nepotism as corruption, the appointment of relatives, friends or political colleagues to public offices regardless of their services or consequences to public welfare. However, in Law No. 3/1971, nepotism is not included in offense formulation. Concerning the sense of nepotism specifically had regulated in Law No. 28/1999 on the Implementation of a Clean Country from Corruption, Collusion, and Nepotism.

Whereas, From a political point, corruption is a disturbing factor and reduces the credibility of the government, especially among educated and young people. Then, from an economic point of view, corruption is one of the high-cost economic factors that are very harmful to the state and society. Finally, from a cultural point of view, corruption severely damages the morals and character of our people who actually have noble values. (Husein, 1986)

In Indonesia, corruption is regulated in Law No. 20/2001 on Amendment to Law No 31/1999 on the Eradication of Corruption (Corruption acts law). As stated in Chapter II of Article 2, corruption is defined as "Every person who unlawfully commits an act of enrichment of himself or another person or a corporation that may harm the state's finances or the economy of the country."

The corruption acts Law (UU Tipikor) also extends the teaching of its unlawful nature either formally or materially. The unlawful nature means an act judged as a criminal offense concerning the laws and regulations (as a form of nature against the law in formal or *formeelwederrevhtelijkid*) also the fact that

itis adisgraceful act in the social life as well as the contrary to the sense of justice Society.

UU Tipikor contains 30 forms of corruption cases spread over 13 articles, those are, Article 2, Article 3, Article 5 paragraph (1) letter a, Article 5 paragraph (1) letter b, Article 5 paragraph (2), Article 6 paragraph (1) letter a, Article 6 Paragraph (1) point b, Article 6 paragraph (2), Article 7 paragraph (1) letter a, Article 7 paragraph (1) letter b, Article 7 paragraph (1) letter c, Article 7 paragraph (1) letter d, Article 7 Paragraph (2), Article 8, Article 9, Article 10 Sub-Article a, Article 10 letter b, Article 10 letter c, Article 11, Article 12 letter a, Article 12 letter b, Article 12 letter c, Article 12 letter d, Article 12 letter e, Article 12 letter f, Article 12 letter g, Article 12 letter h, Article 12 letter i, Article 12 B jo. Article 12 C, and Article 13.

These 30 forms of corruption cases can basically be classified into 7 types, namely:

- 1) Corruption related to state finances, contained in Articles 2 and 3.
- 2) Corruption related to bribery, contained in Article 5 paragraph (1) a, Article 5 paragraph (1) letter b, Article 13, Article 5 paragraph (2), Article 12 letter a, Article 12 letter b, Article 11, Article 6 paragraph (1) letter a, Article 6 paragraph (1) letter b, Article 6 paragraph (2), Article 12 letter c, and Article 12 letter d.
- 3) Corruption related to post office embezzlement, as provided for in Article 8, Article 9, Article 10 letter a, Article 10 letter b, and Article 10 letter c.
- 4) Corruption related to extortion, contained in Article 12 letter e, Article letter f, and Article 12 letter g.
- 5) Corruption related to fraud, contained in Article 7 paragraph (1) letter a, Article 7 paragraph (1) letter b, Article 7 paragraph (1) letter c, Article 7 paragraph (1) letter d, Article 7 paragraph (2), And Article 12 letter h.
- 6) Corruption related to a conflict of interest in some procurement contained in Article 12 letter i.
- 7) Corruption related Graft, contained in Article 12 B and Article 12 C.

UU Tipikor also regulates other types of criminal acts related to corruption. Such types of offenses are provided for in Article 21, Article 22, Article 23, and Article 24. The forms of criminal offenses include 6 kinds, namely:

- 1) Block the corruption case investigation, contained in Article 21.
- 2) Do not giving information or giving false information, contained in Article 22 and Article 28.
- 3) The bank that does not provide the account information of the suspect, contained in Article 22 and Article 29.
- 4) Witnesses or experts who do not provide information or give false information, contained in Article 22 and Article 35.
- 5) The person which holding the office secret, but not give any information or provide false information, contained in Article 22 and Article 35.
- 6) Witnesses who open the complainant identity contained in Article 24 and Article 31.

The formulation of a corruption case in the articles of Corruption Law (UU Tipikor), begins with the word "every person", which is given the meaning of an individual or including

a corporation. Meanwhile, a corporation is a collection of well-organized persons and/or assets, both legal entities and non-legal entities. Thus, corporations can be subject to corruption acts.

B. Reflection toward Reversed Verification System of Indonesian Corruption Acts

Every corruption act that destroys the livelihood of the people is a violation of the human rights of about 200 million people of Indonesia. Thus, it is not surprising when the demand for a thorough investigation prosecutes and punishes the severity of the corrupt loudly voiced. In fact, some people have suggested the corruptor be sentenced to death, so that other do not the same acts in the future.

Dealing with this, the government and law enforcement officers are required to be alert and responsive to the problems faced. However, in principle, law enforcement agencies in action must have a foundation, because with that capital the perpetrators (corruptor) can be brought before the law and get the punishment accordingly.

The eradication new types of corruption committed by those who are classified as *white collar crimes* which affecting the social welfare should use sophisticated legal means to protect the widespread human rights. It is not surprising if priority is given to the handling of corruption, as stated in Article 25 of Corruption Law:

"The investigation, prosecution, and examination at the hearing immediately submit copies of the court proceedings in a corruption case preceded by another case for immediate process". Similarly, relating to the legal tool to ensnare the corruptors constantly had been changed. The changes in tackling the corruption by forming kinds of rules show how complicated the corruption cases are. Corruption has a veiled pattern of behavior and has political or state, economic, legal, financial, social, and cultural goals.

Since 1971, Indonesia has had a positive law to eradicate corruption, namely Law No. 3/1971 on Eradication of Corruption as set forth in the State Gazette No. 19/1971 and enacted on 29th March 1971. The Act Replacing Law No. 24 Prp. 1960 on Investigation, Prosecution, and Corruption case which is considered less effective as a tool to tackle the corruption growth.

Broadly speaking and based on its chronology, the development toward corruption reform in Indonesian legislation is as follows:

- 1) Presidential Decree No. 40/1957, dated 14th March 1957 *jo* *Regeling op de staat van oorlog van Beleg* (St. 39-582 jo 40-79 in 1939) on the Emergency of War, gave rise to regulations; Prt / PM-08/1957, dated 9th April 1957 on Corruption Eradication, Prt / PM-08/1957, dated 1st July 1957, on Ownership of Property, and Prt / PM-001/1957, dated 1st July 1957, on Confiscation and Deprivation of Goods.
- 2) Presidential Decree No. 225/1957 dated 17th December 1957 *jo* Law No. 74/1957 *jo* Law No. 79/1957 on Hazardous Condition, gave birth to the Ruling Rule of the Central Army Chief Staff No. Prt/Perpu/031/1958 dated 16th April 1958 *jo* Regulation of the Rulers of Naval Chiefs Staff No. Prt/ZI/1/7 dated 17th April 1958

on Investigation, Prosecution and Inspection of Criminal Acts and Property Ownership.

- 3) Government Regulation in Lieu of Law No. 24/1960 dated 9th June 1960 *jo* Law No. 1/1961 dated 1st January 1961.
- 4) Law No. 24 Prp 1960 dated 1st January 1961 on Investigation, Prosecution, and Corruption Criminal Investigation.
- 5) Law No. 3/1971 dated 29th March 1971 on Corruption Eradication.

the next period, Corruption is followed by the issuance of various regulations that indicate the government effort regarding corruption cases, such as:

- 1) TAP MPR XI/MPR/1998 on the implementation of a clean country from corruption, collusion, and nepotism.
- 2) Law No. 31/1999 on the eradication of corruption.
- 3) Law number 28/1999 on the implementation of a clean country from corruption, collusion, and nepotism.
- 4) Government rules No. 65/1999 on the procedures for examination of the assets of state operators.
- 5) Government rules No. 19/1999 on the combined team for the eradication of corruption.
- 6) Government rules No. 71/2000 on procedures for the implementation of the role of the community and the granting of awards in the prevention and eradication of corruption.
- 7) Law No. 20/2001 on the amendment toward law No. 31/1999 on the eradication of corruption.
- 8) TAP MPR No. VIII/MPR/2001 on the recommendation of the Policy direction of corruption eradication and prevention.
- 9) Presidential Decree No. 73/2003 on the establishment of the selection committee about the candidate for corruption eradication commission (KPK).
- 10) Presidential Instruction No. 5/2004 on the Acceleration toward Corruption Eradication.

In addition, there is still much legislation regarding the efforts to eradicate corruption. In its development, although it has often changed and perfected, in fact, the laws and regulations are not functioning optimally and do not meet the social expectations. In the new order period, anti-corruption laws are practically non-functional and ineffective. Corruptors can still move freely and breathe with relief for their actions by enriching themselves and their group.

Actually, what is going on with Indonesia law?, Hopefully still as William Shakespeare discloses, "*The law had not been dead, though it had slept*" (the law was not dead, even though he had slept, and if still sleeping the most appropriate is waking him up.). (Ali, 2001)

The classic problem always faced in corruption acts is the difficulty law enforcement officers in verification process, whether or not they have committed a criminal act of corruption. In practice, criminal law enforcement officers find it difficult to determine and look for evidence of alleged corruption. On the other hand, the prosecutor, as the public prosecutor, is obliged to have valid evidence and be admitted to the proceedings in accordance with the indictment, so as to ensnare the perpetrator. On the other hand, the perpetrators are very good at hiding the

wealth obtained from the corruption and in many ways they are evasive from the indictment.

The verification comes from the word "verify/proof", which, according to Soebekti (1980), the things construed as appropriate to assure the truth of a proposition or position. The evidence is defined as an act (things and so on) to prove. While, Sudikno Martokusumo (1981) stated that verification is to provide sufficient grounds to the judge who examines the case concerned to provide certainty about the truth of the proposed event. Furthermore, Andi Hamzah (1986) defines verification as a process of how the evidence is used, proposed or maintained, in accordance with applicable law of procedure.

In the other hand, there is no formal legislation on the understanding of the evidence. However, as a reference to what is meant of evidences, Andi Hamzah provides restrictions that the evidence in criminal cases, namely goods on crime done (offense-object) and goods with offense done, the tools Used to conduct offense, such as state money used (corruption) to buy a private home, then the house is a proof or a result of offense.

The judge in searching for and putting the truth to be judged against the decision in the criminal case under consideration shall be based on the provisions evidence as specified in law in a limitation manner as defined in Article 184 (1) of the Criminal Procedure Code. That is, judges should not diverge or define other evidence, other than those specified in the law. The composition of the evidence as set forth in Article 184 paragraph (1) of the Criminal Procedure Code is hierarchical in nature, which means to indicate the existence of the putting nature of the composition. Hari Sasongko and Lily Rosita stated, from the sequence mentions the tools of evidence can be concluded that the proof in criminal cases more emphasis on witness testimony. (Sasongko & Rosita, 1995)

Previously, in Article 3 of Law No. 3/1971 on the Eradication of Corruption, it was stated that the prosecution of corruption was carried out in accordance with the prevailing provisions, simply not specified otherwise in this law. This Article can be interpreted that if the law does not regulate separately, Article 137 of the Criminal Procedure Code can also be applied to the prosecution of corruption. That is, in the prosecution of corruption is the authority of the General Prosecutor (JPU). The prosecutor in filing the lawsuit must be accompanied by sufficient evidence since the consequence of insufficient evidence will result in the defendant being dismissed free (Article 191 of the Criminal Procedure Code).

On the other hand, as implied in Article 37 of Law No. 31/1999 concerning the Eradication of Corruption, the defendant has the right to prove that he/she does not commit a criminal act of corruption, The public prosecutor still have the authority to provide reversed evidence and shall prove that the defendant is guilty of a corruption act. Thus, the reverse verification system in Dutch is "*omkering van het bewijs*" or in English known as "*shifting the burden of proof*". This reverse verification system is not commonly applied in the proving of criminal offenses in general.

Some practitioners and theoretical law argue the application of this reversed proof system is contrary to the presumption of innocence and the principles that state "*nemo prohiben a pluribus defensionibus uti*", meaning that people are not forbidden to deny. Meanwhile, some of the other view

that considering the condition of corruption in Indonesia is very severe, it needs extraordinary handling.

As revealed by former Minister of Justice and Human Rights, Yusril Ihza Mahendra, at this time the corruption cases can no longer be categorized as "ordinary crime", Because it had widespread systematically. Corruption is not only detrimental to the state's finances but has trampled on the social and economic. Because of its extraordinary nature, the prevention of corruption must be done in particular, ie, with the legislation to eradicate corruption which has been exacerbated by a reversed verification system that actually has also been a restriction on the human rights of the accused.(Yusril, 2017)

Corruption Act law implements a limited and balanced reverse verification system, the defendant has the rights and obligations to prove that he is not committing a corruption act and shall be obligated to provide information concerning all his property. This can be seen in Article 28, Article 37 paragraph (1), paragraph (2), and Article 37 A paragraph (1) and paragraph (2) on Corruption Law.

Article 28 on Corruption Law

For the purpose of the investigation, the suspect shall be required to provide information about all of his/her property and property owned by his/her wife, husband, child, and property of any person or corporation that is known and or reasonably suspected of having any connection with the corruption act committed by the suspect.

Article 37 on Corruption Law

- 1) The defendant has the right to prove that he/she has not committed a corruption act.
- 2) In case the defendant can prove that he/she does not commit a corruption act, then the evidence is used by the court as the basis for stating that the indictment is not proven.

Article 37A on Corruption Law

- 1) The defendant is obliged to provide information about all of his property and property of his wife or husband, child, and property of any person or corporation alleged to have any connection with the alleged case.
- 2) In the event that the defendant can not prove that the wealth is not equal to his income or the source of his wealth, the information referred to in paragraph (1) shall be used to substantiate the existing evidence that the defendant has committed a corruption act.

The reversed verification system is derived from the word "*Reversal of the burden of Proof*" which is a proof system used for Anglo-Saxon countries and aims to facilitate proof that in terms they are called "*certain cases*" or has special nature. Thus, this reversed proof system is very limited only in certain cases which are very difficult to prove it, so that a system of evidence which is actually contrary to the principle or universal principle of proof. (Adji, 2001)

the eradication of corruption cases should be provided by clear and decisive legislation to facilitate the proof as well as to ensnare the perpetrators of corruption and sanction the hardest. In practice, to ensnare a corruptor is not easy considering the legal

instruments governing corruption still overlap. M. Sholehuddin said the formation of our criminal legislation is often done in haste, so it does not seem to pay attention to the related content material in other legislation. This leads to "*inconsistency*" and even "*overlapping*" among legislations. Such criminal legislation is usually not based on a criminal policy that is targeted and perspective in the context of criminal policies toward corruption. (Sholehuddin, 2006)

III. CONCLUSION

The meaning of corruption acts was contained in Law No 20/2001 on the Amendment of Law Number 31/1999 on the Eradication of Corruption (Corruption Act law). As mentioned in Chapter II, Article 2, corruption means "*Every person who unlawfully commits an act of enrichment of himself or another person or a corporation that may harm the state's finances or economy.*" The formulation of a corruption act in the articles of the Corruption Acts begins with the word "everyone", which is given the meaning of an individual or including a corporation. Meanwhile, a corporation is a collection of well-organized persons and/or assets, both legal entities and non-legal entities. Thus, corporations can be subject to criminal acts of corruption. In essence, the reversed verification system means the defendant is charged with the obligation to prove his innocence. The prosecutor only filed the indictment. Furthermore, the defendant himself must prove if he is innocent or his actions are not corruption act.

REFERENCES

- [1] Ikhwanul Habibi, <https://kumparan.com/ikhwanul-habibi/23-nama-anggota-dpr-masuk-dakwaan-kpk-di-kasus-e-ktp>, accessed on 10th April 2017.
- [2] Erna SU Ginting, "Korupsi Masih tetap Tinggi", *Bisnis Indonesia*, 7th Nopember 2006
- [3] Romli Atmasasmita, "Pembuktian Terbalik dalam Perkara Tindak Pidana Korupsi", <https://www.anti.korupsi.org>, accessed at 10th April 2017.
- [4] Djoko Prakoso and Ati Suryati, *Upetisme Ditinjau dari Undang-Undang Pemberantasan Tindak Pidana Korupsi*, (Jakarta: Bina Aksara, 1986), p.68.
- [5] Leden Marpaung, *Tindak Pidana Korupsi Masalah dan Pemecahannya*, (Jakarta: Sinar Grafika, 1992), p. 149.
- [6] Sukarton Marmosudjono, *Penegakan Hukum di Negara Pancasila*, (Jakarta: Pustaka Kartini, 1986), p. 68.
- [7] Syed Husein Alatas, *Sebuah Penjelajahan dengan Data Kontemporer*, (Jakarta: LP3ES, 1986), p.11
- [8] Achmad Ali, "Asas Pembuktian Terbalik dan Praduga Tak Bersalah", *Jurnal Keadilan*, Vol. I, Juni 2001, p. 30
- [9] Soebenti, *Kamus Hukum*, (Jakarta: Pradnya Paramita, 1980), p.21
- [10] Sudikno Martokusumo, *Hukum Acara Perdata Indonesia*, (Yogyakarta: Liberty, 1981).
- [11] Andi Hamzah, *Kamus Hukum*, (Jakarta: Ghalia Indonesia, 1986), p.99.
- [12] Hari Sasongko and Lily Rosita, *Hukum Pembuktian dalam Perkara Pidana*, (Jakarta: Sinar Wijaya, 1995), p.7
- [13] Yusril Ihza Mahendra, "Komisi Anti Korupsi, Calon Penggilas si Extra Ordinary Crime", <http://www.hukumonline.com>, accessed at 10th April 2017
- [14] Indriyanto Seno Adji, "Sistem Pembuktian Terbalik: ke Arah Minimalisasi Hak Terdakwa", *paper assembly at National University Trisaksi*, Jakarta, 11th July 2001, p. 3.
- [15] M. Sholehuddin, "Pencegahan Tindak Pidana Korupsi", *paper*, delivered at short-course Development of Apparatus Behavior in Preventing Misuse of State Finance, period-2,3th July 2006.

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Recent Trends in Power System

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Abstract- This paper is intended to the power system which includes generation, transmission and distribution of the electrical energy. This gives the overview of generation which tells about the recent energy production in the world. It explains about the production of energy and source of energy of top 20 countries in the world, also gives the statistical data about the sources available in India and other countries. The overall electrical energy review in 2015 also explained here. Electrical energy transmission tells about the recent trends present in it and transmission development issues also given here. It tells about the future expansion in transmission system and the reason for going into increasing the voltage level high. The investment in the transmission system also explained here. The only one control system for the five national regions of grid is present in Gurgaon it is named as NTAMC. This also explains the energy distribution present in India with the recent technology includes smart grid, SCADA ...etc. Additionally it tells about the POSOCO with PGCIL and the improvement in the power system by implementing the smart grid very effectively in India.

Index Terms- OECD – Organization for Economic Co-Operation and development, TWh-Terawatt-hour, ckm–circuit kilometers, O&M-Operation and maintenance.

I. INTRODUCTION

Electrical Energy is the basic economic development of a country. Energy exists in different forms in nature but the most important form is the Electrical energy. In this modern society use of electrical energy has become a part and parcel of our life.

An electric power system is a network of electrical components used to generate, supply (distribute), transfer (transmit) and use electrical energy. Here grid plays an important role in supplying uninterrupted supply to all the regions in our country. Grid interconnects all the five regions of our country and now it has been made into one grid, one nation, and one frequency in India.

Though we generate only 11KV from the generating side it is not sufficient to transmit the power. So we go for transmission where increasing of high voltages in HVAC, HVDC transmission system. Then we distribute the power to the consumer's by reducing the voltage levels. Recently the generation of power is increased drastically India using coal and wind energy. In transmission we go for high voltage transmission to reduce loss i.e., I^2R losses and corona. The transmission of high voltage exists in India is till 765KV transmission. This transmission made very sophistication by introducing the SCADA systems into the transmission system. The SCADA system makes the man work more easier way where in control room only two PC

are present where the all available data's are feed into it. In few years, there is a vast development in the generation and transmission of energy in India.

II. ENERGY PRODUCTION

The energy is produce from the generating stations using the available resources either renewable or non-renewable sources. The world's total production of electrical energy is 23,536,500 GWh* till 2014*. In this India stands third largest electricity production in the world. It produces about 1,208,400 GWh* till 2014*.

The following table represents the top 20 electricity producing countries 2014*/2015*.

Rank	Country/Region	Electricity production (GWh)	Date of information
N/A	World Total	23,536,500	2014 ^{[1][2]}
N/A	European Union	3,166,000	2014 ^[1]
1	China	5,810,500	2015 ^[3]
2	United States	4,297,300	2014 ^[1]
3	India	1,208,400	2014 ^[1]
4	Russia	1,064,100	2014 ^[1]
5	Japan	1,061,200	2014 ^[1]
6	Canada	615,400	2014 ^[1]
7	Germany	614,000	2014 ^[1]
8	Brazil	582,600	2014 ^[1]
9	France	555,700	2014 ^[1]
10	South Korea	517,600	2014 ^[1]
11	United Kingdom	356,600	2013 ^[2]
12	Mexico	293,600	2013 ^[2]
13	Saudi Arabia	292,200	2013 ^[2]
14	Italy	288,400	2013 ^[2]
15	Spain	285,300	2013 ^[2]
16	Turkey	264,100	2015 ^[4]
17	Iran	263,400	2013 ^[2]
18	South Africa	256,100	2013 ^[2]
19	Taiwan	252,000	2013 ^[2]
20	Australia	244,600	2013 ^[2]

Electricity 2015 in review- World electricity generation grew by 0.9% in 2015, slightly below the growth of primary energy (1.0%) Growth was down on 2014 (2.4%) and remained well below the 10-year trend (2.8%). OECD electricity grew by 0.2%, after four consecutive years of declining generation. Non-OECD electricity generation grew by 1.4%, significantly slower than 2014 (4.9%) and well below the 10-year trend (5.5%). The slowdown was most marked in China, the world's largest electricity generator, with growth of just 0.3% in 2015, compared to 6.7% in 2014. The world's second largest generator, the US, posted a decline of 0.1%, and North America was the only region to show a decline in electricity generation (-0.1%). India, the third-largest generator, grew by 4.1% to record the largest volumetric growth in generation.

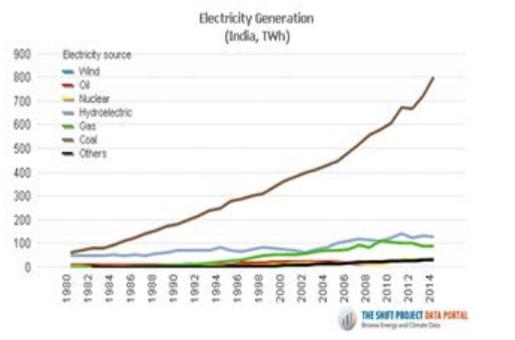
Growth was slightly up on 2012 (2.2%) but remained below the 10-year trend (3.3%) faster than 2013 (4.3%) but well below the 10-year trend (6.3%). Electricity generation grew in all regions except Europe & Eurasia, where it declined by 1.6%. China (+4.0%) and the US (+0.7%) remain the largest and second largest electricity generators, India (+9.6%) is third while

Russia (+0.5) overtook Japan (-2.4%) in 2014 to take fourth place.

Electricity generation in India:

There are various renewable and non-renewable resources present in India. They are wind, oil, nuclear, Hydroelectric, Gas, Coal...etc. In the last decade there is an increase in the generation of electricity using coal as a source and next wind energy falls the second in its generation followed by the gas.

The following graph represents the statistical data of electricity generation,

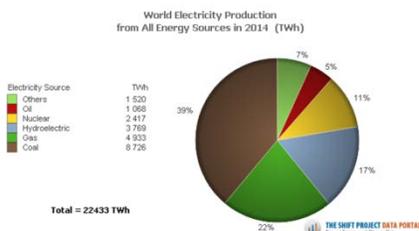


Production and sources of the top 20 countries in the world,

Country	Electricity production (TWh)	% Coal	% Natural gas	% Oil	% Hydropower	% Other renewable	% Nuclear power
Argentina	129.6	2.5	51.4	15.1	24.4	1.7	4.9
Australia	252.6	68.6	19.7	1.6	6.6	3.5	0
Austria	62.2	11.8	19.9	1.6	55	10.7	0
Canada	636.9	12	9.8	1	59	3.3	14.7
Chile	65.7	29.9	20.9	9.7	32	7.6	0
China	4,715.7	79	1.8	0.2	14.8	2.2	1.8
Hong Kong SAR, China	39	71.2	28.5	0.3	0	0	0
Denmark	35.2	39.7	16.5	1.3	0	40.2	0
Egypt	156.6	0	74.7	15.8	8.3	1.3	0
Finland	73.5	14	12.9	0.6	16.9	15.9	31.6
France	556.9	3.1	4.8	0.6	8	3.6	79.4
Germany	602.4	45.1	13.9	1.1	2.9	17.6	17.9
Iceland	17.2	0	0	0	72.7	27.3	0
India	1,052.3	67.9	10.3	1.2	12.4	5	3.2
Indonesia	182.4	44.4	20.3	23.2	6.8	5.2	0
Iran	239.7	0.2	66.6	27.6	5	0.1	0.1
Iraq	54.2	0	62.1	12.9	7.6	0	0
Israel	59.6	59	33.1	7.3	0	0.4	0
Italy	300.6	16.7	48.1	6.6	15.2	12.4	0
Japan	1,042.7	27	35.9	10.1	8	4.2	9.8

Here from the above table we can see that India places 14th among source available countries which produces 1,052.3TWh of electricity. The sources available in India are 67.9% of coal, 10.3% of Natural gas, 1.2% of oil, 12.4% of Hydropower, 5% of other renewable sources.

The following chart represents the world electricity production from all energy sources (TWh) in 2014



Energy transmission:

Electric power transmission is the bulk movement of electrical energy from a generating site, such as a power plant, to an electrical substation. Electricity is a concurrent subject in India i.e., both the central and state governments

are responsible for the development of the electricity sector. NTPC, NHPC, THDC, NEEPCO, SJVNL, NLC etc. are the central generation utilities and POWERGRID is the Central Transmission Utility. At the State level, there are Gencos and Transco in the respective States. The country has been demarcated into five electrical Regions viz. Northern (NR),

Eastern (ER), Western (WR), Southern (SR) and North Eastern (NER). However, NR, ER, WR and NER have been synchronously interconnected and operating as singlegrid – Central Grid (capacity about 110,000MW). The Southern region is asynchronously connected to the Central Grid through HVDC links.

The backbone transmission system in India is mainly through 400 kV AC network with approximately 90,000 circuit kilometers (ckm. (=2xroute km)) Of line length. Highest transmission voltage level is 765kV with line length of approximately 3120 ckm. There are about 7,200 ckm of 400 kV systems, 5500 MW, +/- 500 kV long distance HVDC systems, an HVDC Monopole of 200 MW and four HVDC Back-to-Back links of 3000MW capacity. These are supported by about 1,23,000 ckm. of 220kV transmission network. As mentioned above, all the five regions are interconnected through National Grid comprising hybrid AC/HVDC system. Present inter-regional transmission capacity of the National Grid is about 20,800 MW.

Transmission System Development Issues

As mentioned above, in order to meet growing requirement, development of strongtransmission system between pit-head/resource generation complex and bulkconsumption centers are required. However, development of transmission systeminvolves following issues:

- Minimization of Right of Way
- Protection of flora & fauna, wild life
- Creation of long distance high capacity transmission corridors to enableminimum cost per MW transfer as well as Optimal Transmission losses
- Minimal Impact on Environment
- Strengthening of National Grid

Future Plan in Transmission:

In order to address above issues, high capacity transmission corridors comprising765kV AC and ±800kV 6000MW HVDC system along with 400kV AC and±500kV/600kV 2500Mw/6000MW have been planned to facilitate transfer of powerfrom remotely located generation complexes to bulk load centers.

Transmission Lines	Addition by 2012 (Ckm)	Addition by 2017 (Ckm)
765 kV	7,612	25000-30000
HVDC Bipole	11,078	4000 - 6000
400 kV	1,25,000	50000
220 kV	1,50,000	40000
Total	2,93,852	119,000 – 126,000
Substations	Addition by 2012	Addition by 2017
HVDC	14,700 MW	16,000 -22,000 MW
765 kV	53,000 MVA	1,10,000 MVA
400kV	1,45,000 MVA	80,000 MVA
220 kV	2,30,000 MVA	95,000 MVA
Total Capacity	4,28,000MVA	2,85,000MVA
Inter Regional Transfer Capacity	38,000 MW	75,000 MW

Increase in voltage:

In order to optimize right-of-way, high density transmission corridors (MW per meterROW) either by increasing voltage level or current order or both i.e. increase involtage and current are need to be developed.

Power intensity at different voltageLevel is tabulated in Tablebelow:

High Density Transmission Corridor:

Voltage	132 kV	220 kV	400 kV	765 kV	+500 kV	+800 kV (approx.)	1200 kV (approx.)
ROW Meters(M)	27	35	46	64	52	70	90
Capacity (MW)	Upto 70-80	Upto 160-170	Upto 600-700	Upto 2500-3000	Upto 2000-2500	Upto 6000-6400	Upto 6000-8000
MW/m	3	5	15	45	48	90	90

Towards development of high intensitytransmission corridor, there is a plan to develop ± 800 kV, 6000 MW HVDC system asa part of evacuation of bulk power from North Eastern Region (NER) to NorthernRegion (NR) over a distance of around 2000 kms. In addition, increasing the ACvoltage level at 1200kV level has been planned. It is to mention that we are aimingtowards use of 1100kV equipment’s for 1200kV operation by optimizing their protectivelevel with the help of high energy level Surge arrester so as to achieve economy in respect of 1200kV UHV system development. Research work for 1000kV HVDCsystem has also been commenced.

Upgradation of transmission line:

POWERGRID has successfully implemented upgrading of 220kV D/C KishenpurKishtwarline in J&K to 400 kV S/c first time in India. It has resulted in increase ofpower transfer intensity of the transmission corridor with marginal increase in ROW(from 35m to 37m) but far less than standard 400kV line (46 m). Upgradation of 400kVD/C lines to 400/±500kV HVDC bipoles are also under exploration.

Upgradation of HVDC Terminal:

POWERGRID has been seamlessly upgraded ±500kV Talcher(ER) – Kolar(SR)HVDC terminal from 2000MW to 2500MW without changing of any equipment. Thathas been achieved with enhanced cooling of transformer and smoothing reactor withmeager cost. The payback period is about 2-3 years.

1200kV Test Station:

In order to increase the power density of the corridor, development of 1200kV ACsystem as next higher AC voltage level has been decided. However, 1200kV ACtechnology is relatively a new one in the world. Therefore, to develop this technologyindigenously, a unique effort has been made by POWERGRID through a collaborativeresearch between POWERGRID and Indian manufacturers to establish a 1200kV

UHVAC Test Station. This endeavor shall benefit the Indian Power sector andmanufacturers as availability of 1200KV class equipment within country will not onlyenable optimization of transmission cost, but also help in during O&M phase. In this direction, POWERGRID along with Indian manufacturers is establishing a 1200kVUHVAC Test Station at Binalin the State of M.P) where a 1200KV test line (S/c+D/c) isbeing constructed along with two nos. 1200KV test bays in which the leadingmanufacturers are providing main equipment like transformers, surge arresters, circuitbreakers, CTs, CVTs and transmission line hardware etc. POWERGRID shall provide

Space, civil foundation, 1200kV line, control & protection system, various testingequipment, auxiliaries & fire protection system, 1200kV bushing etc. These test baysand test line shall be used by the manufacturers and POWERGRID for various fieldtests so that the results and feedback can be used for developing field provenequipment of 1200kV system in India as well as gain initial operational experience.Development of this test station is in advance stage and likely to be commissioned by 2010.

Investment in Transmission:

The Estimated total fund requirement for transmission by 12th Plan i.e. 2016-17 hasbeen assessed as USD 42 Billion.

Inter-State Sector	USD 21 Billion
State Sector	USD 21 Billion

NATIONAL TRANSMISSION ASSET MANAGEMENT CENTRE (NTAMC)

i. The emphasis on the power sector to ensure the growth in GDP has brought in many changes in the business environment of Power Sector. The transmission sector being the integral part of is also facing multiple challenges like competitive bidding for transmission project, lack of experienced manpower, stringent demands by the regulator etc.

ii. The technological development couple with falling prices of communication system and information technology provides us the opportunity for virtual manning of Substation thereby optimizing the requirement of skilled manpower and managing the asset with the available skilled workforce.

iii. Thus, state of the art computerized control centers NTAMC & RTAMC with associated telecommunication system and adapted substation for enabling remote centralized operation, monitoring and control of POWERGRID Transmission system has been proposed.

iv. The aim is to have completely unmanned substation except security personnel. The operations of the substations will be done from a remote centralized location i.e. NTAMC. The RTAMC will co-ordinate the maintenance aspect of the substation from a centralized location and will act as a backup to the NTAMC for operation. The maintenance activities would be carried out by maintenance service hub (MSH). One MSH will cater to the requirements of 3-4 substations in its vicinity in coordination with the respective RTAMCs.



v. The substations and various control centers will be connected by redundant broadband communication network through POWERGRID (Telecom) communication links.

vi. Telecom Department to provide high speed communication links between NTAMC, RTAMCs and Substations.

vii. The Connectivity Status has been finalized in association with LD&C department and NTAMC group. More links have to be planned by LD&C for total protection. Bandwidth requirement and Connectivity Scheme finalized. At stations where this connectivity is not possible, leased lines will be hired from other telecom operators up to the nearest connection point.

viii. Total 192 Substation connectivity will be planned in 2 phases.

* Phase-I 120 Sub Stations

* Phase-II 72 Sub Stations

POSOCO:

Power System Operation Corporation Limited (POSOCO) is a wholly owned subsidiary of Power Grid Corporation of India Limited (PGCIL). It was formed in March 2010 to handle the power management functions of PGCIL. It is responsible to ensure the integrated operation of the Grid in a reliable, efficient and secure manner. It consists of 5 Regional Load Dispatch Centers and a National Load Dispatch Centre (NLDC). The subsidiary may eventually be made a separate company, leaving the parent firm with only the task of setting up

transmission links. The load dispatch functions, earlier handled by PGCIL, will now come up to POSOCO.

They maintain 99.9% of online without interruption of power supply to the grid, even at worse cases.

POSOCO mainly comprises -

*National Load Despatch Centre (NLDC)

*Five Regional Load Despatch Centre

*Northern Regional Load Despatch Centre (NRLDC)

*Western Regional Load Despatch Centre (WRLDC)

*Eastern Regional Load Despatch Centre (ERLDC)

*Southern Regional Load Despatch Centre (SRLDC)

*North-Eastern Regional Load Despatch Centre (NERLDC)

POWER GRID transmission network failure:

The Northern Region Grid, which provides power to nine states in northern India including Delhi, experienced a widespread outage due to a grid disturbance that occurred at about 2.35 a.m. on 30 July 2012.

Restoration work started immediately under the direction of CEO, POSOCO and POWERGRID's Chairman & Managing Director. A team of engineers tried to find out a way for restoring the normal supply of power immediately, so that railways, Metro, airports and other power users deemed essential could get immediate restoration of electricity. With the coordinated efforts of the whole team of engineers and constituent state utilities, power supply to the essential services and other essential loads in northern India was restored by about 8.00 a.m. and about 60% of load of the Northern Region was restored by 11:00 a.m. This was possible by gearing up the power supply from hydroelectric sources and also extending power from the Eastern and Western regions for start-up supply for thermal generating units of the Northern Region. Thus the associated problems for want of power supply could be partially overcome by this time. Later, power supply was restored progressively and by 12:30 p.m. power was extended to most of the cities and towns through POWERGRID substations. The Northern Grid was brought back to normalcy to meet the demand of about 30 GW at 7:00 p.m.

On 31 July 2012, the northern grid collapsed for a second time, hours after the power supply was restored in the entire northern region following a disruption on the previous day. The eastern transmission lines also failed, disrupting power supply in Delhi, Uttar Pradesh, Haryana, West Bengal, Assam and Punjab, among other states.

Energy distribution:

An electric power distribution system is the final stage in the [delivery of electric power](#); it carries electricity from the [transmission system](#) to individual consumers. Distribution substations connect to the [transmission system](#) and lower the transmission voltage to medium [voltage](#) ranging between 2 [kV](#) and 35 kV with the use of [transformers](#).

Primary distribution lines carry this medium voltage power to [distribution transformers](#) located near the customer's premises. Distribution transformers again lower the voltage to the [utilization voltage](#) of household appliances and typically feed several customers through secondary distribution lines at this voltage. Commercial and residential customers are connected to the secondary distribution lines through [service drops](#). Customers

demanding a much larger amount of power may be connected directly to the primary distribution level or the [sub transmission](#) level.

Overview of the Existing System:

The distribution segment continues to carry electricity from the point where transmission leaves off, that is, at the 66/33 kV level. The standard voltages on the distribution side are therefore 66kV, 33 kV, 22 kV, 11 kV and 400/230 volts, besides 6.6 kV, 3.3 kV and 2.2 kV. Depending upon the quantum of power and the distance involved, lines of appropriate voltages are laid. The main distribution equipment comprises HT and LT lines, transformers, substations, switchgears, capacitors, conductors and meters. HT lines supply electricity to industrial consumers while LT lines carry it to residential and commercial consumers.

State-Of-The-Art SCADA/EMS System:

SCADA system which is the sensory organ of grid operator measures vital system variables through RTU (Remote terminal Unit) or SAS (Substation automation system) installed at all the important locations in the grid. The recorded data is transmitted through modern communication channels and displayed in the operator consoles in load dispatch centers. It provides real time control and monitoring of energy management facilities to optimize system reliability, load dispatch, voltage control, system restoration, switching operations, planned maintenance outage, data recording, load flow, analyses of existing & future system conditions and thereby optimize operation to each constituent in particular and the Region as a whole.

Effective visualization techniques and tools are used to empower the system operator in facilitating quick response under critical conditions. Techniques used by the Indian grid operators are Tabular presentation, Bus Diagrams, Flow gate Illustration, Control Area – Tie Line Representation, Geographical Displays, Contouring, Three Dimensional Representations, and Animation.

Smart Grid:

The complexity of Grid is increasing continuously due to Growing number of interconnections within and across the regions. The real time information available today through conventional SCADA/EMS system is limited to analog and status data from the remote terminal units. Information, such as indications of protective control actions, event/fault records, device settings are not available. System dynamics are not taken in real time evaluations. Emergency controls such as load shedding do not consider system-wide conditions. Protective relay settings are static – no intelligence is embedded to allow adaptation to the changing system conditions

To take care of above complexities and to ensure safe, secure and reliable operation of large interconnected Indian Grid, system operation in future would be equipped with an

Intelligent/Smart Grid with placement of Phasor Measurement Unit, Wide Area Monitoring, Self-Healing, and adaptive islanding features etc. with an intent to quickly evaluate system vulnerability with respect to cascaded events involving faults, device malfunctions and provide remedial action.

Initiatives have been taken to implement Smart Grid pilot projects for grid security of Indian grid.

(a) Implementation of Pilot project for installation of PMUs (Phasor Measurement Units) in Northern Region

(b) Implementation of CSIR approved Project “Intelligent Monitoring & Control of the Interconnected Electric Power Grid using WAMS.

To keep track of new technology & development POWERGRID is also a member of International group VLPGO (Very Large Power Grid Operators) with other international utilities. VLPGO is a common platform where worldwide large Grid Operators come together for mutual benefit, sharing common problems and solution.

III. CONCLUSION

The regulatory environment is steadily moving towards increasing competition in the electricity market allowing several new players in addition to traditional utilities and independent power producers such as captive power producers, merchant power producers, renewable energy generators, etc., on the one hand and customers requiring access to the grid on a non-discriminatory basis on the other. With full open access in the distribution segment, the consumer will no longer be captive to one discom but will have greater choice in getting power from any of the new entities connected to the grid. If the smart grids are implemented very effectively in India, it will be very useful to meet out the power demands. The regulatory environment too has now become stable with multi-year tariffs becoming a norm in states.

REFERENCES

- [1] https://en.wikipedia.org/wiki/List_of_countries_by_electricity_production#cite_note-BP2015-1
- [2] <http://worldknowing.com/top-10-largest-electricity-consumption-country-in-the-world/>
- [3] <http://www.tsp-data-portal.org/Historical-Electricity-Generation-Statistics#tspQvChart>
- [4] <http://www.tsp-data-portal.org/Breakdown-of-Electricity-Generation-by-Energy->
- [5] <http://worldknowing.com/top-10-highest-electricity-consumption-per-capita-country-in-the-world/>
- [6] <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=4201301&isnumber=4201292>
- [7] <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7282390&isnumber=7282219>
- [8] <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7516515&isnumber=7516363>
- [9] <http://www.npti.in/Download/Transmission/World%20Energy%20Council%20Report%20on%20T&D%20in%20India.pdf>
- [10] IEEE Power Engineering Society
- [11] IEEE Power Engineering Society Distribution Subcommittee
- [12] U.S. Department of Energy Electric Distribution website
- [13] <http://www.electrical4u.com/electrical-power-transmission-system-and-network/>
- [14] <http://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-electricity.pdf>
- [15] <https://data.gov.in/keywords/power-generation>
- [16] <http://www.power-eng.com/articles/print/volume-116/issue-9/features/mega-trends-in-power-generation.html>
- [17] Principles of power system- V.K.Mehta, Rohit Mehta.

[18] <http://www.ece.ncsu.edu/netwis/papers/13wl-comnet.pdf>

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Description of Mughal Tents as a Temporary Capital

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I. INTRODUCTION

The Mughals grandeur has been affirmatively accepted by contemporary historians of all the time. This was expressed in both private as well as in their public life. In order to run the administration efficiently, it was necessary to keep a vigil eyeing on the public affairs, for this the Mughal emperors used to travel long distances. The estimated journey they travelled with their large camps was about 16 km per day. And at the end of the day, they rested in the place like tents, though temporary. Mughal emperors spent nearly forty percent of their time in the camps while on tours and the duration of such tours often lasting a year or longer. One occasion Emperor Jahangir was away from his capital Agra for 5 years and 7 months.¹ The political relevance of Mughal imperial cities continued to be very limited; it was physical mobility which remained at the centre of Mughal imperial court life and, for much of the Mughal period, the imperial court was encapsulated in the physical presence of the king. Mughals introduced the several aspects of Central Asian culture to India. Monika Gronke argued that the mobility of Timur's court, and that of his immediate successors, can be attributed to their ancestry and even be considered a 'transitional phase' between true nomadism and the sedentary life.²

The journey was travelled in intervals. Mughals followed different traditions of Persia. Among these, we can see their following in gardens and large and beautiful tents also. The Persian texts such as Epic of Gilgamesh, the Enuma Elish, the Code of Hammurabi, Zoroastrian texts (e.g. Vendidad and Yasna), and the Book of Genesis do not directly discuss the pavilion structure in gardens, they clearly reflect the development of the prevailing cultural view on gardens in the region. The English word pavilion is used here as a cover term for a variety of terms used in Persian literature and historical documents. For example, in Persian the following terms have been used to describe a pavilion in a natural setting: *kushk*, *emarat*, *khaneh*, *qasr*, *talar*, *kakh*, *Khaimeh*, *sardaq*, and *khargah*. Depending on the context, these words refer to the use of the pavilions as kiosks, palaces, houses, or simply as places for relaxation. While some of these terms (*emarat*, *khaneh*, *qasr*, *moshkuy*, *sarai*, *shabistan*, *tagh*, *iwān*, and *kakh*) refer to the pavilion as a permanent structure, the other terms (*kushk*, *khaimeh*, *sardaq*, and *khargah*) refer to temporary structures in

gardens.³ In contrast to the discussed terms for pavilions, all of which refer to permanent structures, *khaimeh*, *khargah*, and *sardagh*, refer to tents with different sizes. In contrast to *khaimeh*, which is quite simple and easy to erect, *khargah* and *sardagh* refer to huge and complex tents which may even contain smaller tents inside them.⁴ The mobile nature of pavilion has been so dominant that its equal term in Persian, *paloon*, means "packsaddle."⁵ A perfect pavilion should be huge in height.

We can imagine the difficulty of carrying all these tents and the court's furniture between gardens. This phenomenon is observed by Anthony Jenkinson (1529–1610/1611 AD), the British traveller who records his observations of a mobile ordu (a camp) in Central Asia in the 16th century: "by estimation about a thousand camels drawing of carts with houses upon them like tents, of a strange fashion, seeming to be far from a town."⁶ Clavijo, whose notes clarify the social life in tents, tent structure and ornamentation, and even their placement in gardens, records his observations of the Timurid encampments outside the city of Nishapur.⁷

The Mughals were exceedingly partial to camp life and therefore a good deal of time was spent in travel. The Mughal camp was like a moving city.⁸ When the king travels in the military pomp he has always two private camps; one of these campus being a day advance of the other, the king is sure to find at the end of journey a camp fully prepared for his reception. It is for this reason that these separate bodies of tents are called *piche-kanesor* houses which proceed. During the march a camel with white cloths preceded the king, so as to cover over any dead animal or

³ Mohammad Gharipour, *pavilion Structure in Persian-ate Gardens, Reflections in The Textual and Visual Media*, May 2009, Thesis from Georgia Institute of Technology, p.51.

⁴ Mohammad Gharipour, *pavilion Structure in Persian-ate Gardens, Reflections in The Textual and Visual Media*, May 2009, Thesis from Georgia Institute of Technology, p.53.

⁵ *Dehkhoda Encyclopedia of Persian Language* (electronic version)

⁶ Anthony Jenkinson, *Early Voyages and Travels to Russia and Persia*, edited by Edward Delmar Morgan and Charles Henry Coote, The Hakluyt Society, 1886, p.55

⁷ Clavijo, Ruy González de. *Narrative of the Embassy of Ruy Gonzalez de Clavijo to the Court of Timour*, translated by Clements Robert Markham, London: Hakluyt Society, 1859, p.107.

⁸ H.K.Naqvi, *History of Mughal Government and Administration*, Delhi, 1990, p.57.

¹ Lisa Balabanlilar, *The Emperor Jahangir and the Pursuit of Pleasure*, Journal of the Royal Asiatic Society, Third Series, Vol. 19, No. 2, April 2009, p. 178.

² Monika Gronke, *The Persian Court Between Palace and Tent: From Timur to 'Abbas I, Timurid Art and Culture*, ed. by Lisa Golombek and Maria Subtelney, Leiden, 1992 pp. 18-22

human being found on the road⁹ and water carriers ran in front sprinkling the road to prevent the dust from rising.¹⁰ The transport needed for one camp to move is more than sixty elephants, two hundred camels, one hundred mules and one hundred men porters. The heavenly tents with their heavy poles were carried by elephants. The larger tents were made of timber and in fact were portable buildings. The smaller tents are borne by camels and the luggage and kitchen utensils by the mules. Porters were responsible for safe carriage of valuable articles like porcelain, the painted and gilt beds and *karguais* (folding tents, some with one, others with two doors and made in various ways).¹¹

As soon as *thepeiche* - *kane* reach the new place for encampment, the Grand Quarter Master with other engineers selects the appropriate site where the royal tents were to be unloaded. The camp is divided in such a way that on arrival of the army there may be no confusion.¹² He then marked a square on which tent was to be pitched. The whole square is then encompassed with *kanates* or screens, seven or eight feet in height, secured by cords attached to pegs and by poles fixed two by two in the ground. These *kanates* were made of strong cloth with printed Indian calico representing large vases of flowers. The spacious royal entrance in one of the sides of square is of much finer texture richer than rest.¹³

The first and largest tent erected in the camp is named as *Am-kas* for king and the nobles, where they assemble for deliberation on state affairs and for administering justice, but the tents of Rajahs and nobles must not be so high as that of king; otherwise their tent would be knocked down¹⁴. The second tent, little inferior in size is called *gosle-kane* or the place for bathing. It is here that the nobles meet the king at evening. Still deeper in the square is the third tent called *Kaluet - kane* (place of Privy Council) smaller than the above two tents. To this tent none but the principal ministers of state have access.¹⁵

Beyond the *kaluet-kane* there are Kings private tents surrounded by small *kanates* of the height of man, painted over with flowers of hundred different kinds. Adjoining the royal tents are those of the princesses and principal female attendants of seraglio. In the midst of them are the tents of inferior female domestics, generally placed in order according to their occupation.¹⁶ On the

top of very high mast was alighted lantern, which served as a guide to those who arrived late at night.¹⁷

The principal tents including *Am-kas* were elevated above the rest so that they may be distinguished at a distance. The outsider is covered with strong coarse red cloth and variegated stripes; but the inside is ornamented with brocade and velvet and lined with beautiful hand painted chintz. Thick Cotton mats were spread over the whole of floor and these again are covered with splendid carpets, on which are placed large square brocade cushions to lean upon.¹⁸

Two tents were most pompously adorned where stages were built, used by the king and nobles for deliberation and the king gives audience under a spacious canopy of velvet. The other tents also contain *karguais* or cabinets, the little door of which was secured with silver padlocks.¹⁹

On either side of the royal gate usually on the eastern end, there were two handsome tents, holding each nine choicest horses, saddled for different purposes. Besides the stirrup artillery is composed which fire a salute when the king enters into the camp.²⁰ On the front gate, on its extremity was a tent called *Nagar-kane* (*Nakarah* a drum and *khanaha* room, it was a monster kettledrum four feet high resting on the ground and played upon by one man with a pair of sticks).²¹ Close to this tent is another large size, called *chauki-khanah*, where the nobles in rotation mount guard for twenty - four hours, once every week. Most of them, pitch their tents in its vicinity to get more ease and privacy.²²

The other three sides of large square of camp were covered by tents used for arms of king, rich harnesses, and vest of brocades, fruits, sweetmeats and Ganges water. There were fifteen or sixteen other tents which serve for kitchens and in the midst of all these are the tents of great number of officers and eunuchs. Six other tents of large size were for horses and other tents for elephants and animals for hunting; for the birds of prey that accompany the court; for the dogs; the leopards for catching antelopes.²³

It was the duty of Quarter Master to mark out the royal bazars, from which all the troops were supplied the necessities. The principal bazaar is laid out in the form of Wide Street with the tents belonging to the followers of the army who offer their subsistence, running through the whole extent of the army. A pole is planted at both ends of bazars and distinguished by a particular standard. It was a matter of privilege that the red colour was exclusively for royal tents and as a mark of respect all tents has to front the *Am-kas*.²⁴ Nobles provide watchmen to

⁹ Niccolao Manucci, *Storia Do Mogor*, tr. William Irvine, Calcutta, 1965, Vol, 1, p. 65.

¹⁰ H.K.Naqvi, *History of Mughal Government and Administration*, Delhi, 1990, p.58.

¹¹ Francious Bernier *Travels in the Mughal Empire 1656-58* Westminster London, 1891, p.359.

¹² Niccolao Manucci, *Storia Do Mogor*, tr. William Irvine, Calcutta, 1965, Vol, 1, p. 67.

¹³ Francious Bernier *Travels in the Mughal Empire 1656-58* Westminster London, 1891, p.360.

¹⁴ Niccolao Manucci, *Storia Do Mogor*, tr. William Irvine, Calcutta, 1965, Vol, 1, p. 68.

¹⁵ Francious Bernier *Travels in the Mughal Empire 1656-58* Westminster London, 1891, p.361.

¹⁶ Ibid.

¹⁷ Niccolao Manucci, *Storia Do Mogor*, tr. William Irvine, Calcutta, 1965, Vol, 1, p. 68.

¹⁸ Francious Bernier *Travels in the Mughal Empire 1656-58* Westminster London, 1891, p.362.

¹⁹ Ibid.

²⁰ Ibid, p.363.

²¹ Ibid, p.362.

²² Ibid, p. 363.

²³ Ibid, p. 364.

²⁴ Ibid, p.366.

prevent robberies that keep crying *outkhaber-dar* or have a care all the night.²⁵

During the march the king was attended by eight mules carrying small tents for king's desire to rest or to eat a little something.²⁶ Each soldier seems to have had the shelter of a tent, even if it consisted only of a cotton cloth raised on two sticks. The kinds of tents were numerous, from the small, a mere low awning, up to the huge imperial tents. The *Ain-i-Akbari*, i, 54, names twelve different kinds of tents. I have just spoken of one of these, the *Uautl*, and of another, the *Gulallbar*, not a tent but an enclosure. The *sarapardah* was also a screen and not a tent. The *Shamiyanah* is still known and in common use in India; the name may be from sham, evening, that is an awning for use in the evening, or from *shamah* (Steingass, 725), a veil. The *khangah*, are spoken of by Bernier, where he says they were folding tents with one or two doors, and made in various ways; he calls them "cabinets", and leads us to infer that they were set up inside the large tents. The emperor and the great nobles were provided with tents in duplicate, one set being sent on to the next camping ground while the other set was in use.²⁷ The tents thus sent on were known as the *peshkhanah* (literally "advance-house").²⁸ Some of the tents were of an enormous size. There was one made by order of Shah Jahan which bore the name of *Dil'badil* (Generous Heart).²⁹ Similar type of tent was ordered by Bahadur Shah to be erected at Lahore in the year 1711, five hundred tent-pitchers and carpenters were employed for one month in putting it up, and in so doing several persons got killed. The total expenditure spent on it was about 50,000 rupees. A later writer Seir, says the emperor's camp was about one and a quarter miles in circuit, it contained one hundred and twenty tents, some of them big enough for several hundreds of men, and the largest might admit two thousand or three thousand.³⁰ The tents of the emperor, his sons, and grandsons were of a red cloth, called *kharwah*, a stout canvas-like cotton cloth, dyed red with the root of the *al* plant. Round the emperor's tents was the enclosure called the *gulalbar* (The name of screen which Bernier speaks of as being put up round the emperor's tent. *Gulal* in hindi means "red" and bar, "anything in the nature of a wall which prevents entrance or passage through it" Before Akbar's time the tents of the Gurgani kings were surrounded by a rope called the *tanab-i-quruq* (the rope of hindrance). Some of the great nobles such as the vice gerent (*loahl-i-mutlaq*) or the, chief minister (*Jamdat-ulumulk*) were allowed *patapati* or striped tents, one red stripe and one white stripe alternately. Outside the imperial tent, a ditch was dug, and red flags, attribute of sovereignty, were displayed on poles.

²⁵ Ibid, p.369.

²⁶ Niccolao Manucci, *Storia Do Mogor*, tr. William Irvine, Calcutta, 1965, Vol, 1, p. 62.

²⁷ Francious Bernier *Travels in the Mughal Empire 1656-58* Westminster London, 1891, p.359.

²⁸ William Irvine, *The Army of the Indian Mughals: Its Organization and Administration*, London, 1903, p.195.

²⁹ Ibid, p.198.

³⁰ Ibid, p.198.

Akbar demanded a Hindu Prince to dismantle his tents, which were of scarlet colour. He imposed on the prince the command that he should never again use scarlet tents and made it law that the Mughal kings and the princes of royal blood should only be allowed to use tents of scarlet colour.³¹ In 1607 Prince Khurram was granted the use of parasol (*aftabgir*) and red tent which was the special prerogative of royalty.³²

Aurangzeb moved his entire imperial court to south, nearly emptying Delhi and condemning the vast royal household to a lengthy exile from the (then) imperial Capital.³³ Aurangzeb and his royal court moved into a tent city, complete with bazaars, cantonments, administrative offices and imperial quarters, from which the empire was ruled for 26 years. Thus it appears that Mughals were much concerned about their luxury and power to rule with all offices, in any place of their empire.

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³¹ Niccolao Manucci, *Storia Do Mogor*, tr. William Irvine, Calcutta, 1965, Vol, 1, p. 134.

³² Inayat Khan, *Shah Jahan Nama*, tr. A.R. Fuller, ed. And completed W.E. Begley and Z.A. Desai, Delhi, 1990, p.5.

³³ Hamid ud-Din Bahadur, *Ahkam-i Alamgir*, tr. by Jadunath Sarkar as *Anecdotes of Aurangzeb*, (London, 1988) (1st and 2nd ed. 1925; 3rd 1949), p. 74.)

A Prospective Microbiological Study on Suppurative Corneal Ulcer at a Tertiary Teaching Hospital in Bhavnagar, Gujarat, India

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Abstract- It is important to study the epidemiological features and predisposing factors of suppurative corneal ulcers. Subsequently, it is also important to find out its causative microbial agents and their antimicrobial sensitivity-resistance patterns in a particular climate and culture of a particular region of a country. This prospective study was carried out on patients suffering from suppurative corneal ulcer to know the particular bacterial and fungal (not viruses) prevalence as a causative microbial agent for these suppurative corneal ulcers at a particular region of Gujarat and the distribution this disease among the people of different age, sex and occupational group in this region.

It is a prospective study on 112 patients suffering from suppurative corneal ulcers. All the patients are examined thoroughly by ophthalmologist on slitlamp biomicroscope. After proper clinical examination of every patient and before any treatment was initiated, the samples were taken from all the clinically suspected suppurative corneal ulcers, using standard technique, by swabs and scrapings under strict aseptic condition. The scraping procedure was performed using Bard Parker blade, under magnification of slitlamp microscope or operating microscope, after instillation of 2% lignocaine without preservative. The specimen material was scraped from the edge and the base of the ulcers.

The swabs were directly inoculated on to the surface of solid medias, such as blood, Mac Conkey and Sabourad, dextrose agar media. The scraping materials were used for preparation of smear for Gram stain and 10% KOH wet mount. The bacterial growths were identified by colony morphology, smear preparation from colony, followed by Gram stain and microscopy, followed by standard biochemical tests. The fungal growths were also identified by colony morphology, Gram stain for yeast and yeast like group of fungi and LPCB wet mount preparation for mycelial group of fungi. For diagnosis of fungi the help of biochemical and immunological tests was also taken. Out of total 112 specimens of suppurative corneal ulcers, only 76 specimens were found to be culture positive in which bacteria were isolated more frequently than fungi. The coagulase negative staphylococcus (CONS) were the most frequently isolated bacteria and the genus *Aspergillus* were the most frequently isolated fungi. All the bacterial isolates, not the fungi, were passed through antibiotic sensitivity testing (ABST) by Kirby-Bauer disk diffusion method. The incidences of suppurative corneal ulcers were higher in males than females. Patients between 40 to 50 Years of age group were most affected. Ocular

trauma, predisposing to suppurative corneal ulcer was identified as the major risk factor, compared to other predisposing factors. The epidemiology, the predisposing factors, the causative microbial agents and their antimicrobial pattern of suppurative corneal ulcer vary geographically. The CONS and the *Aspergillus* spp. were the most frequent isolates from suppurative corneal ulcer in our institution. The incidences were higher among rural population, especially among labourers who were constantly exposed to different types of vegetative and non-vegetative traumatic matters.

Index Terms- Suppurative corneal ulcer, CONS, *Aspergillus*, *Candida*, ABST, Kirby-Bauer.

I. INTRODUCTION

Corneal blindness is the second most common cause of blindness after cataract (non-operated) among the people of developing countries like India, Bangladesh, Pakistan, etc.^(1,2,3,7) The major cause of corneal blindness in developing countries is suppurative corneal ulcer, caused by trauma and other predisposing factors.⁽⁴⁾ The avascular cornea is particularly susceptible to bacterial and fungal infection leading to suppurative corneal ulcer. Most of the patients have poor clinical outcome, if aggressive and appropriate therapy is not promptly initiated.⁽⁵⁾ Because corneal infection by bacteria and fungi leading to suppurative corneal ulcer is an ocular emergency, where corneal infection rapidly progresses with the threat of vision loss and potential corneal perforation.⁽⁶⁾ The reported incidences of suppurative corneal ulcer in India is near about 1130 per one million of population.⁽⁸⁾

Next to suppurative corneal ulcer, the other causes of corneal blindness in developing countries are trachoma, vit A deficiency, onchocerciasis, etc.⁽⁹⁾ These were stood first before in previous decades, but their incidences are now in decline. These stood initially at 9.5%, but is now 7%.^(10,11) Corneal ulcer due to non-infective causes leading to non-suppurative corneal ulcers are prevalent in developed countries like USA, UK, Australia, etc. Among these non-infective causes vascular, allergic, corneal dystrophies, bullous keratopathy, etc. are common.

Corneal blindness following suppurative corneal ulcer is caused by opacity, due to formation of dense scar tissue in cornea after healing.^(12,13,14) Moreover, the dense scar tissue and opacity,

if does not cause total blindness, produces different grade of visual impairment, varying from mild to severe.⁽¹⁵⁾ Suppurative corneal ulcer following infection may even lead to enucleation resulting loss of an eye. Therefore, suppurative corneal ulcer leading to different grade of visual impairment and blindness is a major public health problem in the developing world. In South East Asia an estimated 12 million cases of suppurative corneal ulcer occur in each year and among them an unknown proportion of cases progresses to different grade of visual impairment, total blindness, and loss of an eye.⁽¹⁶⁾ This is more applicable among the rural population of developing countries those are often unable to access the appropriate treatment.⁽¹⁷⁾

Keratitis means inflammation of cornea. Infective keratitis means inflammation of cornea caused by infection due to any pathogenic microbial agent. When with this infection of cornea, there is production of pus, then this condition is called infective suppurative keratitis. Infective suppurative keratitis is always associated with corneal ulcer. So, suppurative corneal ulcer and infective suppurative keratitis are synonymous. The infection of cornea (infective keratitis) can be caused by bacteria, viruses, fungi, or parasites. Among these pathogens only bacteria, fungi, and parasites cause both the infection and production of pus.⁽¹⁸⁾ Viruses can cause infection of cornea (infective keratitis) and ulcer, but do not produce pus. So, viral keratitis should not be included in this study of suppurative corneal ulcer. Suppurative corneal ulcer (infective suppurative keratitis) is caused only by corneal infection due to bacteria, fungi and acanthamoeba parasite.⁽¹⁹⁾

In normal eyes, there are many defense mechanisms that protect cornea from infections. These defense mechanisms of cornea are: a) intact superficial squamous layer of corneal epithelium, b) tight junctions between the squamous cells of this superficial layer of corneal epithelium, c) continuous secretion of tear from lacrimal glands, d) presence of different enzymes and immune substances such as lysozymes, lactoferrin, ceruloplasmin, Ig A, etc in the tear, e) continuous blinking action of eye lids, etc.⁽²⁰⁾ There is also a continuous balance between the intensity of defense mechanisms and the virulence of microorganisms trying to invade the cornea. If due to any reasons, these defense mechanisms are impaired and the pathogenic organisms are managed to colonize the cornea, then the suppurative infection of cornea leading to suppurative corneal ulcer is developed.⁽²¹⁾

Moreover, the incidences and the pattern of pathogenic microorganisms, responsible for suppurative corneal ulcer are influenced by geographical distribution, occupation of population and climatic factors.⁽²⁰⁾ The incidences and the pattern of pathogens responsible for suppurative corneal ulcer can also substantially be varied between population living in rural and city areas. People living in rural areas are mainly exposed to agricultural and different other types of manual works. So, they are more prone to suppurative corneal ulcer, caused by bacteria and /or fungi due to trauma by both vegetative and non-vegetative matters.

Ocular trauma is a far more common predisposing factor for infective suppurative corneal ulcer in developing countries. Whereas, pre-existing different ocular diseases and contact lens, but not trauma, are common risk factors for developing suppurative corneal ulcer in developed countries.⁽²²⁾ Although,

bacteria or fungi as causative agent for suppurative corneal ulcer varies widely according to geographical area,⁽²⁰⁾ but the incidences of suppurative corneal ulcer caused by fungi have increased remarkably in recent years in different countries and /or at different region of a same country. This is due to the wide spread use of broad spectrum antibiotics and corticosteroids, increased use of contact lens, increased use of immunosuppressants for organ transplantation and anti-metabolites for cancer therapy, etc.

II. MATERIAL AND METHODS

A total of 112 patients who were suffering from clinically suspected suppurative corneal ulcer were included in this study, conducted in the microbiological department of Government Medical College at Bhavnagar. A standard request form was filled out for each patient, documenting all the socio-economic information and as well as all the clinical information, including mode of onset, duration of symptoms, predisposing (ocular) factors, associated systemic risk factors, and previous treatments, etc.

After filled up of request form and after taking extensive history, all the patients were examined carefully and extensively by standard clinical procedures by ophthalmologists. At first the visual acuity of each patient was measured and then all the patients were examined under slit lamp microscope. The size of each corneal ulcer was measured after staining with a sterile fluorescein paper strip, using a variable slit of slit lamp microscope and is recorded in millimetre. The picture of each corneal ulcer was also recorded with the help of a mobile slit lamp adapter and a camera.

In the similar way, the margin and the floor of each corneal ulcer, the size of stromal infiltration around the ulcer and the depth of each lesion were also recorded. Simultaneously, the thinning of cornea due to ulcer, any satellite lesion around the ulcer and any impacted foreign body in the ulcer were also observed. The presence or absence of any hypopyon with ulcers were also noted and recorded. Any associated other ocular conditions, predisposing to suppurative corneal ulcer, such as entropion, trichiasis, conjunctivitis, blepharitis, lagophthalmos, Bell's palsy, dry eyes, acute or chronic dacryocystitis, use of contact lens, bullous keratopathy, corneal anesthesia or ocular leprosy, etc. were also noted. The history of use of topical medications, including topical corticosteroids, were also taken.

After a detailed history and clinical examination, the effected eye was cleaned with sterile normal saline to remove any exudates and necrotic tissues. Then, as samples two corneal swabs and two corneal scrapings were collected from each ulcer by an ophthalmologist with all aseptic precautions. Corneal swabs were taken by rubbing the ulcerated area of cornea with sterile cotton swabs without instillation of any local anesthetic agent. Before rubbing, the sterile cotton swabs should be soaked with sterile normal saline.^(23,24)

Before taking any corneal scraping sample, the eye was next locally anesthetized by installing 2 to 3 drops of preservative free local anesthetic agent on the affected eye. 5 to 7 minutes after instillation of local anesthetic agent, two corneal scraping samples were taken by an ophthalmologist using a sterile Bard-Parker no. 15 scalpel blade, under magnification of

slit lamp microscope. The scraping materials were obtained from the margin and the floor of each corneal ulcer. Great care was taken, not to touch the eye lashes and the skin of eye lids to avoid contamination.^(23,24,25,26)

After taking samples in the form of swabs and scrapings, blood agar, chocolate agar, Mac- conkey agar media were inoculated from swabs for bacterial isolation, following the guide lines of CLSI (Clinical and Laboratory Standard Institute).⁽²⁷⁾ After inoculation all the cultured media plates were incubated at 37⁰centigrade for maximum up to 48 hours. Chocolate agar plates were incubated in candle extinction jar for 5 to 10% CO². All the inoculated and incubated media plates were evaluated after 24 and 48 hours of inoculation for any growth of bacterial colony. If there is no growth of colony, then these inoculated plates were discarded after 48 hours.^(23,24,25,26,28)

Bacterial cultures were considered positive, if the growth of same organism is demonstrated on two or more solid medias or there is semi confluent growth at the site of inoculation on one solid media associated with the identification of same organism with appropriate morphology and staining characteristics by Gram stain of direct corneal smear. All the bacterial isolates were identified by their colony morphology, preparation of smear from colony followed by Gram staining and microscopy, motility testing by hanging drop preparation, type of pigment production, and by the relevant biochemical tests in case of both Gram positive and Gram-negative organisms using CLSI guide lines.

All the bacterial isolates were tested for their antimicrobial sensitivity and resistance pattern by Kirby- Bauer disc diffusion technique against the commonly used ocular antibiotics according to CLSI recommended guide lines. The discs of antibiotic for sensitivity and resistance testing were obtained from Tulip (Micropress) Diagnostic (P) Ltd in our laboratory. The results of sensitivity-resistance tests of microorganisms to antibiotics were recorded as sensitive (S), intermediate (I), and resistant (R). Since till now, there is no available cut-off values for sensitivity-resistance tests against antimicrobial agents for corneal infections by Kirby-Bauer disc diffusion method, so the cut-off values applied for systemic bacterial infections were used according to the CLSI recommendation.⁽²⁹⁾

The samples obtained by corneal scrapings were used for isolation of fungi. The first sample of corneal scraping was used for KOH (10%) wet mount preparation. For KOH wet mount preparation, the samples from corneal scraping was smeared on a slide and 1-2 drops of 10% KOH was put on this specimen. Next, the specimen mixed with KOH was covered with cover slip and incubated at room temperature for 5 to 10 minutes. Then, the specimen was examined under 40X objective for budding yeast, pseudohyphae, hyphae, etc. If in KOH wet mount preparation, by microscopy hyphe was found in corneal smear, but failed to grow in culture, still then the causative organism was reported as fungus.⁽³⁰⁾

The second sample of corneal scraping was used for fungus culture. For fungus culture, one part of the second sample was spot inoculated on plain Sabouraud dextrose agar (SDA) media and another part was inoculated on SDA media with gentamycin and chloramphenicol antibiotic. Among these two medias, one was incubated at 25⁰ centigrade and another was incubated at 37⁰ centigrade. After incubation, the inoculated medias were observed daily for first 7 days and on alternate days for next 7

days as the fungi are slow growing. After 14 days all the inoculated plates for fungal isolation which had no growth, were discarded. Genus and species level identification of fungus was done by colony morphology, preparation of smear from colony followed by Gram stain and microscopy, wet mount preparation using LPCB, and different biochemical and immunological tests.^(31,32,33,34)

The second corneal swab sample was inoculated on one non-nutrient agar media, enriched with E. coli and was examined daily for the presence of acanthamoeba spp. The inoculated media were discarded at the end of three weeks, if there is no signs of growth of this parasite.^(35,36)

III. RESULTS

A total of 112 patients with the clinical diagnosis of suppurative corneal ulcer were enrolled in this present study. Among these total 112 patients, 65 (58.03%) patients were males and 47 (41.96%) patients were females. In both these male and female patients, suppurative corneal ulcers were prevalent most frequently in the age group between 40 to 60 years. The majority of patients were from rural areas. The number of patients coming from rural areas were 77 (68.75%) and from urban areas were 35 (31.25%). Majority of patients (81: 72.32% out of 112 pts) were manual workers, working in paddy fields in this region. Among these 112 patients, suffering from suppurative coneeal ulcer 110 (98.21%) patients had unilateral affections and only 2 (1.78%) patients had affection on both eyes. Out of these total 112 patients, previous treatment was already taken by 87 (77.67%) patients before their first visit to us. Table 1.

Table-1; Demographic characteristics of Suppurative corneal ulcer in this present study.

Epidemiological factors	Number and percentage Total no- 112
Male	65 (58.03%)
Female	47 (41.96%)
Age <30yrs	09 (8.03%)
30-40yrs	29 (25.89%)
40-50yrs	48 (42.85%)
50-60yrs	17 (15.17%)
>60yrs	09 (8.03%)
Rural	77 (68.75%)
Urban	35 (31.25%)
Occupation (Physical labour)	81 (72.32%)

Previous medications	87 (77.6%)
a)Antibiotics	71(63.39%)
b)Antifungal	10(08.29%)
c)Corticosteroids	03(02.67%)
d)Local drugs	03(02.67%)

A history of recent corneal injury was obtained from 83 (74.1%) patients (p>0.001). Among these injury groups, 31 (37.34% of 83) patients had corneal injury with vegetative matters, 17 (20.48% of 83) patients had animal injury. Other significant miscellaneous (35: 42.16% of 83) injurious agents were sand, stone, wooden material, dirt, wire, flying insects, etc. Ocular diseases predisposing to suppurative corneal ulcer were present in 17 (15.17% of 112) patients. Among these predisposing ocular diseases chronic dacryocystitis, entropion and trichiosis were predominant. Within these 112 patients, a total of 9 (8.03% of 112) patients had history of type-2 diabetes mellitus. There were no specific history in 3 (2.67%) patients among these 112 patients, enrolled in this study. Table 2.

Table-2: Predisposing factors associated with suppurative corneal ulcers in this present study.

Predisposing factors	Number and percentage Total no- 112
Trauma	83 (74.1%)
a)Vegetative trauma	31 (27.67%)
b)Animal trauma	17 (15.17%)
c)Miscellaneous (sand, stone, wooden material, flying insect, metal wire)	35 (31.25%)
Coexisting ocular diseases	17 (15.17%)
Coexisting systemic diseases	09 (8.03%)
No specific history	03 (2.67%)

In this present study, out of 112 corneal samples taken from clinically suspected suppurative corneal ulcer patients, cultures were positive in 76 (67.85%) samples and cultures were negative in 36 (32.14%) samples. Among these 76 culture positive samples, 42 (37.5% of 112) samples had produced pure bacterial growth, 28 (25% of 112) samples had pure fungal growth and 6 (5.35% of 112) samples had produced mixed bacterial and fungal growth. Hence, total bacterial isolates, out of these 76 culture

positive samples were 48 (42+6=48) i.e.42.85% of total 112 samples and total fungal isolates, out of these 76 culture positive samples were 34 (28+6=34), i.e.30.35% of total 112 samples. Table 3.

Table-3:Rate of pure bacterial, pure fungal and mixed isolates in culture positive cases.

Samples	Number and percentages
Total samples	112 (100%)
Culture positive samples	76 (67.85%)
a) Pure bacterial growth	42 (37.5%)
b) Pure fungal growth	28 (25%)
c) Mixed (bacterial & fungal) growth	06 (5.35%)
Culture negative samples	36 (32.14%)

Among these total 48 bacterial isolates, coagulase negative staphylococcus (CONS) were the most frequently isolated Gram positive bacterial organism (14: 12.50% of 112samples). Next to CONS, the second most frequently isolated Gram-positive bacteria were Staphylococcus aureus (9: 8.03% of 112 samples). The most frequently isolated Gram-negative bacteria were pseudomonas (12: 10.7% of 112 samples). The other isolated Gram negative bacteria were Klebsiella (08: 07.14% of 112 samples), E. coli (03: 02.67% of 112 samples) and Proteus (02: 01.78% of 112 samples). Table 4.

Table-4: Number of individual bacterial isolates and its percentage in this present study.

Name of bacteria	No. from pure growth	No. From mixed growth	Total no. & percentages (out of total 112 samples)
CONS	13	01	14 (12.50%)
S.aureus	08	01	09 (08.03%)
Pseudomonas	09	03	12 (10.71%)
Klebsiella	07	01	08 (07.14%)
E. coli	03	00	03 (02.67%)
Proteous	02	00	02 (01.78%)
Total	42	06	48 (42.85%)

Among these total 34 fungal isolates, the most common fungal isolate were Aspergillous (22: 19.64% of 112 samples).

The next common isolated fungus was *Candida* (12: 10.71% of 112 samples). Among the genus *Aspergillus*, the fumigatus sp. were 14 (12.50% of total 112 samples), the flavus sp. were 05 (04.46% of total 112 samples), and the niger sp. were 3 (02.67% of total 112 samples). Among the *Candida* genus, albicans sp. were 09 (08.03% of total 112 samples) and nonalbicans sp. were 03 (02.67% of total 112 samples). No acanthamoeba parasite was isolated in this study. Table 5.

Table-5: Number of individual fungal isolates and its percentage in this present study.

Name of fungus	No. From pure growth	No. From mixed growth	Total no. & percentage (out of total 112 samples)
A.fumigatus	11	03	14 (12.50%)
A.Flavus	04	01	05 (04.46%)
A.Niger	03	00	03 (02.67%)
Total	18	04	
Total Aspergillous	18 + 04 = 22		22 (19.64%)
Candida Nonalbicans	08	01	09 (08.03%)
C.albicans	02	01	03 (02.67%)
Total	10	02	
Total Candida	10 + 02 = 12		12 (10.71%)
Total fungal growth	22 + 12 = 34		34 (30.35%)

All the bacterial isolates were undergone through antibiotic sensitivity testing by Kirby-Bauer disc diffusion method, following CLSI guide lines. The Gram-positive organisms were highly sensitive to meropenems, linezolid, vancomycin, 2nd generation quinolones, 4th generation cephalosporines and piperacilin-tezobactam. They are resistant to penicilin, ampicilin, amoxycilin, cloxacilin, 1st generation cephalosporines, 1st generation quinolones, cotrimoxazole, tetracycline, etc. The Gram-negative organisms were highly sensitive to tobramycin, kanamycin, meropenems, piperacilin-tezobactam, 2nd generation quinolones(levomoxi/prulifloxacin) and 4th generation cephalosporines (cefepime and cefpirome) and 3rd generation

cephalosporines (ceftriaxone-salbactam, ceftazidime, cefoperazone).

IV. DISCUSSION

At birth, the eyes are sterile. But, soon after birth the eyes are invaded by various microorganisms. The conjunctival sac and the lid margins of an eye harbour a variety of bacteria. The interior structures of an eye ball are sterile.⁽³⁷⁾ The microorganisms that are present normally as flora in conjunctival sac can be classified in two groups : a) the resident organisms which are constantly present in the eye and which if disrupted promptly re-establish themselves, b) the transient organisms which consist of non-pathogenic and potentially pathogenic organisms that inhabit the eye for short periods.⁽³⁷⁾ Almost any species of bacteria and fungi can invade the cornea, if the normal defence mechanisms of cornea are compromised. The present study describes the microbiological features of many culture proven cases of suppurative corneal ulcer, diagnosed at tertiary care hospital at Bhavnagar in Gujarat.

The suppurative corneal ulcers, caused by bacteria or fungi or both are rare in the absence of any predisposing factors. Until recently most cases of infective keratitis caused by bacteria or fungi or both are associated with ocular traumas or ocular surface diseases. But, the wide spread use of soft contact lenses has greatly increased the risk of infective keratitis, leading to suppurative corneal ulcers. It is estimated that the risk of suppurative keratitis is 10 to 15 times higher with the use of extended wear disposable contact lens.⁽³⁸⁾ However, in my present study there is no patient with the history of the use of contact lens.

In the present study, the most common predisposing risk factor, identified for the development of suppurative corneal ulcer, is ocular trauma. In my study, a history of corneal trauma associated with suppurative corneal ulcer is documented in 83 (74.1% of 112) patients. Among these trauma, 31 (27.67% of 112) patients have corneal injury with vegetative matter, 17 (15.17% of 112) patients have animal injury and 35 (31.25% of 112) patients acquired trauma by several other agents such as sand, stone, soil, wooden material, dirt, wire, flying insects, etc. Gopinath et al and many other researchers have found injury by vegetative material as the principal traumatic agent for the development of fungal keratitis.⁽³⁹⁾ Corneal injury caused with soil, sand, stone, animal material, etc. Leads to bacterial keratitis. In many other studies trauma is the far more common predisposing factor for suppurative corneal ulcer (both bacterial and fungal) in low income group of countries where it accounts for up to 77.5% of total cases.⁽³⁹⁾ The presence of organic substances within the wound represents a much higher risk than does the presence of non-organic substances.

After trauma, the positive history of co-existing ocular diseases such as dacrocystitis, entropion, trichiosis, chronic blepharitis, etc. represent the the second most common cause for suppurative corneal ulcer in this present study. Elderly people are more commonly effected by the co-existing ocular diseases, particularly those with rheumatoid disease. Trauma is more common in younger age group of patients those are engaged in any type of physical works in rural areas in low income group of countries.⁽⁴⁰⁾

The age profile of patients, suffering from suppurative corneal ulcer, in this present study is comparable with previous other studies conducted by other researchers.^(41,42,43) The bimodality in the patient's age distribution can be attributed to corneal trauma in relatively younger age groups and predisposing coexisting ocular diseases in relatively older age groups. Suppurative corneal ulcers are rare in the absence of predisposing factors.

In many studies, it is found that suppurative corneal ulcers are commonly associated with contact lens related keratitis. Contact lens is now the major predisposing factor for suppurative corneal ulcer in The United States, Western Europe and many other developed countries and a major public health problem.^(44,45) However, in my present study at Sir T. Hospital at Bhavnagar in Gujarat there is no patient with the history of contact lens use.

Male preponderance is noted in this present study. Out of 112 patients, selected for present study, the number of male patients are 63 (56.25%) and the number of female patients are 49 (43.75%). The number of patients coming from rural and urban area are 77 (68.75%) and 35 (31.25%) respectively. Both these sex and habitat differences are statistically significant. The reason behind this difference may be due to male, residing at rural area, are more exposed to field work.

The present study focuses on to the prevalence of bacterial, fungal and parasitic pathogens, causing suppurative corneal ulcers among the patients attending a tertiary care teaching hospital at the western part of India

A total of 112 samples which were obtained from patients, suffering from suppurative corneal ulcers, were analysed. Out of these 112 samples, 76 (67.85% of 112) samples had yielded growth for bacteria and/or fungus, i.e. cultures were positive. Pure bacterial growths were detected in 42 (37.5% of total 112 pts) cases and pure fungal growths were detected in 28 (25% of total 112 pts) cases. Mixed growths (both bacteria and fungus) were detected in 6 (5.35% of total 112 pts) cases. Taking the mixed growths into account, the total bacterial and fungal positive culture cases, out of total 112 samples, were 48 (42.85% of 112) and 34 (30.25% of 112) respectively.

As far as the bacterial and fungal causative agents were concerned in this study, bacteria were identified as the principal etiological agents for suppurative corneal ulcers. This is consistent with the findings of other studies, conducted at the different parts of the world. For examples, the bacterial keratitis have been reported to account for 32.3% of all cases of suppurative corneal ulcers from Madurai (South India),⁽⁴⁶⁾ 29.3% from Thiruchirapally (South India),⁽⁴⁷⁾ 35.6% from South Florida⁽⁴⁸⁾ and 25% from the south part of Ghana.⁽⁴⁹⁾ In marked contrast, a study performed in Nepal had documented the principal bacterial etiology of 63.2% among all the suppurative corneal ulcers.⁽⁵⁰⁾ A high percentage of bacterial etiology in the study in Nepal may be due to corneal scraping performed before the use of topical antibiotic therapy.⁽⁴⁷⁾

However, the fungus had been identified as the principal etiological agent for suppurative corneal ulcers by different researchers from the other part of India which was comparable to Shrinivasan et al,⁽⁰⁸⁾ Basak et al,⁽⁵¹⁾ Bharathi et al,⁽⁰¹⁾ Geethukumuri et al,⁽⁵²⁾ etc. and from other countries such as

Japan,⁽⁵³⁾ Malaysia,⁽⁵⁴⁾ USA,⁽⁵⁵⁾ UK and from other developing and developed countries.

In this present study, the bacterial organisms isolated from suppurative corneal ulcers were Staphylococcus, Pseudomonas, Klebsiella, E. coli, and Proteus. Among the staphylococcus genus the coagulase negative staphylococci were the most common isolated organisms (14: 12.5% of total 112 samples). This is followed by Pseudomonas (12: 10.71% of total 112 samples), S.aureus (9: 8.03% of total 112 samples), Klebsiella (08: 7.14% of total 112 samples), E.coli (03: 2.67% of total 112 samples) and Proteus (02: 1.78% of total 112 samples). Currently, the indigenous bacteria such as CONS are increasingly being isolated from suppurative corneal ulcer and have become the principal bacterial pathogen responsible for suppurative corneal ulcer in our tertiary care teaching hospital. The same finding also have recently been observed by Vajpayee et al⁽⁴⁰⁾ in India and by several researchers in Europe⁽⁰⁴⁾ and United States.^(56,57)

In this present study, the fungi isolated from suppurative corneal ulcer were Aspergillous and Candida. Among Aspergillous the most common isolated species was A. fumigatus (14: 12.50% of 112 samples) which is followed by A.flavus (05: 4.46% of 112 samples) and A. niger (03: 2.67% of 112 samples). Among Candida the most common isolated species were C non albicans (09: 8.03% of total 112 samples), followed by C.albicans (03: 2.67% of 112 samples).

In this study out of 112 patients, 34 (30.34% of 112) patients have positive fungal growth. This is less to reports from South India by Leck et al⁽⁴⁷⁾ and Bharti et al.⁽⁰¹⁾ Our rate of incidences of positive fungal growth is also lesser to the study by Srinivasan et al⁽⁰⁸⁾ and much lesser to study by Basak et al.⁽⁵¹⁾ However, it is similar to the study in Assam, Eastern India where the incidence of fungal keratitis is 32%.⁽⁵⁸⁾

Worldwide fungal keratitis is a significant cause for ocular morbidity and blindness. The incidences of fungal keratitis vary with climate and it is more common in tropical regions. The contact lens wear increases the risk of fungal keratitis. Topical steroid use also associated with increased risk of fungal keratitis. Fungal keratitis often occurs following ocular trauma by vegetable matter. Thus, agricultural workers are at greater risk. So, fungal keratitis is more common in males than in females. In our present study, the fungal keratitis may be mainly due to trauma by vegetable matters. Because, in our patient series there is no history of contact lens use.

The present study is an attempt to explore the base line information about the principal microbial etiological agents, causing suppurative corneal ulcer and their sensitivity-resistance pattern to commonly used antimicrobial agents among the patients attending to Ophthalmology Department of Sir T. Hospital of Government Medical College at Bhavnagar in Gujarat. The facts and figures that have been revealed in this study are quite consistent with that of similar studies, conducted at different hospitals in this country and neighbouring countries by other researchers.

It indicates that microbial etiology of suppurative corneal ulcers has a particular geographical distribution with many predisposing factors that may contribute to it. The information about etiological agents and antibiogram that have been gathered in this study, can help the ophthalmologists of our hospital for proper management of cases. This information will also help

other ophthalmologist in managing their patients, especially those who are working at rural hospitals in this region and where microbiological laboratory facilities are lacking.

V. CONCLUSION

Suppurative corneal ulcer is an avoidable vision threatening disease. But, still it represents a considerable proportion of daily new OPD cases and creates a huge economic burden on the resources of national health services. The clinical presentation of bacterial and fungal corneal ulcer are often overlapping. So, confirmation by microbiological diagnosis is very essential in order to limit the ocular morbidity and to prevent the complications.

The present study is an attempt to explore the base line information about the epidemiological factors, predisposing factors and major microbiological agents causing suppurative corneal ulcer among patients attending Ophthalmology Department of SiT. Hospital of Government Medical College at Bhavnagar in Gujarat. The facts and figures that have been revealed from this study are quite consistent with similar studies, done at home and in the neighbouring countries. This present study indicates that microbial etiology of suppurative corneal ulcer has a particular geographical distribution with many predisposing factors that may contribute to it.

In this study, male individuals residing at rural area are mainly suffering from the suppurative corneal ulcer following trauma as they are mainly exposed to different types of physical works, including agricultural works. Among these patients, majority are above 50 years.

In this study, the most common predisposing factor identified for the development of suppurative corneal ulcer is ocular trauma. Among these trauma, caused by vegetative matter is most prevalent. This is consistent with other studies which shows that trauma is the far more common predisposing factor for suppurative corneal ulcer in low income group of countries.

In this study bacteria are identified as the principal etiological agent than fungus for suppurative corneal ulcer. Out of 112 patients suffering from suppurative corneal ulcer, bacteria are identified in 48 patients. Among these bacteria CONS are the most prevalent causative microbial agents. Out of 112 patients, fungus is identified in 34 patients. Among these fungi *Aspergillus* is the most prevalent causative microbial agent.

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REFERENCES

- [1] Bharathi MJ, Ramakrishnan R, Vasu S, Meenakshi R, Aetiological Diagnosis of Microbial Keratitis in South India. *Indian J Med Microbiol* 2002; 20:19-24
- [2] Thylefor B, Epidemiological patterns of ocular trauma. *Aust.N A J Ophthalmol* 1992;20:95-98.
- [3] Khan M U, Haque M R. Prevalence and Causes of Blindness in Rural Bangladesh. *Ind J Med Res* 1985; 82:257-262.
- [4] F.Schaefer, O.Bruttein, L.Zografos, Y.G.Crosier, Jules Gonin Eye Hospital, University of Lansanne, Switzerland, Correspondance to Yan Guex Crosier, Jules Gonin Eye Hospital, 15, AV de France, 1004 Lansanne, Switzerland.
- [5] P Rosant, Grag MS. Corneal Ulcer Diagnosis and Management. *Community Eye Health* 1997; 12:30.
- [6] Ogawa GA, Hyndink RA. Bacterial Keratitis and Conjunctivitis- Clinical Diseases. In: *The Cornea: Scientific Foundation and Clinical Practice*. 3rd ed. Smolin G, Thoft RA, Eds. (Little, Brown and Company, Boston) 1994: 125-167.
- [7] Guidelines for the Management of Corneal Ulcer at Primary, Secondary, and Tertiary Care Health Facilities in the South-East Asia Region. WHO bulletin 2004; p 6-8.
- [8] Srinivasan M, Gonzales CA, George C, et al. Epidemiology and Aetiological Diagnosis of Corneal Ulceration in Madurai, South India. *Br j Ophthlmo*, 1997; 81: 965-971.
- [9] What Is Onchocerciasis". Retrived 2010-06-28 "transmission is most intense in remote African rural agricultural villages, located near rapidly flowing stream". WHO expert committee on onchocerciasis estimates the global prevalence is 17.7 million, of whom about 270,000are blind.
- [10] Ashaye A, et al. Retinopathy among type-2 diabetic patients seen at a tertiary hospital in; Nigeria. A preliminary report. *Clin. Ophthalmol*. 2008; 2(1): 103-8.
- [11] Seyoum B, et al. Retinopathy in patients of Tikur Anbessa Hospital Diabetic Clinic. *Ethiop Med J*. 2001; 39: 123-31.
- [12] Yanoff M, Duker J S *Ophthalmology*. 2nd edition, Spain: Mosby, Inc, 2004.
- [13] *Text Book of Pathology* by Harsh Mohan. 6th edition. India. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
- [14] *Comprehensive Ophthalmology* by A. K. Khurana. 5th edition. India. New age International Publishers.
- [15] Abraham D, et al. Epidemiology of Eye Injuries in Rural Tanzania, *Neuro-Ophthalmology*. 1999; 6(2) :85-94
- [16] John P Whitcher, M Srinivasan, Madan P Upadhaya. Corneal Blindness: A Global Perspective. *Bulletin of World Health Organisation*, 2001; 79(3):216-217.
- [17] Negrel AD, Thylefors B. The Global Impact of Eye Injuries. *Neuro-Ophthalmology*. 1998888; 5(3): 143-169.
- [18] 18) Keay L, Edwards K, Naduvilath T, Taylor H R, Snibson G R, Forde K, Stapleton F. Microbial Keratitis: Predisposing Factors and Morbidity. *Ophthalmol* 2006; 113: 109-116
- [19] 19) Ly C N, Pham J N, Badenoch P R, Bell S M, Hawkins G. Clinical Experiment *Ophthalmol* 200666; 34: 44-50.
- [20] 20) Leek A K, Thomas P A, Hagan M, Kaliampurthy, Ackuaku E, John M, et al. Aetiology of Suppurative Corneal Ulcers in Ghana And South India and Epidemiology Of Fungal Keratitis. *Br J Ophthalmol* 2002; 86: 1211-1215.
- [21] 21) Reddy M, Sharma S, Rao G N. Corneal Ulcer. In: *Modern Ophthalmology*. 2nd edition. Dutta L C. Eds (Jaypee Brothers Medical Publishers, New Delhi). 2000; 1: 200-216.
- [22] 22) Sharmeen Ahmed, Anamika Ghosh, Syed A Hassan, Shirin Tarafder, Md Ruhul Amin Miah, et al. Predisposing Factors and Aetiologic Diagnosis Of Infections Corneal Ulcers. *Bangladesh J Med, Microbial*. 2010; 04(01): 28-31.
- [23] 23) *Practical Medical Microbiology*"by Macki and Mc Cartney. 14th edition, edited by J.G.Coll, A.G.Foster, B.P.Marmion. Published by Churchill Living Stone, an imprint by ELSEVIER. P:95-150.
- [24] 24) "District Laboratory Practice in Tropical Countries" 2nd edition, Monica Cheesbrough.Cambridge University Press. P:35-70.
- [25] 25)"A Text Book of Microbiology" P. Chakrobhorthy. 3rd edition.Published by New Central Book Agency(P)Ltd. P:308-358.

- [26] 26) "Essentials of Medical Microbiology" by Apurba Sankar Sastry and Sandhya Bhatt 1st edition, Published by Jaypee Brothers Medical Publishers(P) LTD. P: 43-53, 211-220, 298-245.
- [27] 27) Wilhelmus K.R, Liergang T.J, Osato M.S. Laboratory diagnosis of ocular infectious. In: Specter SC, ed. CUMITECH. Washington: American Society for Microbiology, 1994.
- [28] 28) Ananthanarayan & Paniker, s "Text Book Of Microbiology". 9th edition, P:39-54.
- [29] 29) Poggio E C, Glynn R J, Schein O D, et al. The incidences of ulcerative keratitis among users of daily wear and extended wear soft contact lenses. N Engl J Med 1989; 321: 119-83.
- [30] 30) Srinivasan M, Gonzales C.A, Gorge C, et al. Epidemiology and aetiological diagnosis of corneal ulceration in Maduri, South India. Br J Ophthalmol, 1997; 81: 965-971
- [31] 31) "Text Book of Ophthalmology" by Ernst Fuchs.
- [32] 32) "Ophthalmology for Undergraduates". P S Girija Devi.
- [33] 33) "Text Book of Ophthalmology" by Agarwal.
- [34] 34) "Kanski, s Clinical Ophthalmology": A Systemic Approach, 8th edition by Brad Bowling. ISBN-13:978-0702055720, ISBN-10:0702055727.
- [35] 35) Lorenzo- Morales, Jacob; Khan, Naveed A; Walochnik, Julia (2015). "An Update on Acanthamoeba Keratitis: Diagnosis, Pathogenesis, And Treatment". Parasite 22: 10.
- [36] 36) "Parasitology" K.D.Chatterjee, 13th edition, CBS publishers & distributors PVT. LTD.P:44-45.
- [37] 37) Leek A K, Thomas P A, Hagan M, Kaliamurthy, Ackuaku E, John M, et al. Aetiology of suppurative corneal ulcers in Ghana and South India, and epidemiology of fungal keratitis. Br J Ophthalmol 2002; 86: 1211-1215.
- [38] 38) Hagan M, Wright E, Newman M, Dolin P, Johnson G J. Causes of suppurative keratitis in Ghana. Br J Ophthalmol 1995; 74: 1024-1028.
- [39] 39) Coster D J, Badenoch P R. Host, Microbial, And Pharmacological Factors Affecting the Outcome Of Suppurative Keratitis. Br J Ophthalmol.
- [40] 40) Dart J K, Stapleton F, Minassin D. Contact Lens and Other Risk Factors In Microbial Keratitis. Lancet 1991; 338: 650-3.
- [41] 41) Eric J C, Nevitt M P, Hodge D O, et al. Incidences of ulcerative keratitis in a defined population from 1950 1988. Arch Ophthalmol. 1993; 111: 1665-71.
- [42] 42) MacLead S D, Kalaahdouz-Isfahani A, Rostamian K, et al. The role of smears, cultures, and antibiotic sensitivity testing in the management of suspected infectious keratitis. Ophthalmology 1996; 103: 23-8.
- [43] 43) Miedziak A I, Miller M R, Rapuano C J, et al. Risk factors in microbial keratitis leading to penetrating keratoplasty. Ophthalmology 1999; 106: 1166-70.
- [44] 44) Laila Akter, M A Salam, Bulbul Hasan, Nurjahan Begum, Iftikhar Ahmed. Etiological agents of suppurative corneal ulcers: Study of 56 cases. Department of Microbiology, Rajshahi Medical College, Rajshahi. Enam Medical College, Dhaka.
- [45] 45) Gomes D J, Huq F, Sharif A. Corneal ulcer in Bngladesh: Aetiological Diagnosis. Trans Ophthal Soc. Bangladesh 1990; 17: 12-21.
- [46] 46) Upadhyay M.P, Karmacharya P.C, Koirala S, Tuladhar N.R, Bryan L.E, Smolin G, et al. Epidemiologic characteristics, predisposing factors, and etiologic diagnosis of corneal ulceration in Nepal. Am J Ophthalmol. 1991; 111:92-99
- [47] 47) Basak S K, Basak S, Mohante A, Bhowmik A, Epidemiological and microbiological diagnosis of suppurative keratitis in Gangetic West Bengal. Eastern Indian J Ophthalmol 2005; 53(1): 17-22.
- [48] 48) Geethakumari, P.V.Remya, Girijadevi, M.S, Reena A. Bacterial keratitis and Fungal Keratitis in South Kerala: A Comparative Study; 2011. KJD. 23(1):43-46.
- [49] 49) Joanne W. Ho, Mark M. Fernandez, Rachelte A. Rebong, Alan N. Carlson, Terry Kim. Journal of Ophthalmic Inflammation and Infection, 2016, 6:5, Southern-eastern USA.
- [50] 50) Etiological agents of corneal ulcer: "Five Years Prospective Study In Eastern Nepal" by R.Amatya, S.Shrestha, B. Khanal, R. Gurung, N. Pandya, SKBhattacharya, and B P Badu. Nepal Med Coll J 2012; 14(3): 219-222.
- [51] 51) Norina T J, Raihan S, Bakiah S, Ezance M, Liza Sharmini A T. Microbial Keratitis Aetiological Diagnosis And Clinical Features In Patients Admitted To Hospital University Saim Malaysia. Singapore Med J 2008; 49: 67-70.
- [52] 52) Toshida H, Kogure N, Inoue N, Murakami A. Trends in Microbial Keratitis In Japan, Eye And Contact Lens, 2007; 33: 70-3
- [53] 53) Cohen E J, Fulton J C, Hoffman C J, et al. Trends In Contact Lens Associated Corneal Ulcers. Cornea 1996; 15: 566-70
- [54] 54) Musch D C, Sugar A, Meyer R F. Demographic and Predisposing Factors In Corneal Ulcerations. Arch Ophthalmol, 1983; 101: 1545-8.
- [55] 55) Gopinath U, Grag P, Fernandes M, Sharma S, Athmanathan S, Roa GN. The epidemiological features and laboratory results of fungal keratitis: a 10 years review at a referral eye care centre in South India. Cornea 2002; 21:555.
- [56] 56) Mac Lead S D, Kalaahdouz-Isfahani A, Rostamian K, et al. The role of smear, culture, and antibiotic sensitivity testing in the management of suspected infectious keratitis. Ophthalmology 1996;103: 23-8.
- [57] 57) Miedziak A I, Miller M R, Rapuano C J, et al. Risk factors in microbial keratitis leading to penetrating keratoplasty. Ophthalmology 1999; 106: 1166-70.
- [58] 58) Dr Latanpuia Chhangte, Dr Shanti Pandey, Dr Umesh: Epidemiological and Microbiological Profile of Infectious Corneal Ulcer in Tertiary Care Centre, Kumaun, Uttarakhand. International Journal of Scientific and Research Publication. Volume-5, Issue-2, February: 2015.

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Evaluation of Community Adaptation to Climate Change in Homa Bay County, Kenya

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Abstract- Climate change remains a major challenge to Homa Bay County whose main sources of livelihoods include fishing and fish trade, fish processing and agricultural production. The objectives of this study were to establish the potential of households to adapt to climate change and to evaluate adaptation strategies to climate change impacts in Homa Bay County, Kenya. The study adopted cross-sectional survey and evaluation research designs. Both qualitative and quantitative data were collected from male and female farmers in Homa Bay County. A sample size of 384 farmers was randomly selected and used in the study. Quantitative data analyses were done using SPSS package. The results reveal that there exist potential for households to adapt to the changing climate in the study area. The major factors influencing adaptation include lack of economic resources; availability and access to technology; levels of information and skills; social infrastructure; role of institutions; and equity in resource allocation. The local community response strategies include tree planting 335 (95%), planting more vegetation 245 (70%), changing and or diversifying crops 153(43.5%), rehabilitation of water storage structures 119 (34%) and paying more attention to weather forecasts. The main barriers to these coping strategies include lack of knowledge 207 (54%), insufficient funds 150 (39%) and lack of tools 27 (7%). The study proposes the use of short, medium and long-term adaptation measures for sustainability. These findings are important in strengthening local adaptation strategies and developing suitable policy frameworks to address the issue of resource mobilization in Homa Bay County.

Index Terms- Climate Change, Adaptation Strategies, Response Measures, Household Vulnerability, Climate Change Impacts, Livelihoods

I. INTRODUCTION

Adaptive capacity greatly influences the vulnerability of communities and regions to climate change effects and hazards (Downing *et al.*, 1999; Kates, 2000). At the individual level, adaptive capacity can be seen as a different resource that one can draw upon in such times of need, such as time, money, belief in efficacy, knowledge, entitlements, personal networks, social and institutional support (Grothmann and Patt, 2005). The resources required for adaptation include the social, health, educational and financial. These are available to a rural community, together with the formal and informal social networks and government programs or policies, such as assistance during drought (Mulwa, 2008). Considerable attention has been devoted to the characteristics of households,

communities or regions that influence their ability to adapt and/or their priority for adaptation measures (Kelly and Adger, 1999). These characteristics influence the occurrence and nature of adaptations and thereby circumscribe the vulnerability of systems and their residual impacts. With regard to climate change, the vulnerability of a given system or society is a function of its physical exposure to climate change effects and its ability to adapt to these conditions (Appendi and Liverman, 1996). Deficiencies in adaptive capacity like economic resources, technology, institutions, and lack of equity in allocation of power and access to resources within a community, region or nation results in low adaptive capacity and increased vulnerability to climate change impacts.

According to Kelly and Adger (1999), natural and human systems including agriculture, forestry, settlements, industry, transportation, human health, and water resource management have adapted to spatial differences in climate. Many systems are particularly vulnerable to changes in the frequency and magnitude of extreme events or conditions outside the coping range.

Adaptation types have been differentiated according to numerous attributes which include distinctions such as purposefulness and timing, autonomous or spontaneous adaptations and planned adaptations usually undertaken before impacts are apparent (Bryant *et al.*, 2000). Although an impressive variety of adaptation initiatives have been undertaken across sectors and regions, the responses are not universally or equally available (Rayner and Malone, 1998). McGregor points out that the viability of crop insurance depends heavily on the degree of information, organization, and subsidy available to support it. Similarly, the option of changing location in the face of hazard depends on the resources and mobility of the affected part and on the availability and conditions in potential destination areas (McGregor, 1993).

Studies have shown that over 50% of Australian and British respondents indicated that they either strongly agreed or tend to agree with the statement that it is their responsibility to help to do something about climate change (Reser, *et al.*, 2012). While responsibility for tackling climate change is more often placed at governmental and international levels, there is also evidence that the British and European public is aware of the need for wider collective and individual involvement in responding to climate change (Querol, *et al.*, 2003; Lofstedt, 1996). The results of a study on Climate Change and Crop Agriculture in Nile Basin of Ethiopia which measured impacts and adaptation options indicated that the five major constraints to adaptation included lack of information (43%), lack of access to credit (22%),

shortage of labor (16%), shortage of land (11%), and poor potential for irrigations (8%) respectively (Meseret, 2009). As Bibbings (2004) notes, the public accepts in theory that responsibility for environmental problems should be shared between society, business, industry and government but perceives that, in practice, nobody is living up to their side of the bargain (Lorraine, 2006). This shows that inaction by others may not be a disincentive for taking pro-environmental action among majority of the respondents (Adeniyi, 2011).

In Kenya, effective smallholder response to drought has shifted from traditional planting strategies to employment diversification (Downing *et al.*, 1989). Poor and landless households have limited resources, yet failure to adapt can lead to significant deprivation, displacement, morbidity, and mortality. Subsistence farmers do not have the same adaptation options as commercial producers (Downing *et al.*, 1997). Not only is there rarely only one adaptation option available to decision makers (Burton and Cohen, 1993) but also rarely do people choose the best responses among those available that would most effectively reduce losses often because of an established preference for, or aversion to, certain options (Rayner and Malone, 1998). Adoption of adaptive measures is constrained by other priorities, limited information and access to resources, adaptation costs, and residual damages or economic or institutional barriers (Bryant *et al.*, 2000; de Loë and Kreutzwiser, 2000, Mayaya *et al.*, 2014). In most cases local coping and adaptation strategies employed are event specific and the strategies are based on local knowledge and innovations (Bhusal, 2009). In this study, factors responsible for household vulnerability to the impacts of climate change in Homa Bay County were evaluated and subsequent recommendations given.

II. MATERIALS AND METHODS

2.1 Study area

Homa Bay County lies between latitude 0°15' South and 0° 52' South, and between longitudes 34° East and 35° East (Figure 2.1). The County covers an area of approximately 4,267.1 Km² inclusive of the water surface. The county is located in South Western Kenya along Lake Victoria where it borders Kisumu and Siaya Counties to the North, Kisii and Nyamira Counties to the East, Migori County to the South and Lake Victoria and the Republic of Uganda to the West (GoK, 2013). This study was carried out in all the eight sub-counties of Homa Bay County namely; Ndhiwa, Homa Bay Town, Mbita, Suba, Karachuonyo, Rangwe, Kasipul and Kabondo Kasipul; 19 divisions, 116 locations and 226 sub locations. Based on projections from the 2009 Kenya Population and Housing Census, Homa Bay County had an estimated population of 1,038,858 persons consisting of 498,472 males and 540,386 females by the end of the year 2012. The County's Poverty rate for 2009 stood at 49.6% (Wiesmann *et al.*, 2014). The main economic activities in the County include fishing and fish trade, fish processing, agricultural products: Maize, Millet, Cassava, Sunflower and sand harvesting (KNBS, 2013).

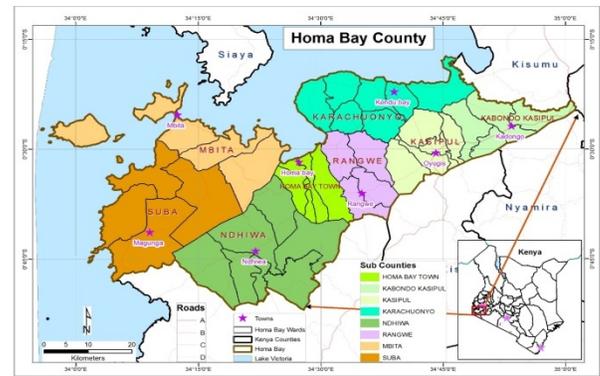


Figure 2.1: Map of Homa Bay County

Source: GoK, 2013.

2.2 Research design and sampling strategy

This study adopted a cross-sectional survey and evaluation research designs. The information required for this study was both qualitative and quantitative and was gathered from male and female farmers in Homa Bay County. The questionnaire was first piloted on a small sample of the population in an area with similar characteristics but not within the study area, in order to establish the reliability of the instrument. Questionnaires were used to gather information responses to impacts of climate change in the study area. The respondents were requested and assisted to fill the questionnaires. A face to face interview schedule on the subject of responses to impacts of climate change were conducted with some of the participants sampled for the study. The interviews were semi-structured, allowing participants to freely express their experiences and attitudes in their own language. Focus group discussions were held in four different areas within the county. The study explored the sources of information, adaptation strategies and the barriers to taking action on climate change effects. The study adopted a mix of quantitative and qualitative methods which made it possible to pool the strengths of different methods through triangulation (Gilbert, 2006; Cloke *et al.*, 2004)

A sample size of 384 farmers were randomly selected and used in the study. Quantitative data analyses were done using SPSS statistical package. The analysis of the sample was done according to the total sample, major geographic regions, gender, age brackets, level of education, poverty index and occupation categories. For qualitative data a coding frame was developed through a consultative process with the research assistants based on the research questions, and was further extended through open coding of a selection of the transects. Once the coding process was completed for all transects, the researcher identified which themes were most prominent across the transects and selected and grouped together all the quotations relating to each research question, so that they could be compared and analyzed together.

III. RESULTS AND DISCUSSION

3.1 Potential of households to adapt to climate change impacts in Homa Bay County, Kenya

In order to determine the households potential to adapt to climate change effects in Homa Bay County specific focus was

directed to the following variables: demographic characteristics; economic resources; availability and access to technology; levels of information and skills; social infrastructure; role of institutions; and equity in resource allocation.

3.1.1 Economic Resources

To determine the levels of economic resources within the county, the respondents were asked to state land ownership and the findings revealed that 69.3% household heads owned land while 30.7% were landless. The respondents were then asked to state their levels of income and the findings revealed that 46.7% of the households were poor while 53.3% were between medium to high income groups. This is in line with the 49.6% poverty incidence determined during 2009 population census as reported in Wiesmann *et al.* 2014. When asked to state their employment status, the findings revealed that 73.4% household heads were not formally employed while 26.6% were engaged in gainful formal employment. Distribution of household assets among households is a proxy indicator for the wealth status of the respective households. Whether it is expressed as the economic assets, capital resources, financial means, wealth, or poverty, the economic condition of nations and groups clearly is a determinant of adaptive capacity (Burton *et al.*, 1998; Kates, 2000). It is therefore widely accepted that poverty is directly related to vulnerability (Chan and Parker, 1996) and therefore a rough indicator of the ability to cope in the face of changes in climate (Dow, 1992).

Generally it is usually the poor who are among the most vulnerable to famine, diseases, malnutrition, and hunger. This is partly due to the insufficient financial power that would enable them to diversify and engage in multiple sources of income. The poor are also characterized by poor housing quality and little community organization. Kelly and Adger (1999) demonstrate the influence of poverty on a region's coping capacity by indicating that poor regions tend to have less diverse and more restricted entitlements and a lack of empowerment to adapt to changes. Material poverty adversely affects the poor, eroding their wellbeing, security and development potential. The type of material used for the floor of a dwelling often serves as a useful indicator of housing quality from both a wealth and health perspective. It is a proxy for wealth status because floors are typically given lesser priority for investment than walls and roofing (Wiesmann *et al.*, 2014).

Lack of technology has the potential to seriously impede a nation's ability to implement climate change adaptation options by limiting the range of possible responses (Scheraga and Grambsch, 1998). Adaptive capacity is likely to vary, depending on availability and access to technology at national and county levels. Many of the adaptive strategies identified as possible in the management of climate change directly or indirectly involve technology including warning systems, protective structures, crop and animal breeding, irrigation, settlement and relocation or redesign, and flood control measures among others.

3.1.2 Information and Skills

On examining the various trusted sources of information, it was established that radio was the main source of information 300 (78%) followed by Television 162 (42%), Newspapers 103 (27%) and school 93 (24%) while one out of ten people

mentioned NGOs, workshops and conferences, chiefs and neighbours (Figure 3.1).

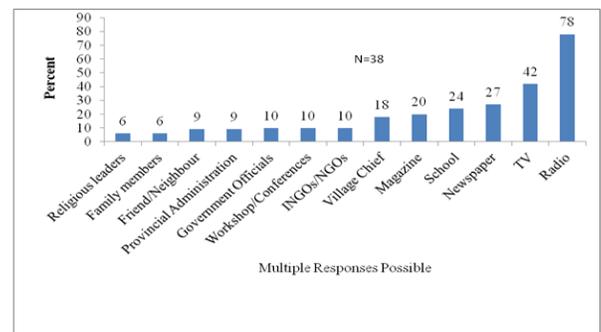


Figure 3.1: Sources of trusted information

Further analysis indicated that TV coverage was least in Karachuonyo 4 (7.5%), highest for the Government officials 80% and those aged 55-59 (70%). Proportionally, it was found out that more male 87 (35.4%) than female 44(31.9%); more urban 28 (45.9%) than rural 103(31.9%) and more of the employed 45 (44.1%) than the unemployed 86 (30.5%). More males than females could be reached through TV (35.4%), radio (88.2%), neighbours 11.8%, weather reports, newspapers and provincial administration/chiefs while the reverse was true for family and school. More urban than rural residents could be reached through Radio, TV, Neighbours and Newspapers with the reverse also true for family, weather report, provincial administration/chiefs and schools.

When asked where they find information about climate change, the interviewees indicated Ministry of Environment Water and Natural Resources, Ministry of Agriculture Livestock and Fisheries, National Environment Management Authority (NEMA), University libraries, Journal articles, research institutions, internet, colleges offering environmental courses and the Meteorological Department. Among them the most trusted sources of information include NEMA, meteorological department, elders, Kenya Forest service (KFS), Institutions like Jomo Kenyatta University where they offer these courses and United Nations bodies like United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP) and the World Agro-forestry center, University research departments, The Government of Kenya.

The respondents were asked to state their level of formal education. The results showed that 22.4% had attained primary level of education, 36.7% secondary, and 33.8% tertiary while 7% had no formal schooling. Basic capacity enhancement contributes to the improvement of adaptive capacity of local societies, by enhancing their basic capacity in terms of technologies, programs, financing, and human resources that is typically present in regions and sectors. Both integrated adaptation and basic capacity enhancement have other benefits even if the actual situation differs from projected climate change and its impacts and should be promoted systematically and consistently, with a long-term perspective.

Electronic information and communication tools play an important role in the development of a nation. They provide easy access to information enabling dissemination of content and

national languages that may be relevant for development. About 73.9% of residents in Homa Bay County own radio 15% own TV. Successful adaptation requires recognition of the necessity to adapt, knowledge about available options, the capacity to assess them, and the ability to implement the most suitable ones (Fankhauser and Tol, 1997). In the context of climate variability and change, this idea may be better understood through the example of the insurance industry: As information on weather hazards becomes more available and understood, it is possible to study, discuss, and implement adaptation measures (Downing, 1996).

Building adaptive capacity requires a strong, unifying vision; scientific understanding of the problems; an openness to face challenges; pragmatism in developing solutions; community involvement; and commitment at the highest political level (Holmes, 1996). Lack of trained and skilled personnel can limit a nation's ability to implement climate change adaptation options (Scheraga and Grambsch, 1998). In general, countries with higher levels of human resources are considered to have greater adaptive capacity than developing nations and those in transition (Burton *et al.*, 1998; Magalhães (1996) includes illiteracy along with poverty as a key determinant of low adaptive capacity to climate change in northeast Brazil. Such findings have prompted Gupta and Hisschemöller (1997) to conclude that it is important, therefore, to ensure that systems are in place for the dissemination of climate change and adaptation information nationally and regionally and that there are forums for discussion and innovation of adaptation strategies at various levels.

3.1.3 Infrastructure Facilities

To determine the resources required and available in the county for use in adapting to climate.6% indicated finances, 18.2% education, 18.2% Knowledge, 13.5% support from government, 7.8% information while 4.7% mentioned support from NGOs as below (Figure 3.2).

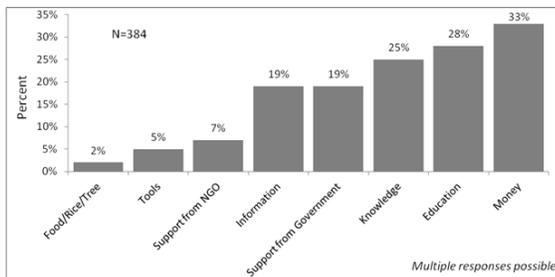


Figure 3.2: Resources required to help people adapt

Adaptive capacity is likely to vary with social infrastructure (Toman and Bierbaum, 1996). Some researchers regard the adaptive capacity of a system as a function of availability of and access to resources by decision makers, as well as by the vulnerable subsectors of a population (Kelly and Adger, 1999). Nations that depend solely for example on hydroelectric power for industries will have increased vulnerability during times of drought.

Common social and institutional enablers and constrainers influence adaptive capacity by providing opportunities or constraints to adaptation, including preparedness for climate risk. These include the kind of social, health, educational and financial

services available to a rural community, including formal and informal social networks and government programs or policies, such as drought assistance. Due to inherent institutional deficiencies and weaknesses in managerial capacities to cope with the anticipated natural event, it would be extremely difficult for a country to reduce vulnerability to climate change (Ahmed *et al.*, 1999).

3.1.4 Economic Equity

Economic inequality is viewed as a social and economic burden and especially when linked to poverty they threaten the core values as articulated in Kenya's constitution 2010. Economic inequalities exist with Homa Bay county standing at position 43 countrywide with an index of 0.42 as measured by the Gini Coefficient (Wiesmann *et al.*, 2014). Other inequalities exist in areas of education in which gender disparities stands at 0.32 against a national average of 0.23. Interestingly for Homa Bay County the female participation in economic activities 77% is higher than male participation 76.5% Weismann, 2014. This can be explained partly by women's role in small-scale agriculture. A growing rate of female participation in economic activities can be a strong indication of improvements in gender mainstreaming policies and practices, equal employment opportunities, women's empowerment, and involvement of the total population economic and national development potential Wiesmann *et al.*, 2014.

It is frequently argued that adaptive capacity will be greater if social institutions and arrangements governing the allocation of power and access to resources within a community, nation, or the globe assure that access to resources is equitably distributed (Ribot *et al.*, 1996; Kelly and Adger, 1999). The extent to which nations or communities are entitled to draw on resources greatly influences their adaptive capacity and their ability to cope (Adger and Kelly, 1999). Some people regard the adaptive capacity of a system as a function not only of the availability of resources but of access to those resources by decision-makers and vulnerable subsectors of a population (Kelly and Adger, 1999). In the case of technological innovation, Cyert and Kumar (1996) show that differential distribution of information within an organization can impose constraints on adaptation strategies. Differentiation in demographic variables such as age, gender, ethnicity, educational attainment, and health often are cited in the literature as being related to the ability to cope with risk (Chan and Parker, 1996; Burton *et al.*, 1998).

3.2 Adaptation strategies to climate change impact practiced in Homa Bay County, Kenya

Adaptation strategies employed by households to respond to climate change impacts in Homa Bay County were determined and evaluated. The study first established the strategies the households have used and barriers in response to the changing weather then went further to establish where the power to act on the changing weather lay. The strategies were critically evaluated in terms of effectiveness and efficiency.

The respondents were first asked if people in their community had done anything in response to the changing weather in which 352 (92%) responded affirmatively while the rest 32 (8%) responded to the contrary. Among those who indicated that nothing had been done by their community, about

30% were from Suba sub-county, 29% of those aged 70 years and above, the poorest group. More female than male and more urban than rural respondents indicated that something has been done by their community. Most of them said their work had been affected by the weather changes and community response has been in terms of tree planting 335 (95%), planting more vegetation 245 (70%), changing and or diversifying crops 153(43.5%), rehabilitation of water storage structures 119 (34%) and paying more attention to weather forecasts. Others responses included talking to friends and neighbours, praying, reducing water consumption and irrigation canals as shown in the figure 3.3 below.

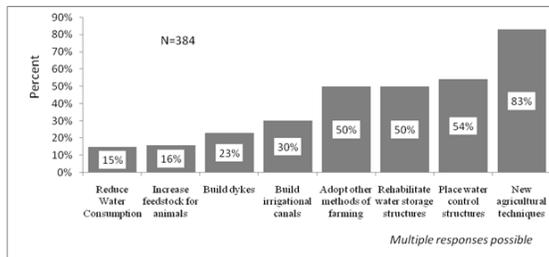


Figure 3.3: Actions in response to the changing climate

People have taken adaptive measures over the history of time to utilize the given climate conditions of their surroundings in the best possible way. When asked if they had done anything to prevent climate change in the past one year at the time of this study, a number of the key informants mentioned joining committees to give information on activities that need attention; Some respondents indicated that they had adopted use of biological farming methods to minimize overreliance on chemical based agriculture, tree nursery establishment and planting trees and use of energy saving stoves, and awareness creation in the communities to reduce on tree cutting for firewood. Other responses included having managed to plant many seedlings of trees and also minimizing the use of charcoal as main source of fuel.

The residents of Homa Bay indicated that if at all weather changes were to get worse they would resort to reforestation 296 (77%), changing and or diversifying crops 188 (49%), and rehabilitating water storage structures 159 (41%) and water control structures 146 (38%) respectively. Others said they would talk to friends and neighbours 63 (16%), build dykes 62 (16%) while about 13% do not know what to do (Figure 3.4).

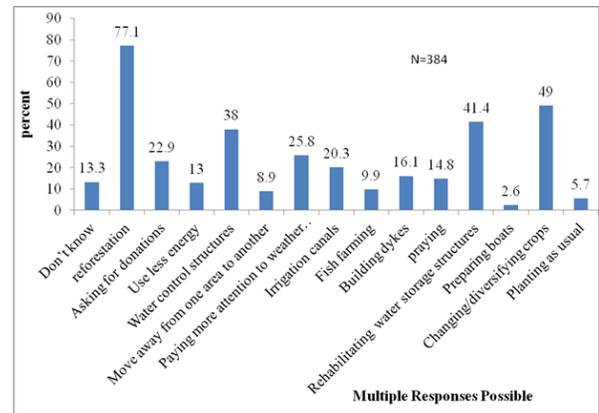


Figure 3.4: Respondents proposed actions with worse climatic conditions

A study conducted in Nepal among 113 interviewees to determine the local peoples' perceptions to climate change, its impacts and adaptation measures (Bhusal, 2009), found that local coping and adaptation strategies were event specific and the strategies were based on local knowledge and innovations and included practicing vegetable farming instead of cereal crops and crop diversification to earn more income while other strategies included forest protection, and utilization of marginal lands by planting trees and grasses. In a similar study (Meseret 2009), indicated that most commonly observed responses of farmers towards temperature and precipitations changes showed that 56.8% of the selected households had no adaptation strategy, 20% changed crop varieties, 13.3% planted trees while 2.9% put into practice soil conservation techniques. Regarding adaptation to change in rainfall patterns, about 42% had no adaptation strategy. Soil conservation schemes (30.4%) was the most commonly adapted strategy followed by use of different varieties of crops (11.1%), planting early and harvesting water for irrigation purposes among others.

Majority of the key informants said that the responses required for climate change adaptation include engagement of the County government through the environment ministry where government must protect forests from destruction, conducting baseline surveys to establish the extent of impacts, planning meetings and mobilizing groups, collect and compile data and information, provision of materials for awareness creation and engaging the media to ensure wider audience reach regarding climate change awareness and adaptation.

The results revealed that all sectors from maize to sugarcane to fishing have realized they must do things differently to cope with this new and harsh reality of climate change. The need to dig water reservoirs to store water for irrigation and for cows to drink is inevitable. The results also showed that most people had lost hope in farming in Homa May County due to the dry weather patterns. Other key informants indicated that the weather patterns had changed they needed to adapt to the changes to stay afloat. The earlier practice where runoff water would be let to go to waste has been abandoned and is now harvested and stored for use during the dry season.

The key informants had realized the need to come up with progressive strategies such as embracing the use of indigenous seeds which are resistant to drought since the exotic seeds cannot withstand the extreme weather. Without politicizing the whole

issue, the need to conserve water catchment areas and also reduce the cost of gas and use of electricity will drastically reduce charcoal burning and sustain the environment.

3.3 Barriers in responding to the impact of weather changes

In determining the barriers to taking action to respond to the effects of climate change, 207 (54%), 150 (39%) and 27 (7%) said lack of knowledge, insufficient funds and lack of tools respectively as shown in Figure 3.5. People may not adapt, or adapt incompletely, for a variety of reasons or obstacles that impede adaptation. Common social and institutional enablers and constrainers influence adaptive capacity by providing opportunities or constraints to adaptation, including preparedness for climate risk. These include the kind of social, health, educational and financial services available to a rural community, including formal and informal social networks and government programs or policies, such as drought assistance.

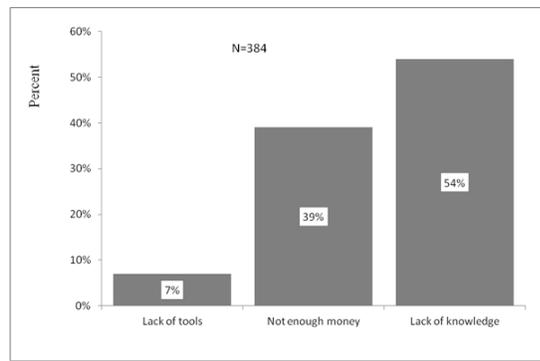


Figure 3.5: Barriers in responding to the impact of weather changes

Qualitative research highlights a prevailing belief amongst the public that they can do little to influence political processes and that their concerns and opinions are irrelevant to policy-makers (Bibbings, 2004b; Macnaghten and Jacobs, 1997). The results of a study on Climate Change and Crop Agriculture in Nile Basin of Ethiopia which measured Impacts and Adaptation Options (Meseret, 2009) indicated that the five major constraints to adaptation included lack of information (43%), lack of access to credit (22%), shortage of labor (16%), shortage of land (11%), and poor potential for irrigations (8%).

3.4 Power to act on the changing weather

The respondents were further asked if they knew any individual, organization or government department that is working to respond to the changing weather and their responses were that 245 (63.8%) responded affirmatively while 100 (26%) responded contrary with 39 (10.2%) not knowing. When asked who has the most power to respond to the changing weather (42%) mentioned the national government followed by the people of Homa Bay (18%) and the respondents themselves (16%) while another (4%) mentioned God as indicated in Figure 3.6 below.

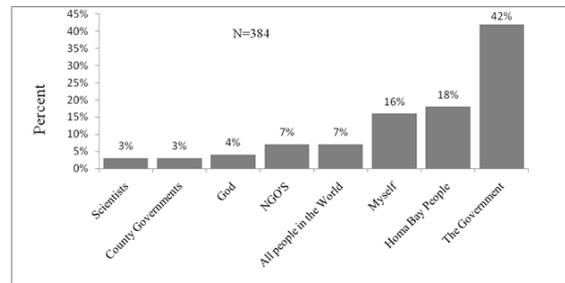


Figure 3.6: Power holders to changing weather

Responding to the issue of whose responsibility it is to deal with climate change; the key informants indicated that it is a multi-stake holder and a multi sectoral response strategy that can counter climate change and therefore all citizens, Governments, Non State Actors, NGOs, CBOs, PBOs) private sector organizations and networks across the country must be involved. Adaptation is not only a responsibility of national and local governments, but also directly related to the general public, corporations, and other actors in society although almost all the respondents 373 (97%) think the government is able to act to help cope with the problem of the changing weather in Homa Bay County.

Key among the activities that the Government can implement is stopping deforestation 173 (45%), planting more trees 134 (35%), giving out money to the people 65 (17%) and initiating irrigation schemes 12 (3%). The responses indicate that the respondents are aware that forests play an important role as sources of wood and non-timber products and as regulators of water flows and in addition, natural forests are key biodiversity hot spots (Weismann, *et al.*, 2014).

Adaptation measures are normally related to the activities of national and local government agencies, but they also relate to the daily lives of citizens, and the activities of businesses. It is therefore important that a broad range of actors act with an awareness of their relationship and roles in the respective adaptation policies, plans, and measures. Efforts should therefore be made to clarify the responsibilities of departments in order to gather information relating to climate change, and to promote the adaptation measures in individual sectors in an organized way.

Over the past century, forest cover in Kenya has been reduced to about 2.4% of the total land area with Homa Bay county having a paltry 1.0% forest cover covering total area of 31 km² (Wiesman, *et al.*, 2014). The decline of forest cover in Kenya is a reason for concern, especially in view of the vital function forests play in protecting water resources. The protection, preservation and sustainable use of these forests is important for the County's natural resource base, and poses both challenges and opportunities for inter county collaboration (Wiesman, *et al.*, 2014).

Studies on strategies and responsibility for mitigation indicate that respondents believe that national governments, the international community, and the industrial corporate sector bear a strong responsibility for taking action to combat climate change. But the Australian multiple response data suggested that individuals and families are viewed as having almost equal responsibility to take action in the context of climate change. It is noteworthy that in response to the question of whether they felt a sense of urgency to change their behaviours to help to reduce

climate change, 41.9% of British and 35.6% of Australians responded affirmatively. Over 50% of both Australian and British respondents indicated that they either strongly agreed or tended to agree with the statement that it is their responsibility to help to do something about climate (Reser, *et al.*, 2012).

While responsibility for tackling climate change is more often placed at governmental and international levels, there is also evidence that the British and European public is aware of the need for wider collective and individual involvement in responding to climate change (Querol, *et al.*, 2003; Lofstedt, 1996). When asked explicitly whether they felt they could help stop global warming, two-thirds of British people agreed they could (DETR, 1997). Furthermore, a BBC (2004) poll found that 85% of the British public say they 'would be prepared to change the way they live in order to lessen the possible impact of global warming'.

Bibbings (2004) posits, the public accepts in theory that responsibility for environmental problems should be shared between society, business, industry and government. However, it is perceived that, in practice, nobody lives up to their side of the bargain (Lorraine, 2006). When the respondents were asked to respond to the statement as to whether it is not worthy for them to do things to help the environment if others don't do the same, most (90%) of the respondents either disagreed or strongly disagreed with this statement. This shows that inaction by others may not be a disincentive for taking pro-environmental action among majority of the respondents (Adeniyi, 2011).

3.5 Proposed short and long term adaptation strategies

Adaptation prevents or moderates harm or exploits beneficial opportunities, by making changes in natural or human systems in the context of climate change impacts. The impacts of climate change are already occurring, and because they are projected to become even more severe in the future, it is essential to undertake short-, medium- and long-term adaptation measures. In this respect the respondents were asked to list short and long term adaptation strategies and rank them.

3.5.1 Short term climate change adaptation strategies

Short-term adaptation measures are those that are required immediately in order to prevent and moderate impacts that are already experienced. When asked on what they do to respond to the changes in weather patterns, majority indicated resorting to planting trees (94%), new agricultural techniques (83%), placing water control structures (54%), rehabilitation of water storage structures (50%) and adopting other methods of farming (50%) respectively. Suggested ways of keeping cool during hot weather included bathing often 3% and acquiring air conditioning equipment 2%. Of more concern is the group that suggested planting as usual 7.3%. Other responses centred around water management strategies including building irrigation canals 30%, building dykes 23% and reducing water consumption 15% as shown in Figure 3.7.

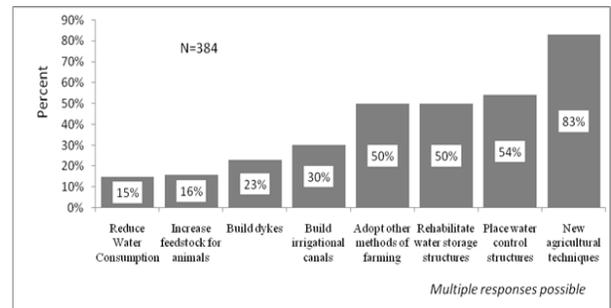


Figure 3.7: Possible responses to the changing weather

During the next few decades, it will be essential to initiate and encourage to the greatest extent possible and as quickly as possible, urgent adaptation and recovery measures for impacts that have a high likelihood of arising from climate change already occurring despite mitigation efforts. These would include introduction of heat-resistant crop varieties and promotion of appropriate cultivation methods, to address the declining crop quality and yields. Others would include crisis management arrangements and improvements in early warning systems, to deal with sea-level rise and with rising damage in confined areas and from intense rainfall events; installation and augmentation of independent electrical generation equipment for water purification plants to respond to power outages caused by the increase of natural disasters.

The Key informants indicated that it is essential to initiate and encourage urgent response measures to prevent or mitigate short-term impacts that are already occurring and are likely to arise from climate change. They said that it is essential to initiate urgent efforts to prevent and/or mitigate short-term impacts, and also to give higher consideration to measures where socioeconomic benefits are clearly superior in terms of cost to majority of the people. As the impacts of climate change are already occurring, it is important to strengthen existing response measures in individual sectors and take short-term adaptation measures. The respondents further revealed that it is vital to indicate basic approaches to adaptation, based on the current state of discussions about adaptation measures and the latest scientific knowledge to make national and local government departments responsible for adaptation. Efforts should be put in place to consider, plan, and implement adaptation measures in a coherent way.

From the focus group discussions, it came out that some adaptation measures are appropriate in the short-term including enhancing crop varieties and adjusting planting and harvesting dates by farmers. They also indicated that there is need to increase conservation of drought-resistant crop varieties by adopting water-conserving farming practices and promoting crop diversification. They further recommended that national and county governments should help set up a much-needed early-warning system for climate risks that will include educating farmers in the use of drought-tolerant seeds, plants and trees, as well as expand eucalyptus plantations for charcoal. The discussants also recommended scaling-up risk-transfer mechanisms for farming communities, restoration of degraded pasture lands, installation of air-conditioning systems in buildings and enforcement of building codes standards.

3.5.2 Long term climate change adaptation strategies

Long-term adaptation measures are those meant to prevent and mitigate projected future impacts. Response measures are necessary to enhance adaptive capacity to prevent and mitigate possible impacts, by assessing the risks of impacts that may occur in the medium and long term, and by controlling the impacts, reducing vulnerability, and strengthening resilience. These will include transforming the agricultural production system itself into a more resilient system to [climate change](#). Among the longer term adaptation strategies are integrated farming, embracing insurance and banking and providing incentives for relocation.

Key informants indicated that there is need to ensure that we integrate individual sectors improve basic capacity enhancement. Long term strategies should also provide convenience and environmental improvements that can be expected to offer larger synergies than measures that aim only at adaptation. These may include improvements of river and sea embankments, functional improvements of existing facilities; land-use regulations and incentives in affected areas; strengthening of measures to prevent outbreaks of infectious diseases; development of global food supply-and-demand systems that consider climate change impacts based on existing projection methods; and systematic water supply development to cope with recent recurrent droughts. In order to ensure the safety, security, and sustainable development of the society, it is therefore essential to implement not only initiatives for the long-term mitigation of climate change, but also policies to adapt to climate change. Parallel with this, it is essential to start planning the medium- and long-term adaptation measures, while assessing the future risks of climate change based on the latest scientific research.

IV. CONCLUSION AND RECOMMENDATIONS

The people of Homa Bay County have limited resources to adapt to climate change and this will further limit their capacity in the face of the magnitude of future hazards. Local adaptation strategies employed in Homa Bay County (tree planting, planting more vegetation, changing and or diversifying crops, rehabilitation of water storage structures, and paying more attention to weather forecasts) were effective but not sufficient and therefore not sustainable. Although communities in Homa Bay have used these strategies to adapt to climate change, the magnitude of future hazards may limit their capacity. It was revealed that the use of short, medium and long term strategies in adapting to climate change will enhance sustainability. It is recommended that local adaptation strategies be strengthened through improved extension services, training and research and developing suitable policy frameworks to address the issue of resource mobilization in Homa Bay County.

REFERENCES

[1] [1] G.A. Achiando, (2012). Effectiveness of Communication Systems and Indigenous Knowledge in Adaptation to Climate Change by Smallholder Farmers of Kilifi District, Kenya. Unpublished Masters Thesis, Egerton University, Kenya.

[2] [2] A. Adeniyi, (2012). Climate change knowledge, perception and concern among corporate elites in Lagos. Vantage Publishers, Lagos, Nigeria.

[3] [3] A.U.Ahmed, M. Alam, and A.A. Rahman, 1999: Adaptation to climate change in Bangladesh: future outlook. In: Vulnerability and Adaptation to Climate Change for Bangladesh [Huq, S., M. Asaduzzaman, Z. Karim, and F. Mahtab (eds.)]. J. Kluwer Academic Publishers, Dordrecht, The Netherlands, pp. 125–143.

[4] [4] K. Appendi, and D. Liverman, (1996) Agricultural policy and climate change in Mexico. In: Climate Change and World Food Security [Downing, T.E. (ed.)]. Springer-Verlag, Berlin, Germany, pp. 525–550

[5] [5] BBC (2004). Poll for Climate Change Special. www.bbc.co.uk: BBC. Date retrieved-7/10/2014

[6] [6] Y.R. Bhusal, (2009). Local Peoples' Perceptions on Climate Change, Its Impacts and Adaptation Measures in Mid-Mountain Region of Nepal (A Case study from Kaski District).BSc (Hons) Dissertation, Tribhubhan University, Nepal (unp.)

[7] [7] J. Bibbings (2004a). Climate Concern: Attitudes to climate change and wind farms in Wales. Cardiff: Welsh Consumer Council and Friends of the Earth Cymru.

[8] [8] J. Bibbings (2004b). A High Price to Pay? Cardiff: Welsh Consumer Council. New Society. Publishers, Philadelphia. Date retrieved-7/10/2014.

[9] [9] C.R. Bryant, B. Smit, M. Brklacich, T.R. Johnston, J. Smithers, Q. Chiotti, and B. Singh, 2000: Adaptation in Canadian agriculture to climatic variability and change. Climatic Change, 45(1), 181–201.

[10] [10] I. Burton, J.B. Smith, and S. Lenhart, (1998). Adaptation to climate change: theory and assessment. In: Handbook on Methods for Climate Change Impact Assessment and Adaptation Strategies [Feenstra, J.F., I. Burton, J.B. Smith, and R.S.J. Tol (eds.)]. United Nations Environment Programme and Institute for Environmental Studies, Free University of Amsterdam, Amsterdam, pp. 5.1–5.20.

[11] [11] I. Burton and S.J. Cohen, (1993). Adapting to global warming: regional options. In: Cai, Y. and Smit, B., 1996: Sensitivity and adaptation of Chinese agriculture under global climate change. Acta Geographica Sinica, 51(3), 202–212.

[12] [12] I. Burton and S.J. Cohen, 1993: Adapting to global warming: regional options. In: Proceedings of the International Conference on the Impacts of Climatic Variations and Sustainable Development in the Semi-Arid Regions, A Contribution to UNCED[Magelhães, A.R. and A.F. Bezerra (eds.)]. Esquel Brazil Foundation, Brasilia, Brazil, pp. 871–886.

[13] [13] N. Chan and D. Parker (1996) Response to dynamic flood hazard factors in peninsular Malaysia.

[14] [14] P.J. Cloke, I. Cook, P. Crang, Mark, Goodwin., J. Painter & C. Philo., (2004). Practicing Human Geography. London: Sage.

[15] [15] R. Cyert, and P.Kumar, (1996). Strategies for technological innovation with learning and adaptation costs. Journal of Economics and Management Strategy, 5(1), 25–67.

[16] [16] R.C De Loë, and R. Kreuzwiser, (2000). Climate variability, climate change and water resource management in the Great Lakes. Climatic Change, 45(1), 163–179.

[17] [17] DETR (Department of the Environment Transport and the Regions) (1997). Digest of Environmental Statistics - Public Attitudes to the Environment. London: HMSO.

[18] [18] K. Dow, (1992). Exploring the differences in our common future(s): the meaning of vulnerability to global environmental change. Geo forum, 23 (3), 417–436.

[19] [19] T.E Downing. (ed.), (1996) Climate Change and World Food Security. Springer-Verlag, Berlin, Germany, pp. 662.

[20] [20] Downing,T.E., Gitu, K.W., and Kaman, C.M. (eds.), 1989: Coping with Drought in Kenya: National and Local Strategies. Lynne Rienner, Boulder, CO, USA, 411 pp.

[21] [21] T.E. Downing , L. Ringius, M. Hulme and D. Waughray (1997) Adapting to climate change in Africa. Mitigation and Adaptation Strategies for Global Change, 2(1), 19–44.

[22] [22] T.E. Downing , M.J.Gawaith, A.A. Olsthoorn, R.S.J. Tol., and P.Vellinga ,(1999) Introduction. In: Climate Change and Risk [Downing, T.E., A.A.Olsthoorn, and R.S.J. Tol (eds.)]. Routledge, London, United Kingdom, pp. 1–19.

- [23] [23] S. Fankhauser and R.S.J. Tol, (1997): The social costs of climate change: the IPCC second assessment report and beyond. *Mitigation and Adaptation Strategies for Global Change*, 1, 385–403.
- [24] [24] N. Gilbert. (2001). *Researching Social Life*. Sage Publications.
- [25] [25] GoK (2013). *Homa Bay County Integrated Development Plan 2013-2017*. Nairobi, Kenya: Government Printers.
- [26] [26] T. Grothman, and A. Patt., (2005). Adaptive capacity and human cognition: The process of individual adaptation to climate change. *Global Environmental Change*, 15, 199–213.
- [27] [27] J. Gupta and M. Hisschemöller (1997). Issue linkage as a global strategy toward sustainable development: a comparative case study of climate change. *International Environmental Affairs*, 9 (4), 289–308.
- [28] [28] R.W. Kates 2000: Cautionary tales: adaptation and the global poor. *Climatic Change*, 45(1), 5– 17.
- [29] [29] P. Kelly and W.N. Adger (1999) *Assessing Vulnerability to Climate Change and Facilitating Adaptation*. Working Paper GEC 99–07, Centre for Social and Economic Research on the Global Environment, University of East Anglia, Norwich, United Kingdom, 32 pp.
- [30] [30] KNBS (2013). *Kenya National Bureau of Statistics, Homa Bay County 2012 projections*. Nairobi, Kenya: Government Printers.
- [31] [31] R. Lofstedt, (1996). An evaluation of a UK energy conservation programme. *Energy & Environment*, 7, (1), 41-49.
- [32] [32] W. Lorraine, (2006). Behavioural responses to climate change: Asymmetry of intentions and impacts, *Journal of Environmental Psychology*, doi:10.1016/j.jenvp.2008.05.003.
- [33] [33] A.R. Magalhães, (1996). Adapting to climate variations in developing regions: a planning framework. In: *Adapting to Climate Change: An International Perspective* [Smith, J., N. Bhatti, G. Menzhulin, R. Benioff, M.I. Budyko, M. Campos, B. Jallow, and F. Rijksberman (eds.)]. Springer-Verlag, New York, NY, USA, pp. 44–54.
- [34] [34] Mayaya, H.K., Opat, G.P. and Kipkorir, E.C. (2014). Analysis of Local Community Adaptation to Climate Change in Semi-Arid Areas of Dodoma region in Tanzania: Strategies and Challenges. *International Journal of Research in chemistry and Environment*, Vol. 4 a. Issue 4 (208-218)
- [35] [35] J. McGregor (1993) *Refugees and the environment*. In: *Geography and Refugees: Patterns and Processes of Change* [Black, R. and V. Robinson (eds.)]. Belhaven, Chichester, United Kingdom, 220 pp.
- [36] [36] M. K. Meseret (2009). *Climate Change and Crop Agriculture in Nile Basin of Ethiopia: Measuring Impacts and Adaptation Options*. MSc Thesis, Addis Ababa University (unp.)
- [37] [37] W. F. Mulwa, (2008). *Demystifying Participatory Community Development*. Pp. 114-16
- [38] [38] C. Querol, A.G. Swartling, B. Kasemir, et al. (2003). Citizens' reports on climate strategies. In B. Kasemir, J. Jager, C.C. Jaeger & M.T. Gardner (Eds.) *Public Participation in Sustainability Science: A handbook*. Cambridge: Cambridge University Press, pp. 126-152.
- [39] [39] S. Rayner and E.L. Malone. (1998). Ten suggestions for policymakers. In S. Rayner & E.L. Malone (Eds.) *Human Choice and Climate Change, Volume 4: What have we learned?* Columbus, Ohio: Battelle Press, pp. 109-138.
- [40] [40] J. P. Reser, G.L. Bradley, A.I. Glendon, M.C. Ellul and R. Callaghan. (2012). *Public Risk Perceptions, Understandings, and Responses to Climate Change and Natural Disasters in Australia and Great Britain*, Gold Coast, Australia: National Climate Change Adaptation Research Facility.
- [41] [41] J.C. Ribot, A. Najam and G. Watson (1996). Climate variation, vulnerability and sustainable development in the semi-arid tropics. In: *Climate Variability, Climate Change and Social Vulnerability in the Semi-Arid Tropics* [Ribot, J.C., A.R. Magalhães, and S.S. Panagides (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 13–54.
- [42] [42] J. Scheraga and A. Grambsch (1998). Risks, opportunities, and adaptation to climate change. *Climate Research*, 10, 85–95.
- [43] [43] E.K. Serem, J. Mburu, R. Mdachi, S. Korir, J. Kibugu, J. Kagira, and R. Ngure, (2013). Effects of crude extracts of *Solanum nigrum* on the liver pathology and survival time in *Trypanosoma brucei rhodesiense* infected mice. *Sci. J. Microb.* Doi:10.7237/sjmb/242.
- [44] [44] U. Wiesmann, P. Samoei, L. Trechsel, M. Engesser, (2015). A socio-economic atlas for informed decision-making. In: Ehrensperger A, Ott C, Wiesmann U, editors. *Eastern and Southern Africa Partnership Programme: Highlights from 15 Years of Joint Action for Sustainable Development*. Bern, Switzerland: Centre for Development and Environment (CDE), University of Bern, with Bern Open Publishing (BOP), pp. 95–98. <http://doi.org/10.7892/boris.72023>.

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Prevalence of Hepatitis B Surface Antigen among HIV Patients Inlimi Hospital Abuja

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Abstract- Hepatitis B (HBV) is one of the commonest and wide spread infections of humans and it is most prevalent in developing countries, including Nigeria. The disease is closely related to HIV, with one influencing the other in no small measure. This study aims at determining the prevalence of hepatitis B surface antigen (HBsAg) among HIV positive patients attending Limi hospital in Central Area of Abuja. A total of 250 HIV patients were screened for HBsAg, using rapid monochromatic test strip to determine the presence or absence of HBsAg in the samples. Of the 250 serum samples screened, 35 were positive for HBsAg, giving an overall prevalence of 14.0%. The highest prevalence rate (19.4%) was recorded among patients within the age group of 51-60 years, while the lowest prevalence of 12.3% was recorded among patients within the age group of 21-30 years. The prevalence was also higher in the female population (14.3%) than in the male population (13.6%). The prevalence of the disease with respect to socioeconomic status of the patients showed highest prevalent rate (22.34%) among people with low socioeconomic status, followed by a prevalence rate of 18.18% and 3.96% among people with middle and high socio-economic status, respectively. The prevalence based on knowledge of the patients about the infection showed 20.43% prevalence among people that were not aware and 10.19% prevalence among people that were aware. The prevalence of the infection in this work is statistically related to all the parameters tested, i.e. Age, Sex, Social status and knowledgeability of the subjects about the infection. The study here, thus confirms a high prevalence of HBV infection among the studied population. Public enlightenment, routine diagnosis and proper treatment of infected people are recommended for the public in general, and among immunocompromised patients in particular.

Index Terms- Hepatitis, Cirrhosis, Surface antigen, Virus, Prevalence, Limi Hospital Abuja

I. INTRODUCTION

Hepatitis is a common infection of the liver in which the liver cells called hepatocytes are inflamed. Hepatitis can be induced by both infectious and non-infectious agents. The infectious agents include a variety of different hepatitis viruses which include hepatitis A virus (HAV), Hepatitis B virus (HBV), Hepatitis C virus (HCV), Hepatitis D virus (HDV) and Hepatitis E virus (HEV). Other two newly discovered hepatitis viruses are Hepatitis G virus (HGV) and Transmission Transfusion Virus (TTV) (Prescott *et al.*, 2008). Hepatitis can also result from bacterial infection (Alabi and Halim, 1999).

Non-infectious agents that can cause hepatitis include: an overactive immune system, use of drugs, alcoholism, toxic chemicals from paint and spray thinners, and environmental toxins (Diestag and Hollinger, 1995; Alabi and Halim, 1999).

Hepatitis can also result in autoimmune infection in which the body mistakenly sends disease fighting cells to attack its healthy tissues, which is the liver. Viruses such as the cytomegalovirus, Epstein-Barr virus, herpes simplex virus, rubella and yellow fever viruses have also been implicated as causal agents of liver inflammation (Cheesbrough, 2006).

Of all human hepatitis viruses, hepatitis B virus (HBV) is the most virulent, versatile and most prevalent. HBV is present in the body fluid of infected individuals, such as urine, blood, serum, semen, vaginal secretions, sweat glands and even saliva, though in low concentration (Lindsey, 1990). The virus can, therefore, be transmitted through blood and secretions, unprotected sexual contact, blood transfusion, use of contaminated needle and syringe and vertical transmission from mother to child during birth (Prescott *et al.*, 2008). It can also be spread by fomites (inanimate objects), sharing of tooth brush, abrasion and sexual contact with infected persons (Otegbayo *et al.*, 2003; Keffe and Marcellin, 2007; Olokoba *et al.*, 2009; Kurbanov *et al.*, 2010).

Hepatitis B virus infection is a widespread problem. Epidemiological survey showed that about 5% of the world population is asymptomatic carriers i.e they show no apparent symptoms (Omer, 1995). However, sometimes there could be fever, loss of appetite, nausea, fatigue, abdominal discomfort and other symptoms such as jaundice which occurs as a result of bilirubin accumulation in the skin and other tissues resulting in yellowish appearance which is more prominent on the palm and eyes. The jaundice appears within three (3) months incubation period (Prescott *et al.*, 2005). The world health organization estimated that approximately 400 million people in the world are affected with hepatitis B including endemic areas such as sub-Saharan Africa, South East Asia and South America. However, most of the carriers were reported to have acquired it perinatally (Haller *et al.*, 1989).

Hepatitis B virus has caused epidemics in Asia and Africa and it is endemic in China and various other parts of Asia (Williams, 2006). About 2 billion people have been infected with this virus, 350-400 million people are chronic carriers of the disease. In the acute phase, it causes vomiting, jaundice and rarely death, it eventually leads to liver cirrhosis and liver cancer, leading to death of the infected person as it is very poor in response to chemotherapy (Chang, 2007).

Human immunodeficiency virus (HIV) infection appears to influence the natural history of infection with certain hepatitis virus. There is a high degree of epidemiological similarities

between HBV and HIV as regards to high risk group, routes of transmission and prevalence of the virus in the body fluids. Other factors associated with acquisition of HBV include increasing age, male gender, and low level of education, history of previous surgery, multiple sexual patterns, HIV infection, and non-use of condom (Mehmet *et al.*, 2005).

HBV and HIV share common routes of transmission; therefore, markers of either active or past infection are present in many HIV infected patients. Serological markers of past or present HBV infection have been reported in up to 90% of HIV patients. It has also been reported recently that HIV positive men with HBV are at risk of liver related mortality (Thio *et al.*, 2002).

The level of hepatitis B virus infection seems to have risen over the years and has become a thing of concern. Hepatitis B virus has caused epidemic in Africa. About 350 million people remain infected chronically and have become carriers of the virus. 1 million people a year die, from chronic or acute hepatitis, cirrhosis or primary liver cancer (WHO, 1987).

Nigeria is said to be among the group of countries endemic for hepatitis infection with about 20 million people infected with the disease (Ahmad, 1998). In Nigeria, the prevalence of HBV in normal population range from 2.7% to 13.3% (Leukonia *et al.*, 1969). In 1991 it was 1.4%, 5.8% by 2002. The prevalence rates in some states are: Bauchi 13.3% (Nasidi *et al.*, 1983), 13.7% in Ibadan (Ayoola *et al.*, 1986) and 22% in Maiduguri (Harry *et al.*, 1994). Nigeria is a holoendemic area for HBV, with carrier rate of 15 to 35% (Bojuwoye, 2007) and an estimated 12% of the total population being chronic carriers of HBsAg (Olumide, 2007).

The human immunodeficiency virus (HIV) poses a higher risk for patients with chronic (prolonged) hepatitis and its potential complication. Studies conducted in Northern Nigeria have reported lowest prevalence of 10.3% and highest prevalence of 28.7% in patients with HIV infection (Sirisera *et al.*, 2002) and a prevalence of 10.3 in the general population (Baba *et al.*, 1998). Another study conducted in Maiduguri revealed similar prevalence rate of 15.0% in HIV positive patients (Baba *et al.*, 1998). This therefore emphasizes the importance of detecting the group of HIV infected individuals who are concurrently infected with HBV (Gitlin, 1997).

The situation described above is frightening and calls for a thorough investigation in the Nigerian population. In HIV patients (already immunocompromised) the acquisition and spread of hepatitis B infection can be great and the consequences could be very serious. It is in this vein that the present work was undertaken to determine the magnitude of Hepatitis B virus infection among HIV patients, with a view to sensitize the public and make useful recommendations so as to reduce the disease burden, generally in the public and among the HIV patients in particular.

Limi hospital and maternity was selected for this work because of its strategic location in the Federal Capital Territory (FCT).

The aim of this study, therefore, is to determine the prevalence of hepatitis B surface antigen (HBsAg) in HIV positive patients attending Limi hospital in Central Area of Abuja, with the objectives of determining the occurrence of HBsAg in the study population, to obtain base line information on the disease burden in the study population; also to determine

the Age, Gender and Socioeconomic status distributions of HBsAg in HIV infected patients in order to establish possible relationships. Also the Knowledgeability of the people screened about the infection was considered.

II. MATERIALS AND METHODS

Study Area

The study was carried out at Limi hospital and maternity, that provides a secondary health care service in the central area of Abuja.

Study Population

The study population was HIV infected patients (males and females) within the age group of 21-60 years.

Sampling Method

A randomized cross sectional method was used for the study.

ETHICAL CONSIDERATION

Permission was sought from the authority of the hospital used, after which the consent of the HIV patients was sought, and blood was collected from the volunteers.

Sample Collection

Two millimeters of blood samples were collected from each of the 250 HIV infected patients during their visit to the hospital, into a sterile EDTA bottle for laboratory analysis. Blood samples were collected aseptically by venipuncture using 2ml sterile disposable syringe and needles. The samples were quickly transferred in baskets to the laboratory where they were stored at -15 to -20°C. The samples were collected between July-August.

Sample Processing

In the laboratory plasma was carefully separated from each blood sample by centrifugation at 300rpm for 5 minutes. Each serum was screened for the presence of HBsAg by the one step HBsAg test strip [Skytec for HB and C (USA)], which is a rapid chromatographic immunoassay for qualitative determination of HBsAg in the serum. All the sera specimens were allowed to equilibrate to room temperature prior to testing. The test was run in accordance with the method of Chessbrough (2006). The results were recorded and subjected to statistical analysis.

III. RESULTS

A total of 250 blood samples were screened for Hepatitis B Surface Antigen (HBsAg) among HIV patients attending Limi Hospital and Maternity in Central Area, Abuja. Of the 250 samples, 35 (14.0%) were positive and 215 (86.0%) were negative. Therefore the overall prevalence of Hepatitis B surface antigen among the sampled population was 14.0%. The prevalence of Hepatitis B surface Antigen according to age in the sampled population is shown in table 1. The highest prevalence was found among age group 51-60 years (19.4%) and lowest in age group 21-30 years (12.3%). Age group 31-40 years had a prevalence of 14.5% while the age group 41-50 years had a prevalence of 12.9%. There is a significant association between Hepatitis B surface antigen and age ($P > 0.05$) as shown in table 2.

Of the 250 patients screened, 103 and 147 were from male and females respectively. The prevalence of hepatitis B Surface

Antigen (HBsAg) by gender shows a prevalence of 13.59% (14 out of 103 positive cases) and 14.29% (21 out of 147 positive cases) for male and female, respectively. This indicates a higher prevalence rate among the female than the male population and statistically there is a significant association between Hepatitis B surface antigen and gender ($P > 0.05$) as shown in table 3. The prevalence of Hepatitis B surface antigen by socio-economic status showed that 22.34% of people with low socio-economic status were infected with hepatitis B virus, 18.18% of people with average socio-economic status were positive for Hepatitis B surface antigen infection. The high socioeconomic class had seroprevalence of 3.96%. However, there is significant

association between hepatitis B surface antigen and the socio-economic status of the people ($P > 0.05$). This is shown in table 4.

The prevalence of hepatitis B surface antigen based on the awareness on the existence of the infection showed that, out of the 157 that were aware of the existence of the infection, 16 out of 157 (10.19%) were infected and 19 out of 93 (20.43%) that were not aware of the existence of the infection were infected. There is a significant association between hepatitis B surface antigen and awareness on the existence of the disease, ($P > 0.05$) as shown in table 5.

TABLE 1: The overall prevalence of Hepatitis B among HIV Patients in Limi Hospital.

Infection Screened for	Number of people examined	Number of people infected	Number of uninfected people	Prevalence (%)
Hepatitis B	250	35	215	14.0

TABLE 2: PREVALENCE OF HEPATITIS B SURFACE ANTIGEN AMONG HIV INFECTED PATIENTS BY AGE

AGE (YEARS)	NUMBER EXAMINED (%)	NUMBER INFECTED (%)	NUMBER NOT INFECTED (%)
21-30	66 (26.40)	8 (12.12)	58 (87.88)
31-40	83 (33.20)	12 (14.46)	71 (85.54)
41-50	70 (28.0)	9 (12.86)	61 (87.14)
51-60	31 (12.40)	6 (19.35)	25 (80.65)
TOTAL	250	35	215

TABLE 3: PREVALENCE OF HEPATITIS B SURFACE ANTIGEN AMONG HIV INFECTED PATIENTS BY GENDER

GENDER	NUMBER EXAMINED (%)	NUMBER INFECTED (%)	NUMBER NOT INFECTED (%)
MALES	103 (41.20)	14 (13.59)	89 (86.41)
FEMALES	147 (58.80)	21 (14.29)	126 (85.71)
TOTAL	250	35	215

TABLE 4: PREVALENCE OF HEPATITIS B SURFACE ANTIGEN AMONG HIV PATIENTS BY SOCIO ECONOMIC STATUS

SOCIO ECONOMIC STATUS	NUMBER SCREENED (%)	NUMBER INFECTED (%)	NUMBER NOT INFECTED (%)
LOW	94 (37.60)	21 (22.34)	73 (77.66)
AVERAGE	55(22.0)	10 (18.18)	45 (81.82)
HIGH	101 (40.40)	4 (3.96)	97 (96.04)
TOTAL	250	35	215

TABLE 5: PREVALENCE OF HEPATITIS B SURFACE ANTIGEN AMONG HIV PATIENTSBASED ON AWARENESS ON THE EXISTENCE OF THE DISEASE.

AWARENESS	NUMBER SCREENED (%)	NUMBER INFECTED (%)	NUMBER NOT INFECTED (%)
KNOWLEDGE ABOUT HBV INFECTION	157 (62.80)	16 (10.19)	141 (89.81)
NOT KNOWLEDGABLE ABOUT HBV INFECTION	93 (37.20)	19 (20.43)	74 (79.57)

TOTAL	250	35	215
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IV. DISCUSSION

This study examined the prevalence of Hepatitis B surface antigen in HIV patients attending Limi Hospital and Maternity. The observed prevalence was 14.0%, 35 out of the 250 samples examined. This shows a high prevalence of hepatitis B surface antigen among HIV patients attending Limi hospital and Maternity, reaching an endemicity level because according to Hodges *et al.*, (1998), high endemicity for hepatitis is defined as HBsAg greater than 7%. The 14.0% prevalence exceeds the national range of 2.7 to 13.3% in normal population (Leukonia, 1969). However, the prevalence recorded among the HIV patients in this work is similar to the results of other previous researchers like Nasidiet *et al.*, (1983) who obtained 13.3% in Lagos, Baba *et al.*, (1998) obtained 15.0% in Maiduguri, Suleet *et al.*, (2010) obtained 14.0% prevalence among HIV patients attending Universal Hospital, Ankpa, Kogi State Nigeria. Also the prevalence recorded in this study is similar to that of Agbaji, (2005) who reported 14.5% prevalence in Jos University Teaching Hospital. However, it is lower than the 28.7% prevalence reported among HIV patients in the Northern Nigeria by Siriserat *et al.*, (2002). The prevalence is also lower than the results of Balogunet *et al.*, (2010) and Harry *et al.*, (1994) who obtained a prevalence of 28.4% and 22.0%, respectively. The different prevalence rates obtained in different parts of the country, and even worldwide, could be as a result of multiple factors that determine the seroprevalence of hepatitis, which vary from person to person and region to region. With respect to gender, females had a prevalence rate of 14.29% and the males had a prevalence rate of 13.59%. This differs from what was reported by Mehmet *et al.*, (2005), who reported higher prevalence rate of 12.7% in males than 2.1% in females concluding that male sex was an important risk factor for HBsAg positivity. The higher prevalence in females is similar to the results obtained by Okonkoet *et al.*, (2012) who reported higher HBsAg prevalence in females (10.2%) than males (5.5%), Suleet *et al.*, (2010), who reported that females had higher seropositivity for HBsAG (15.6%) than the males (11.7%). This finding is also similar to the report of Okechukwuet *et al.*, (2014), who found a higher prevalence in females (65.5%) than males (34.4%). Another study of 260 HIV positive patients in Abuja, Nigeria, showed higher prevalence of (12.5%) in females than males (9.2%), (Adewoleet *et al.*, 2009). Future researches will, therefore, be necessary to clear the discrepancies on the gender situation as regards HBV patients.

In this research, the age group 21-30 years had a prevalence of 12.12%, 31-40 years had a prevalence of 14.46%, 41-50 years had a prevalence of 12.86% and 51-60 years had a prevalence of 19.35%, contradiction reports by Adewoleet *et al.*, (2009), who had a higher prevalence of 14.6% in the 31-40 age group and 7.1% in the >40 age group. Laret *et al.*, (2013) and Okechukwuet *et al.*, (2014) also found a higher prevalence rate of 12.2% in the 21-30 age groups and 5.0% in the >40 years age group. Human Immunodeficiency virus shares common route of infection with hepatitis B virus (HBV). The difference among the group studied was statistically significant; hence the disease is age dependent. This result depicts that the likelihood of complications of acute

chronic liver disease and overall mortality are higher in elderly population. It is also well established that older individuals with viral hepatitis have a higher mortality rate now. Furthermore, physiological changes associated with ageing, such as diminished immune response, metabolic derangement, nutritional deficiencies, and greater exposure to environmental hepatoxins, also contribute to worse outcome by HBV prevalence in the elderly (Davis and Robert, 2010). This research agrees with Mehmet *et al.*, (2005) which states that increasing age is a factor associated with the acquisition of hepatitis B virus.

The prevalence of hepatitis B surface antigen based on the awareness of the existence of the disease was 10.19% in patients that were aware of the disease, while those who were not aware were 20.43%. This research shows that there is a significant association between the infection and the level of awareness of the people. This result with higher HBV prevalence among those that were not aware or knowledgeable about the disease is not unexpected since being aware of the existence of a disease and its mode of transmission can help people in avoiding things that could predispose them to the disease.

Naturally, the socio-economic status of people can go a long way in determining their level of acquiring some diseases. This can account for the highest prevalence of 22.34% in the low socioeconomic group, followed by those with average or middle socioeconomic status (18.18%) compared to people with the high socio-economic status that had 3.96% prevalence.

V. CONCLUSION

The result obtained from this study revealed the prevalence rate of Hepatitis B surface antigen to be 14.0% which implies that hepatitis B infection is endemic among HIV patients attending Limi Hospital and Maternity. The high prevalence of HBV among HIV patients in this study is an indication of what is most likely obtained in the public generally, hence the situation calls for a prompt medical intervention among HIV patients in particular and the general public at large, so as to prevent the epidemic of the disease.

VI. RECOMMENDATIONS

The following recommendation can be emphasized to serve as preventive and control measures for the spread of the virus (hepatitis B virus) in the study area and the general public at large.

- Programs such as health education, aimed at enlightening the public on the dangers of Hepatitis B virus infection and those factors that could predispose them to the infection, should be organized periodically.
- Donated blood should be thoroughly screened to ascertain their HBV status before blood transfusion.
- Since there is effective treatment, positively screened individuals should be treated thoroughly to reduce the spread of the infection.
- People should have access to counseling and health care services.

- Awareness campaign should be linked with that of HIV/AIDS since both viruses (HBV and HIV) have same routes of transmission.

REFERENCES

- [1] O.O. Adewole, Z. Antyi, I. Ajuwon, F. Wada (2009). Hepatitis B and C virus co-infection in Nigerian patients with HIV infection *J. infect. Dev. Countries*,3:369-375.
- [2] O. Agbaji. (2005).Seroprevalence of hepatitis B virus and hepatitis C virus infection among HIV infected patients attending the attending the antiretroviral clinic at Jos University Teaching Hospital (JUTH), Jos , Nigeria. Abstract Type 1: 1034.
- [3] K. Ahmad (1998) Hepatitis B in Viral Hepatitis: An overview: proceedings of seminar.
- [4] Armed Forces Institute of Pathology(AFIP) Rawalpindi, Pakistan: 16 – 19.
- [5] N.K. Alabi, O.I. Halim (1999). Risk factor and seroprevalence of Hpatitis B and antibodies in blood donors in Nigerian.*East Africa Medical Journal* 77:410-412.
- [6] E.A. Ayoola, A.B. Adelaja(1986). Sub determinants and incidence of Hepatitis B antigen.*Nigerian Medical Practitioner* 11:133-136.
- [7] M.M. Baba, I. S. Onwuka, S.S. Baba (1998).Hepatitis B virus infection among HIVpatients in Maiduguri, Nigeria.*Central European journal of Public Health.* 7(2):62-66.
- [8] T.M. Balogun, I.O. Durojoie, A. Sagoe, S. Emmanuel (2010). Seroepidemiology of Hepatitis B surface antigenaemia in HIV Positive Patients.*West Africa J Medicine*, 29(3):169-173.
- [9] M. Cheesbrough.(2006). *District Laboratory Practice in Tropical countries Part 2. 2nd Ed.* Cambridge University Press, United Kingdom: 250-252.
- [10] G. L. Davis, W.L. Roberts. (2010). The health care burden imposed by Liver disease in aging Baby Boomers. *CurrGastroenterol Rep.*12:1-6.
- [11] J.L. Dienstag.(1999). External lamivudine retreatment for chronic hepatitis B.Maintenance of viral suppression after discontinuation of therapy. *Hepatology*30: 1082-1087.
- [12] J.L. Dienstag, F.B. Hollinger.(1995). Hepatitis B and D viruses.In manual of *Clinical microbiology*.Murray PR, Barron EJ, eds., AD ASM Press, Washington,: 1033-1049.
- [13] N. Gitilin. (1997). Hepatitis B: Diagnosis, Prevention and Treatment. *Clinical Chemistry*, 43:1500-1506.
- [14] S.C. Hadler,D.P. Francis, J.E. Maynard. (1986). Long term immunogenicity And efficiency of hepatitis B vaccine in homosexual men. *New England Journal of medicine.* 315:209.
- [15] T. D. Harry, A. M. D. Bajani, A.E. Mosts. (1994). Hepatitis B virus infection Among HIV patients and pregnant women in Maiduguri,Nigeria. *EastAfrican medical journal*,7:32-33.
- [16] S. W. Hodies,M. J. Luke, R. K. Obi. (1998).Hepatitis B: Evolving Epidemiology and Implications for Control. *Seminars in liver Diseases.* 11:84-89.
- [17] E. B. Keffe,P. Marcellin.(2007). New and emerging treatment of chronic HepatitisB. *Clin.Gastroenterol.Heptol.* 5(3):285-94.
- [18] F. Kubanov, Y. Tanaka, M. Mizokami (2010). Geographical and Genetic diversity of the human Hepatitis B virus.*Hepato. Res.*, 40(1):14-30.
- [19] P. M. Lar, V.K. Pam, P.B. Christopher, L. Gwamzhi,M. D. Mawak. (2003). Prevalence and immune status of HIV/HBV co-infected patients. *Afr. J. Clin. Exp. Microbiol.*, 14:120-126.
- [20] R. M. Leukonia, T. Rowland (1969). ABO blood groups distribution in serum Hepatitis. *Britannia Medical Journal.* 13:268-269.
- [21] T.K. Lindsay (1990). Control of Hepatitis B Virus Infection In Third World Countries.*Transfuse Medicine*, 4(3): 187-190.
- [22] D. Mehmment, E. Melksah, Y. Sherif, S. Gunay, O. Tuner, S. Zeryep (2005).Prevalence of Hepatitis B Infection in the Southeastern Region of Turkey, Comparison of Risk Factors for HBV Infection in Rural and Urban Areas. *J. Infectious Dis.*, 58:15-19.
- [23] A. Nasidi, T.O. Harry,S.O. Yazou, G.M.R. Munube, B.B. Azzan, V.A. Ananier(1983).Prevalence of Hepatitis B infection markers in two Different Geographical Areas of Nigeria.*Proceeding Of The First International Conference on Viral and Bacterial Vaccines*, Paris 213-217.
- [24] N. Okechuckwu, M. Godwin, O. Egeudenia, E. Desmond,O. Patrick. (2014).TheSeroprevalence of Hepatitis B Viral Infection in HIV Tested Positive Individuals inOwerri, Imo State, Nigeria.*J. Aids Clin. Rec.* 5:273.
- [25] I.O Okonko, A.O. Udeze(2011). Detection Of Hepatitis B Surface Antigen Among Pregnant Women Attending Antenatal Clinic at O.L.A Catholic Hospital, Oluyoro, Ibadan, Oyo State, South Western Nigeria.*Nature and Sci.* 9(11): 54-60.
- [26] E. A. Olumide(2007). The Distribution of Hbsag in Africa and Tropics Report of Population Studies in Nigeria.*Int. J. Epidemiol* 5(3):279-289.
- [27] J.A. Otegbayo, F.O. Fasola, E. Abaja (2003).Prevalence of Hepatitis B Surface Antigen And Hepatitis B Envelope Antigens, Risk Factors of Viral Acquisition And Transminase Among Blood Donors In Ibadan, Nigeria. *Trop Gasterorent*, 24:217-226.
- [28] L.M. Prescott, J.P Harley, D.A. Kilen (2005). Microbiology, 6th Ed., Mcgraw Hill, New York: 936-938.
- [29] N. Sirisera, M.O. Njokwu, J.A.Idoko (2002). Hepatitis B surface antigenemiaIn patients with human immunodeficiency virus- (HIV-1) infection in Jos,Nigeria. *Nigeria medical practitioner*,41:18-20.
- [30] W.F Sule, I.O. Okonko, I.P. Yunusa, N.N. Odu, N. Frank-Peterside (2010). Detection of Hepatitis B surface antigen and risk factors of transmission among HIV patients attending Universal Hospital Ankpa, Kogi State, Nigeria.*Nature and Sci*, 9(10):37-44.
- [31] C.L. Thio, E.C. Seaberg, R. Skolasky (2002). HIV-1, Hepatitis B virus, and risk of liver related mortality in the Multicentre Cohort Study (MACS). *Lancet*; 360:1921-1926.
- [32] R. Williams (2006). Global challengesin liver disease. *Hepatology*, 44(3):521-526.
- [33] World health Organization (1987).*Hepatitis B virus*.New York. WHO 2:235-238.

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A Stylistic Analysis of “Ode to A Nightingale” by John Keats

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Abstract- This stylistic analysis of the poem “Ode to a Nightingale” by John Keats who was acknowledged to be the romantic of all romantics, reveals his unprecedented style of writing poetry. The conception of negative capability and the wholesome concept of exquisiteness are the idiosyncratic characteristics of Keats poetry, which distinguish him from his contemporary poets. In this analysis, specifically, main stylistic levels are discussed and accordingly stylistic devices are extracted and explained to analyze this spectacular poem of the renowned and beloved poet, which had made it a part of Pakistani syllabus because of its charismatic and hypnotic impression. To this end, the corpus of the poem has been processed through various softwares for stylistic analysis of corpora and the results have been discussed in this analysis so that it could be helpful as pedagogical implications in applied linguistics and productive for comprehension of stylistic devices for preliminary learners. Moreover, the usage of various softwares for analyzing a corpus can be learnt through this study.

Index Terms- Stylistics, Stylistic devices,Phonetic &Phonological Level, Graphitic &Graphological Level, Lexical & Grammatical Level, Semantic, Discourse & Pragmatic Level, Annihilation, death, eternity, bliss.

I. INTRODUCTION

“Ode to a nightingale” has been written by John Keats in the spring of 1819. He was stimulated by the song of a nightingale that had lived close to the house of his friend in Hampstead. The bird’s entrancing and charismatic song had impacted on Keats’ mind and stimulated him with tranquil pleasure and aspiration of a blissful eternal life. The theme of the poem is not merely the nightingale itself rather it is the poet’s exquisite craving to get rid of the depressing and mortal world to the immortal life of splendor, tranquility and excellence, which is exposed to Keats for a while by listening to the song of nightingale.

For him, beauty and nature must be cherished. On the other hand, Coleridge attempts to explore truth in order to attain the measures for problems and the obscurities of life, the other renowned writer Shelly also sensed and imagined beauty through intellectualization, moreover, Wordsworth explored the spiritualized dimensions of beauty. Nevertheless, Keats was not in the favour of the artistic subjectivity for propagating personal thoughts, rather he cherished beauty of nature which can be felt and imagined by the intellectual capabilities to grasp truth. He adored poetry and beauty literally for the sake of natural beauty. For Keats an impeccable poet is similar to an empty vessel which must be loaded with another potential beings and things. He was acquiescent to the nature in such a way that he did never attempt to change natural phenomena or even negate them. The golden

words of Keats that he believed in the holiness of the heart’s affection and truth of imaginations that seize as beauty must be truth, whether it is existent before or not. Hence, this stylistic analysis is not only based upon the dissection of the magnificent stylistic devices integrated for the portrayal of sentiments depicted in the poem by adorable John Keats, likewise it emphasized on the collective impression of the stylistic devices used in the entire construction of different parts represented together coherently and in well-adjusted manner in the poem. This masterpiece of Keats also symbolizes the literal concept of beauty. He wanted to create a divine relationship with through his invocations.

This stylistic analysis is in compliance with the relevant parameters and procedures of stylistic devices used in the poem to foreground the hidden intentions and sentiments of the renowned poet. The sensuousness, overall structure of the poem, imagery, figurative language, romantic allusions, and various sound patterns prove it to be an unprecedented masterpiece of John Keats. The stylistic approach is used to separate all the stylistic features for emotive and pictorial aims to elucidate this poem. Moreover, his choices of devices integrated in the structure which makes it a flawless and adorable piece of art; and find the symbolic elements to give Keats’ pure concept of beauty.

Research Questions:

1. What are the stylistic devices used related to Phonetic Level as well as Phonological Level and the emotive impacts of these devices?
2. What are stylistic devices employed relating to Graphitic Level in the ode?
3. What are the stylistic devices employed relating to Graphological Level?
4. What are the stylistic devices used relating to Lexical Level as well as Grammatical Level?
5. What are the stylistic devices exists in the ode relating to Semantic Level / Discourse Level and Pragmatic Level?
6. What are the integrated impact of the stylistic devices and the structure of the poem which have made this poem a great masterpiece?

Objectives:

1. To explore the stylistic devices at 8 major levels
2. To attain emotive functions achieved through these devices
3. To reveal the artistic beauty of employed stylistic devices in the structure of the poem

Methodology:-

There are mainly 8 Levels of Stylistic Analysis i.e. Phonetic Level/Phonological Level, Graphitic Level, Graphological Level, Lexical Level, Grammatical Level, Semantic Level / Discourse Level, Pragmatic Level. This stylistic analysis is based on the related stylistic devices of these major levels. For parts of speech tagging of this poem and stylistic devices representation, these softwares are used, Free CLAWS TAGGER, COMPLEAT LEXTUTOR, MAT TAGGER, SPSS, Antconc.

Literature Review:-

Stylistics makes our explanation valid and enriches our gratification of literature due to its objectivity as well as comprehensions in relation to linguistic terminologies. Nowadays, stylistics has become an inextricable part of modern-day criticism; none can merely overlook it because now it cannot be separated vast domain of literature. The development of plot and situations to conclude a moral evaluation are the major aims of writers and this purpose cannot be exclusively separated from style which is employed for artistic finer structure.

In stylistics, the analysts closely examine the text and analyze its noteworthy language forms for interpreting its main purpose and meanings; it is closer to practical critical analysis. Rather, stylistics plays its role in the reader response theory criticism or reception theory. It has a great effect in virtually every sort of critical approach. According to lexical interpretations, stylistics refers the discipline of literary style or the art of forming worthy style in writing. Leech and Short (1981:13) also describe it as "the linguistic study of style". Widdowson (1975:4) defines stylistics as follows:stylistics means the study of literary address from a linguistic orientationthat distinguishes stylistics from literary criticism on the basis of linguistics and stylistics and it comprises both literary criticism as well as linguistics according to the morphological make-up of this word that suggests: "style" and "istics".

The literary patterns and stylistics are integrated as compositions and colors to form a painting (Carter &Stockwell, 2008: 44). The stylistic analysis of literary language is based on linguistics; however, it can be perplexing term as the word 'style' was formerly referred to different varieties of language, namely the language of legal documents or religion. One of the contributions of stylistics is its objective way of analysis, inclusively linguistic tools of modern criticism as well as linguistic insights. —Language oriented theories attempt to form an analysis based upon objective methodology of and elucidation by concentrating on the artistic work independent of an author's actual aims (Kumar, 1987:40). Verdonk(2002:4) refer stylistics to be the analysis of characteristic expression in language, moreover, the portrayal of its main goal and impact. Bradford (1997:1) described that stylistics as an obscure and volatile subject matter with contribution to the immense multidimensional domain of literary studies will be in relation to style.

Nonetheless, these varieties are now considered to be registers. In the intervening time, the words style and stylistics have attained a specialized usage of application in literature. As literary language deviates, hence, certain features can be emphasized, or foregrounded, by distinguishing them (Ibid). In

fact, the writers knit their ideas to create new patterns and avoid banal sequences and formulate innovative combinations which fascinate readers. As unusual phrases have been composed, e.g. Dylan Thomas's phrase "a grief ago" overwhelms the readers' mind (Aitchison, 1999:141). Wales (1989:435) considered the word style to be difficult to define because in different ways readers may understand it, moreover, it may affect the features associated to stylistics as a part of linguistics. Additionally, most common features of style are given as follows:

1:- Wales (1989:435) highlighted that every individual has his own approach and technique of doing an action or writing about the similar theme or even explaining a painting. She urged that style can be diverse in several states of affairs and according to the level of formality which is termed as "style shifting". In addition, the genres of literature vary in their style e.g. poetry, drama, fiction, and other types of literature. Wales (1989: Ibid) expressed that style can deviate and differ through time, for instance, the style of modern and metaphysical poetry is fairly different.

2:-In fact, every person has a distinctive style which means the mode of expressing oneself in writing and speaking in an analogous way, this style is discernable in doing things e.g. in playing games or thinking in a particular way to find a solution for problems, speaking and sense of humour, or serious discussions, etc. this style can be good or bad (Ibid).

3:- Linguistics which represents the broader discipline and stylistics is its branch that assists readers to unveil the concealed clues related to the employed language. It is similar to a screw that shatters the pieces of the entire text into minor comprehensible parts. It can extremely help to comprehend and deduce the meanings of a particular literary work. Carter and Stockwell (2008: 39) emphasized that the linguistics can provide readers a viewpoint, an insight into a text that assist readers to produce a reliable analysis, and insist them to raise questions about the available language of the text. Initially, it is important to introduce important terms used in stylistics.

Furthermore, the amounts of linguistic features are employed to determine the style by which the personality of each writer can be reflected in his works, as mentioned in Wales' dictionary. The selection of lexical items and merging them is surely varied and recognizable. Jane Austen's novels e.g. Persuasion and Pride and Prejudice have noticeable resemblance in the style of the novelist in both of the texts (Wales, 1989:435). Carter &Stockwell (2008: 44) emphasize that there is versatility in the style of the author e.g. vigorous, formal or stately, and colloquial or conversational ones which depict the selection of specific structures instead of other available choices in the language. However, it is not always a conscious choice because if a writer had to make all phonological, syntactic, semantic and pragmatic selections consciously then it would be extremely time consuming. However, the mindset of the writer automatically ensures his style.

Foregrounding is an important feature of literary works which refers to give unusual distinction to an element or characteristics of a text, relative to other less perceptible dimensions as it is the practice of making something stand out from the surrounding words or images.(Paul Garvin: 1960s) Literary works foreground their own linguistic status, hence drawing attention to the manner how they say something rather

than to what they say. In fact, poetry differs from everyday speech as well as prose because of usage of meter, startling metaphors, alliteration, and other enthralling devices (Leech, 1969:43).

Phonological Level includes on the one hand, Segmental features i.e. Onomatopoeia, Sound Symbolism, Assimilation and Elision, Repetition of sounds e.g. Alliteration, Assonance, Rhyme. On the other hand, Phonological level also include **Supra-segmental features** i.e. Stress, Rhythm, Intonation, Pause, Tempo.

Graphology means the study of the writing system of a language. The **Graphological Level** includes the expression or realization of language in its written form where out of all the written marks are existing, each language opt for only a few. The carefully chosen marks are employed in a limited number of arrangements.

Lexical Level consists on General Wording Inclination i.e. General or Specific Vocabulary, simple or complex words on the basis of number of morphemes in a word, Rare Or Specialized or Latinate vocabulary in any Formal/informative text, descriptive words, evaluative, Slang words, Archaism, Neologism, Jargon, Collocation. Moreover, it also includes Word Types e.g. Affixation, Portmanteau or deviant forms such as words made by combining two words, Nonce words, Puns.

Grammatical Level includes firstly, Sentence Types namely declarative, interrogative, imperative or exclamatory; simple, compound, complex or complete or elliptical, and Parallelism, in addition this level also includes Clause Types e.g. independent clauses, dependent clauses, non-finite structures (infinitive/-ing/-ed structures), types of dependent clauses are favored in a text: relative, adverbial, or nominal clauses, the proportion of nouns to verbs, frequency of objects, complements, adverbials, frequency of transitive verb constructions. Furthermore, this Level includes clause elements, Group Types such as Nominal Group, premodified nominal groups, postmodified nominal groups.

Semantic / Discourse Level mainly emphasized on a text as a stretch of language which creates a unity by reason of its Linguistic Cohesion. Moreover, in this level the analysis of grammatical and lexical links to join sentences and words, use of synonyms, lexical sets, pronouns, verb tenses, time references, grammatical reference, explicit (the words which aids clarity and underlines the structure of an argument) or implicit (sequence of events) cohesive links.

In Semantic Level we also analyze Types of Connectives: Transitional Word/Phrase, Grammatical Devices like Ellipsis, Substitution, Co-Reference, Anaphora, Cataphora, and Lexical Reiteration.

Pragmatic level includes the study of the relationship between linguistic forms and the users of these forms and it deals with Deixis namely Personal, Spatial, Temporal Deixis, in addition, Presupposition and Entailment, Cooperation and implicature, The Cooperative principle like Maxims, Hedges, furthermore it also includes Speech acts, Felicity Conditions.

Biography of John Keats:-

Keats, John (1795-1821) universally regarded as the most endowed of the English romantic poets, Keats, whose artistic work was inadequately received and published during his

lifetime that he could not have relished his later acknowledgment and appreciation. Unluckily, he wrote for his own epigraph: "Here lies great poet whose name was considered to be immortal." Ode to a Nightingale (1819) Initial lines: My heart aches, and a drowsy numbness pains / My sense, as though of hemlock I had drunk, ...

John Keats' poetry is a concise but comprehensive summary of a larger work of the innovative use of lexical resources to create the desired impact on the readers. He systematized language resources to depict his experience in a skillful and conclusive manner. Keats' style is renowned from his contemporary era. Garrett Stewart focused in his article, 'Keats and Language' that John Keats was trained as a physician, self-schooled as a poet, and was an intuitive anatomist of language, closely articulated structure of poetry, ligaments and fibers of the language and its muscular tensions and release, rhythmic corridors of breath, a genetic and God-gifted specialist of poetic art in its origins and mutations. His pen was rather a stethoscope by which he took the phonetic pulse of the diction through the listening ear of script." (Cambridge Companion. 2001: 135)

John Keats created poems with astounding vivacity of diction; he developed optimum employment of verbal gifts as he had a distinctive negative ability. Keats' characteristic style emerged from the writing of *Isabella*. This style has an expressive power of impression that can arouse intense sentimental and visionary response. His style motivates the reader to attain literal recognition of the world of experiences. Before *Hyperion*, his poetic style was characterized by the subjective constituents with more empathic than sympathetic ways. It can be observed that the use of y-ending adjectives, hyphenated words, adverbs made from participles, abstract nouns, and the use of conventional props in his imagery were the prominent characteristics of his style during this adolescent period. It is analogous that Keats and Leigh Hunt both had tried in their respective styles to break away from the neoclassical devices of verse writing e.g. heroic couplets. Keats' Odes were his masterpieces which were distinguished by a deep melancholic feeling, a rich stress of introspection and grandeur of imagery. They depict his keen aesthetic sense of observing nature, art and mythology. These odes disclose his intuitive perception of the ultimate mystery of beauty. Graham Hough argues that his odes were closely integrated with the theme of transience and permanency. (Hough, G. 1969) Keats has an intense sensitiveness to relish the nature's beauty; however, this bliss is blended with a peculiar kind of wretchedness which seems to be informed with the despair of entire suffering humanity. These Odes are the expression in varying sentiments of a mind which has cherished the principle of beauty in everything, and pursues in a world of transformation and degeneration, among the momentous forms of exquisiteness and allurements, for everlasting and eternal life. Keats' Odes disclose the varied feelings of bliss, ecstasy and grief. They symbolize Keats' emotional response to the exquisiteness of nature, art, the volatility of life and disappearance of bliss. Keats' poetry has been interpreted with diversification of elucidations. Critics have monitored different frames for the analysis of these Odes for instance, the techniques of historical, psychological, mythological approaches etc. The Odes have spellbound scholars

to interpret in miscellaneous ways particularly to interpret the thematic concerns of the Odes, their literary virtues and aesthetic dimensions. Their structural characteristics, for instance, diction, stylistic features, verbal arrangement and the pioneering use of words to accomplish the sought after influence have not been thoroughly analyzed.

Ode to a Nightingale is the lengthiest and one of the unsurpassed of Keats's odes. Keats had used his ingenuity to create the ode-form, and structured the ode-stanza well-matched to his purpose, in the Ode to Psyche. Then in the summer of 1819, he wrote four odes: To a Nightingale, on a Grecian Urn, On Melancholy and on Indolence in a prompt sequence. Of these, the Ode to Nightingale was composed in an extraordinary way. It deals with Keats' natural obsessions with the opposite aspects of life e.g. the ideal and the real, the imaginary and the actual, elation and mourning, lastingness and transience, the unending and the spatial, etc.

Introduction of the poem:-

The poem begins at the height of the empathic experience. And the first stanza of the ode sharply juxtaposes the two empathies—pivoting them on the two central lines: the weighty and sluggish movement of the opening four lines conveying the dull ache of the poet's unnatural strain; the unruffled flow of the last four lines conveying the natural ease with which the bird participates in nature. Thus, the seminal elements of the poem are obvious. John Keats' desire is to reach to this perfect world of the bird's song. First he tries to reach the world with the help of wine and then through poetic imagination. According to Cleanth Brooks and Robert Penn Warren observe: "Ode to a Nightingale is a very rich poem. It contains some complications which we must not gloss over if we are to appreciate the depth and significance of the issues engaged. One of these complications has to do with the close connection between pleasure and pain; another, with that between life and death." (Stillinger, Jack. 1987: 45) It is generally believed that it was the first Ode to be composed after the Ode to Psyche between late April and early May, 1819. This longest ode of Keats was written with considerable speed within a few hours of a morning. The death of Keats' brother, Tom, financial difficulties and jealousy in his passion for Fanny Brawne provided the necessary background for the composition of the Ode. The poet contrasts the transitoriness of human life with permanence of the world of the bird's song. The ode contains eight regular stanzas of ten lines each. The movement of the thought in the poem is natural and unhampered. In the first stanza, the poet describes his ecstatic experience of listening to the beautiful song of the nightingale. In the ecstatic state, excessiveness of joy makes his heart ache and his senses are numbed. The song of the bird has dulled his brain and dimmed his consciousness and he has become forgetful of the evening. He is in a state of inertia and is led towards oblivion. The inseparability of pain and pleasure is aptly brought out in this stanza. The poem suggests a contrast between the mortal state and the world of perfect beauty represented by the song of the Nightingale.

Pedagogical implications of the study:-

It is noticeable that stylistics as a scientific discipline and is literally beneficial to those who are teachers, or students of

English language and literature. Whether English is the native language of the readers, or it is a second or the foreign language, not only foreign students but also the native speakers of the English language can benefit from stylistics. They can get the linguistic as well as the literary proficiency. At present, stylistics with its tools and methods of linguistics can assist to analyze literature logically and scientific comprehension of the literary texts based on linguistic evidences and systematic devices and finding these stylistic devices with the help of various productive softwares for corpus analysis.

Stylistic analysis of Ode To A Nightingale:-

According to Phonetic and Phonological level, this poem exhibits impressive Meter and Rhyme Scheme; it has eight separate stanzas which are written in iambic pentameter except the 8th line that is written in trimeter, e.g.

My sense/ as though/ of hem/ -lock I/ haddrunk

The rhyme scheme of each stanza is "ABABCDECDE", reflects exquisite symmetry e.g. pains/drains, drunk/sunk, lot/plot, happiness/numberless, trees/ease. Moreover, he used an unprecedented combination of short and long vowels to create melody and rhythm e.g. "And purple-stained mouth", "Cool'd a long age in the deep-delved earth", "What thou among the leaves hast never known", "Or emptied some dull opiate to the drains", "Away! Away! For I will fly to thee", "Still wouldst thou sing, and I have ears in vain". It can be observed that Keats used pattern of five "short" vowels tailed by "long" and "short" vowel combinations and it finishes with a "long" vowel.

In this level, Assonance and Consonance can be clearly observed in this ode, for instance, "Already with thee! tender is the night", represents assonance of "ea", "i", "e", moreover, "I cannot see what flowers are at my feet" shows assonance of "æ", "ee". This poem is an impeccable combination of consonance, for instance, "Or emptied some dull opiate to the drains", "And leaden-eyed despairs," contains consonance of "p", "t", and "d" sounds. Other examples are "But being too happy in thine happiness," "With beaded bubbles winking at the brim", "And with thee fade away into the forest dim:" represents consonance of "b", "p", "d", "w".

Alliteration is a prominent stylistic feature of Keats' poetry which creates melodious and sensory effect in his poetry, for instance, "hemlock I had drunk," "Or emptied some dull opiate", "But being too happy in thine happiness," "That thou, light-winged Dryad", "Singing of summer", "deep-delved earth", "With beaded bubbles winking at the brim," "As she is fam'd to do, deceiving elf", "fade away into the forest dim," "Fade far away", "the leaves hast never known", "Away! away! for I will fly", "Fast fading violets",. These examples represent alliteration of "h", "b", "o", "ð", "s", "d", "b", "w", "f", "n", "f" sounds.

Graphetics/ Graphology:-

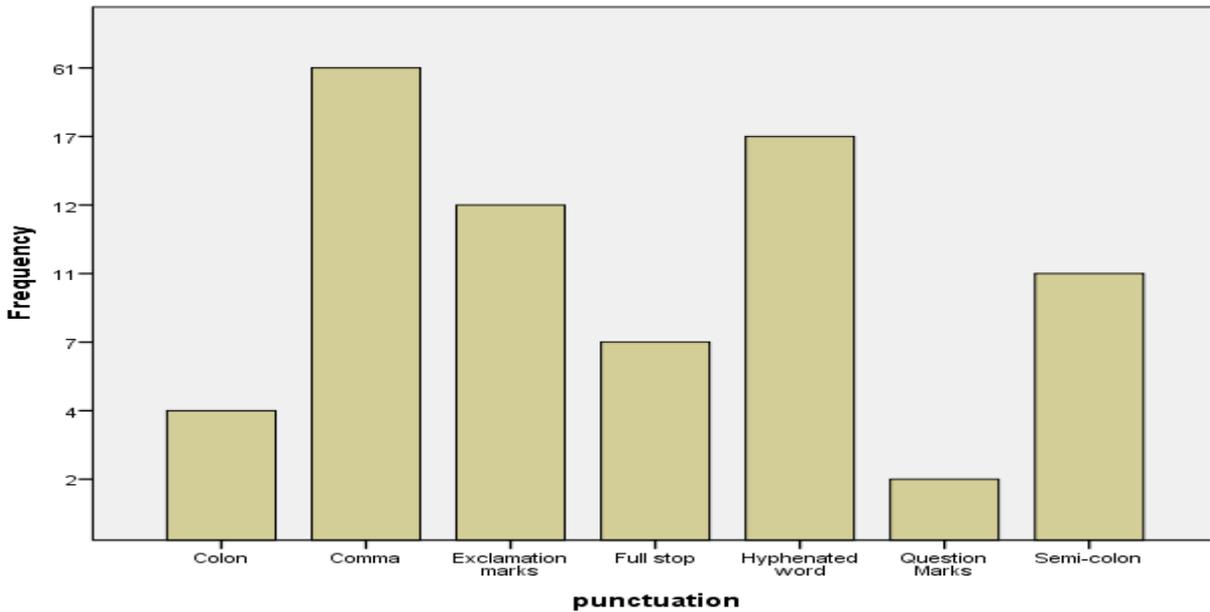
The direction of writing of this poem is conventional i.e. (left to right) and marked (top to bottom), moreover, Layout of text has spatial organization. Its title represents the symbol of aspiration of happiness with eternal life which is elusive and therefore leads to annihilation and nothingness. The Greek Mythological references reflect the beliefs of Keats and his mystic meditation. Moreover, rhetorical considerations can be

observed in this poem as, at the end of the poem, “Was it a vision, or a waking dream?”, “Fled is that music:- Do I wake or sleep?”.

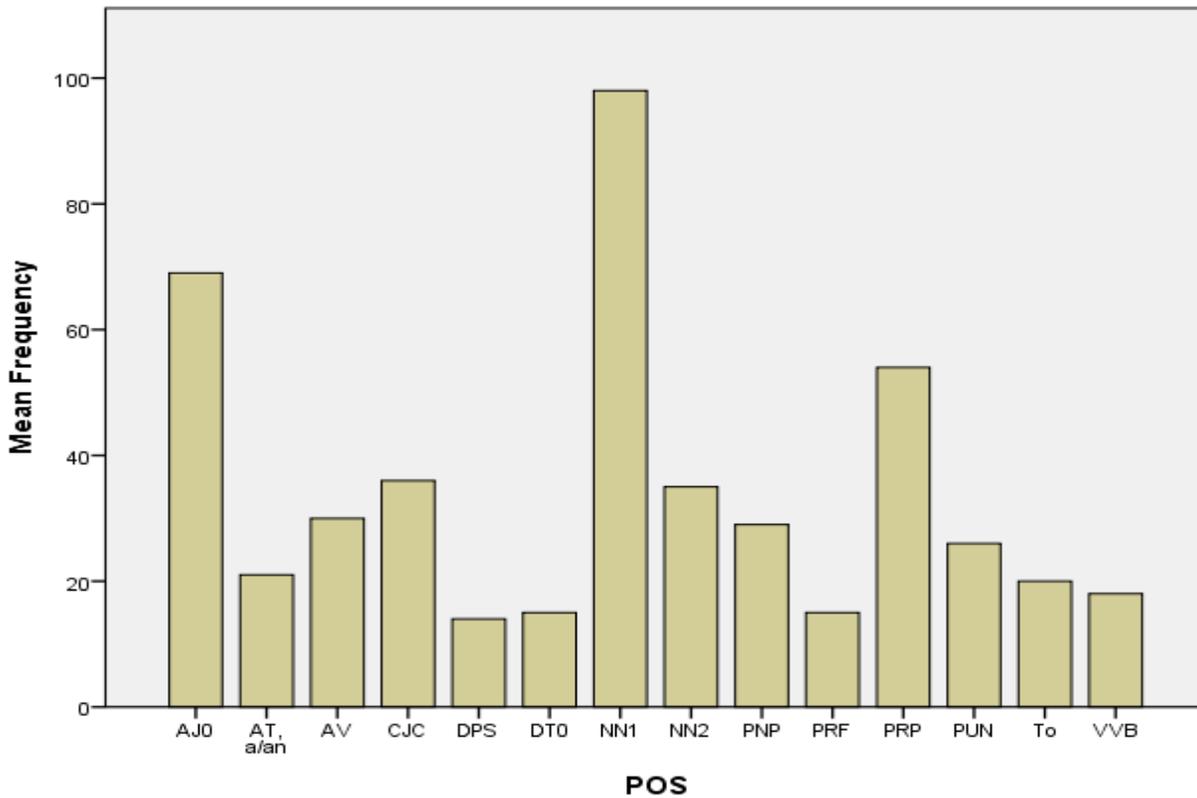
It can be observed that the Capitalizations of proper names, important words, conveys loudness and stress on the major themes of this poem i.e. happiness versus sadness, eternal life versus death. In addition, repetition of letters e.g.” My heart

aches,/ My sense,”” Adieu! the fancy cannot cheat so well”, “Adieu! adieu! thy plaintive anthem fades”, represent symmetry in speech representation.

Punctuation marks include, 61 commas, 2 question marks, 4 colons, 11 semi-colons, 12 exclamation marks, 17 hyphens e.g. hyphenated words, and 7 full stops.



Grammatical Level:-



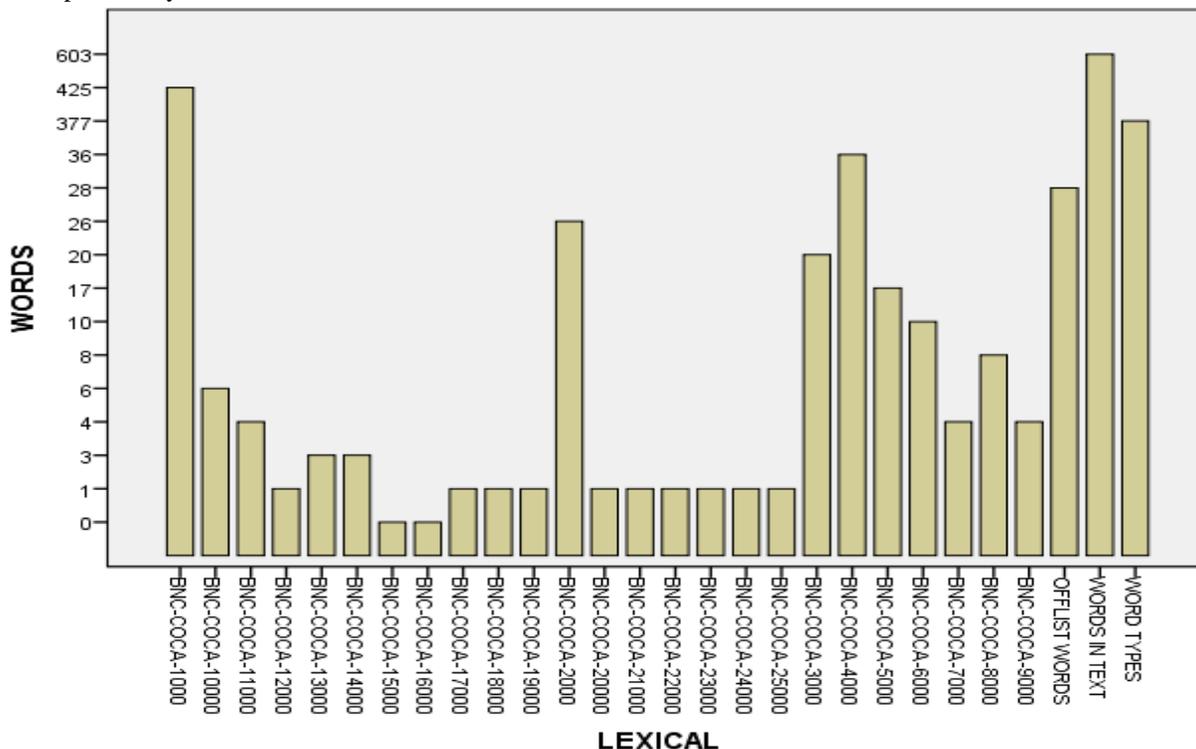
Parts of speech used in this poem are disclosed through the diagram.

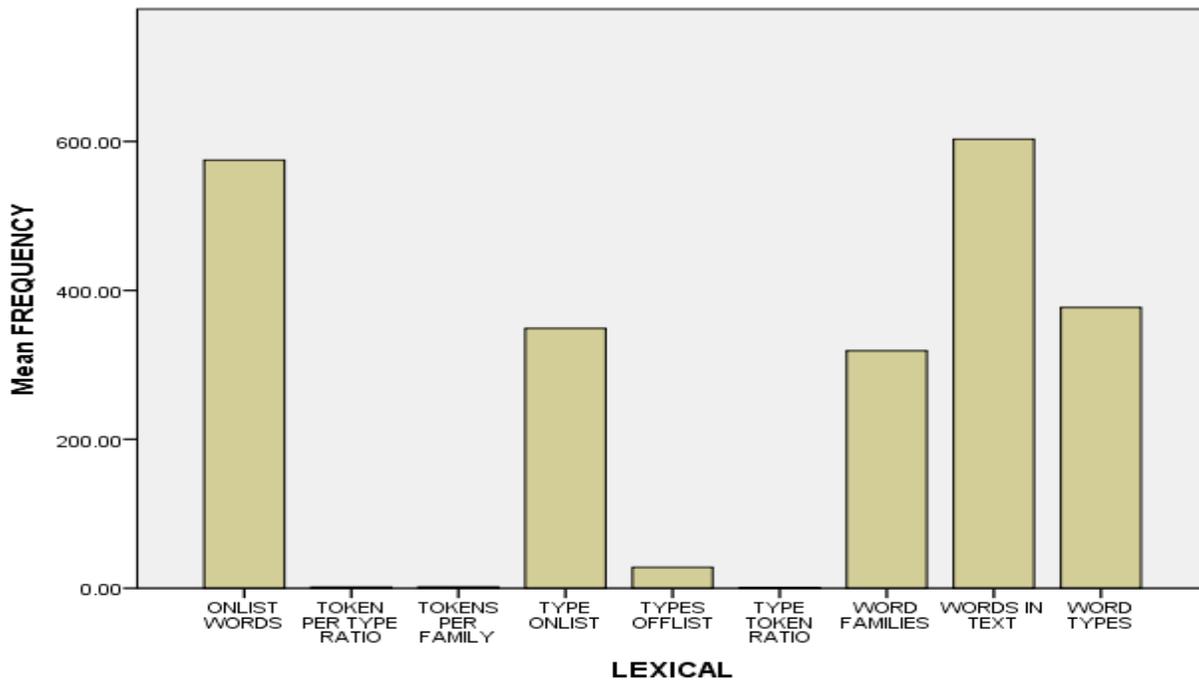
AJ0	AJ0= 69	adjective (unmarked) (e.g. GOOD, OLD)
AT0	AT0=41+20times TO	article (e.g. THE, A, AN)
AV0	AV=30	adverb (unmarked) (e.g. OFTEN, WELL, LONGER, FURTHEST)
CJC	CJC=36	coordinating conjunction (e.g. AND, OR)
DPS	DPS=14	possessive determiner form (e.g. YOUR, THEIR)
DT0	DT0=15	general determiner (e.g. THESE, SOME)
NN1	NN1=98	singular noun (e.g. PENCIL, GOOSE)
NN2	NN2=35	plural noun (e.g. PENCILS, GEESE)
PNP	PNP=29	personal pronoun (e.g. YOU, THEM, OURS)
PRF	OF-PRF=15	the preposition OF
PRP	PRP=54	preposition (except for OF) (e.g. FOR, ABOVE, TO)
PUN	PUN (and)=26	punctuation - general mark (i.e. . ! , ; - ? ...)
VVB	VVB=18	base form of lexical verb (except the infinitive)(e.g. TAKE, LIVE)

Lexical Level:-

In this poem, related ratios and indices pertaining to the text are given as follows:-

- Words in text (tokens): 603
- Different words (types): 377
- Type-token ratio: 0.63
- Tokens per type: 1.60
- Pertaining to onlist only
- Tokens: 575
- Types: 349
- Families: 319
- Tokens per Family : 1.80





BNC-COCA-1,000 types: [fams 191 : types 215 : tokens 425]

BNC-COCA-2,000 types: [fams 25 : types 26 : tokens 26]

BNC-COCA-3,000 types: [fams 17 : types 19 : tokens 20]

BNC-COCA-4,000 types: [fams 21 : types 24 : tokens 36]

BNC-COCA-5,000 types: [fams 17 : types 17 : tokens 17]

BNC-COCA-6,000 types: [fams 10 : types 10 : tokens 10]

BNC-COCA-7,000 types: [fams 4 : types 4 : tokens 4]

BNC-COCA-8,000 types: [fams 7 : types 7 : tokens 8]

BNC-COCA-9,000 types: [fams 4 : types 4 : tokens 4]

BNC-COCA-10,000 types: [fams 6 : types 6 : tokens 6]

BNC-COCA-11,000 types: [fams 4 : types 4 : tokens 4]

BNC-COCA-12,000 types: [fams 1 : types 1 : tokens 1]

BNC-COCA-13,000 types: [fams 3 : types 3 : tokens 3], for instance, Hemlock, morrow, nightingale

BNC-COCA-14,000 types: [fams 1 : types 1 : tokens 3] e.g. adieu

BNC-COCA-17,000 types: [fams 1 : types 1 : tokens 1] e.g. provencal

BNC-COCA-18,000 types: [fams 1 : types 1 : tokens 1] e.g. Dryad

BNC-COCA-19,000 types: [fams 1 : types 1 : tokens 1] e.g. darkling

BNC-COCA-20,000 types: [fams 1 : types 1 : tokens 1] e.g. wast

BNC-COCA-22,000 types: [fams 1 : types 1 : tokens 1] e.g. poesy

BNC-COCA-23,000 types: [fams 1 : types 1 : tokens 1] e.g. wherewith

BNC-COCA-24,000 types: [fams 1 : types 1 : tokens 1] e.g. Eglantine

BNC-COCA-25,000 types: [fams 1 : types 1 : tokens 1] e.g. Lethe

OFFLIST: [?: types 28 : tokens 28]

Bacchus, beechen, blushful, easeful, faery, fam, fays, haply, Hippocrene, midnight, murmurous, pards, ruth, seasonable, singest, sunburnt, verdurous, viewless, wouldst.

Semantic Level and Pragmatic Level:-

This ode is an “**Apostrophe**” i.e. direct address to a nightingale which is **personified**. The starting lines of first stanza shows **Foregrounding** as the ache that is not relating to his will rather it disclose emotional pain not mind but literally his heart is aching and his senses are numb. In fact, Keats’ negative capability, i.e. that is when man is capable of being in uncertainties, mysteries, doubts, without any irritable reaching after fact and reason, is conspicuous along with his emotional

distress and longing for happiness and eternity. He was aspiring to overcome bitter realities of life and longing for nature to heal him. He gave examples of **Hemlock** i.e. a poisonous tree from where **Socrates** drank and died by numbness. Keats was a patient of **Tuberculosis**, that is why he felt that his consciousness is numb and dull. Afterwards, an obsessional combination of emptiness versus dullness was emphasized by giving **mythical allusion** of river of **Lethe** which is known as a river of **forgetfulness**. This metaphor reveals that he wanted to escape arduous realities of life.

Through his intuition and imagination, he addressed to the nightingale that he is not jealous rather share happiness of the bird but the loss of consciousness went side by side with the contrasting images. g. contrast of ease to the dullness, numbness versus wit of poetry. Later, the other **mythical allusion** and metaphor is found when he was requesting nature's wine, thus he alluded to wine for seeking a solution in the form of wine of nature to have a life without worries and care. On the contrary, he wishes for fullness of consciousness to ease the burden of reality and for going to supernatural world of imagination which is beautiful and serene, moreover, he prayed to Goddess of poetry named Flora to give him wit of poetry. This represents not ordinary joy rather; nature's producing joy in the provincial area of France or Italy, i.e. Provencal songs as well as he wants to resolve the solution to his problems. The antonymic words display contrasts mirth and fullness to dullness and emptiness, Lethe versus **Hippocrene** i.e. river of oblivion versus river of consciousness and poetic wit respectively. It reveals the emptiness of his life, annihilation and nothingness versus fullness and pleasure, whereas he wanted to escape from bitterness of life. **Hippocrene** refers to the River of poetic inspiration which is used as a **mythological allusion** and represent **Hellenism** in this ode.

Personification of beaded-bubbles as winking at the brim shows the **sensuousness** felt by the poet and his creation of **imagery** to sense nature's producing mirth, brightness of summer, enjoyment and relishment. Moreover, the transcendent experience and fullness of poetic consciousness are integrated with Keats' wish to join the happiness of the nightingale in which he was looking for escape from transient world by going with the nightingale, he compares this world with divine paradise and disclose the dimness of the world. Nevertheless, later he referred his personal conflict by describing to be dissolved, cease his life, remorse over temporary life, **annihilation**, because of his broken relationship with a girl due to Tuberculosis, his lost family members in early age owing to the disease.

Afterwards, **Paradox** representing man's world, **annihilation/nothingness**, tragedy of old age, mortality, aging, transience, death, never maintainable youth forever, and added oxymoron "full of sorrow" i.e. fullness but fullness of sadness rather than happiness. The use of Simile to show the eyes heavy as lead is demonstrating the situation of death of old and young human beings.

The 8th line has 6 syllables per line which is iambic trimeter. He emphasized on that the beauty is not going to last, thus, the mourning and lamenting on transient life that is fading away are emphasizing the main theme of the ode, preceded by a **Mythological allusion** of **Roman God of wine** named **Dionysius**, moving along with his leopards

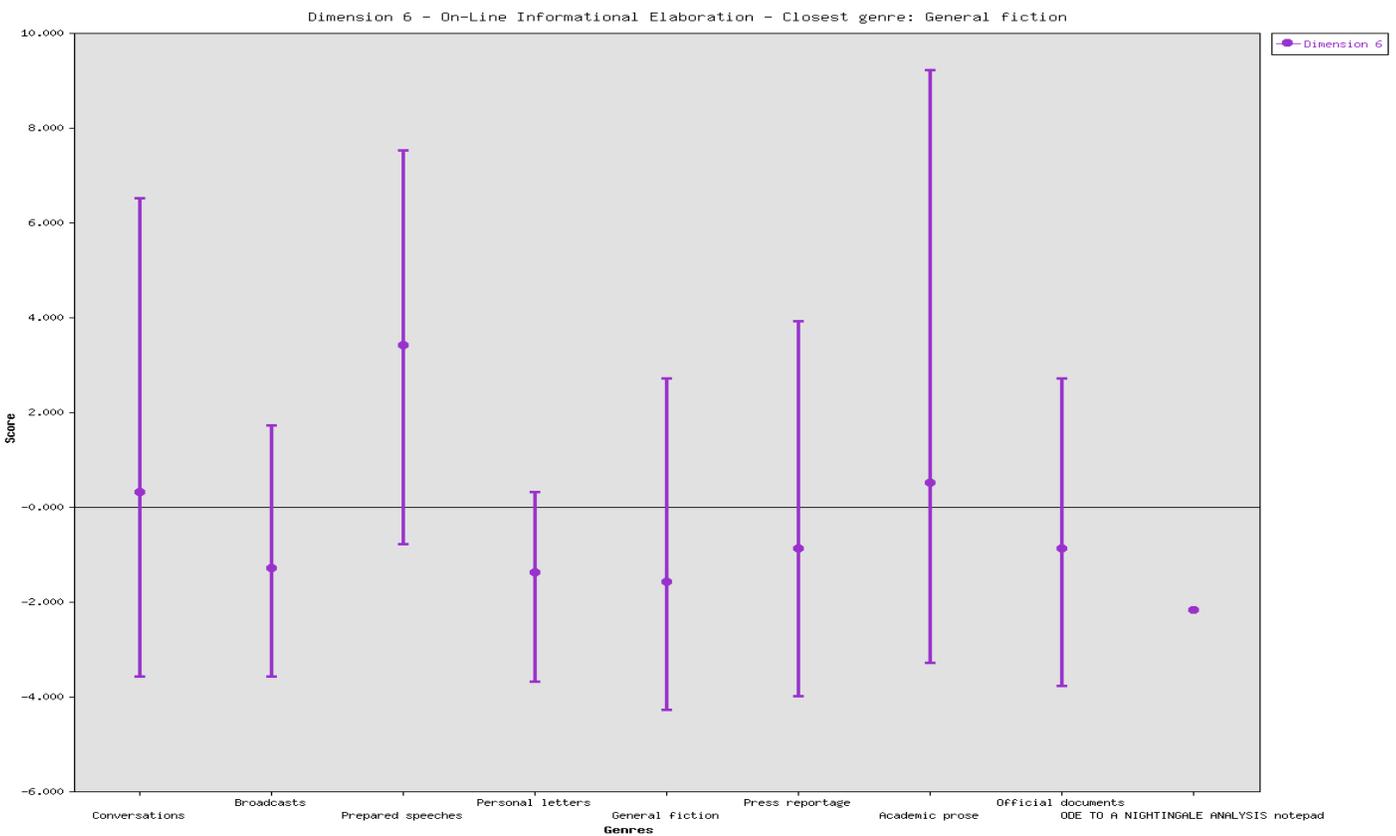
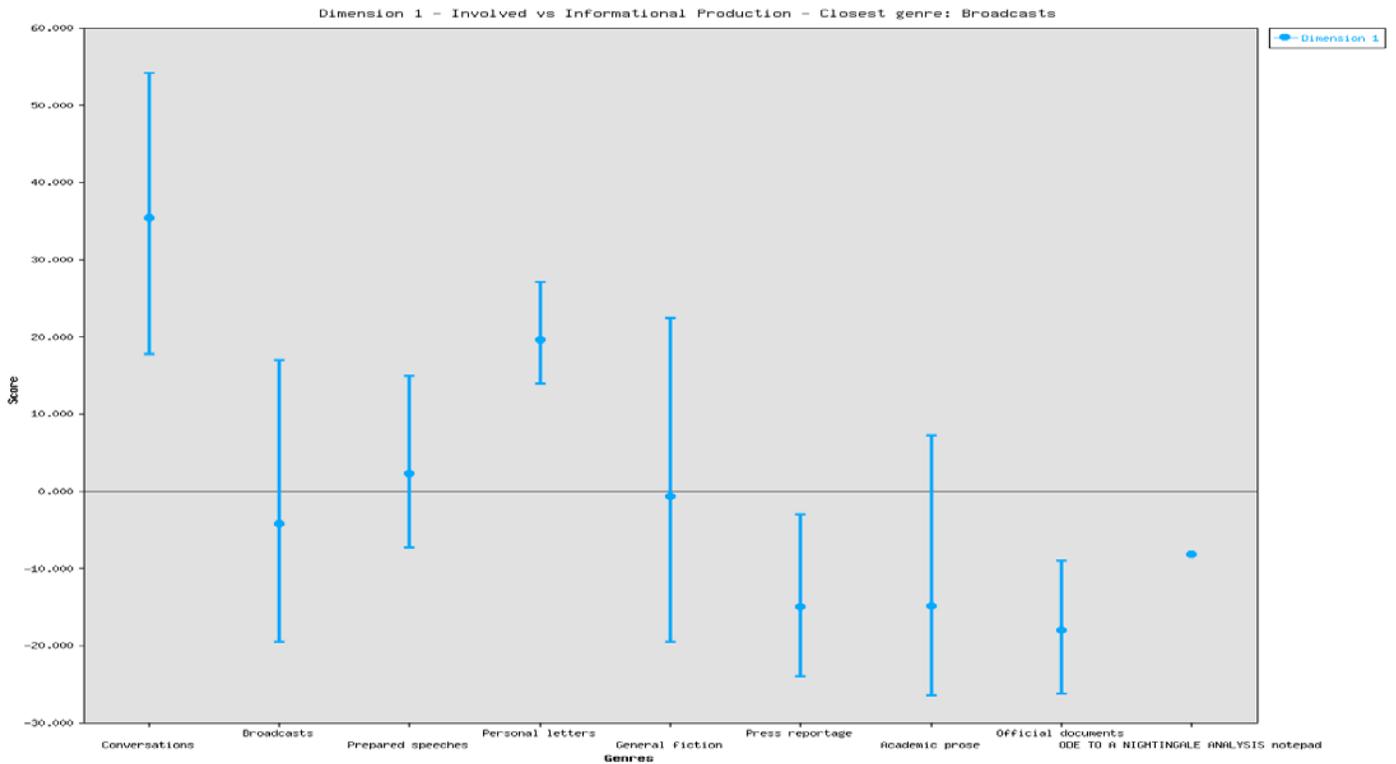
, hence, with the help of his poetry he aspired to flee from the world. He felt slowness of brain, and that the nights are tender, this tenderness of the night in the world of darkness only gets light merely comes through breeze, a flickering and unstable light which is insufficient to dispel the gloom, dullness, darkness, confusion, in fact, no light refer to blindness of man, funeral. During his flight into the natural world where he felt sweetness and wildness of the natural world and his experience of flight was considered to be blind flight by Keats. He effectively explained the theme of death as an ultimate escape from wretchedness of life and praised the bird's song so much that he lived life and now ready to die satisfactorily after feeling natural bliss from the song the he reveals a **Presupposition** that if he would die then he could not be able to listen that lovely song and it would become a bereavement over his funeral, then the Death bell waked him up from the ecstasy he felt through that eternal song of nature in the form of that nightingale. Hellenism is a discernable feature of Keats' poetry.

II. DISCUSSION

This stylistic analysis discloses the impressive features of John Keats' poetic style which made him an immortal poet because of his divine skill of describing thought-provoking and insightful themes with symmetrical dispositions. It is discernible in this analysis that there is symmetry regarding the phonetic and phonological level because of conspicuous alliteration, rhyme scheme, assonance and consonance in this Ode, moreover, the personification and paradoxes made it more exquisite and charismatic poem which was also adorned by the use of rhetorical questions, **mythical allusions** and imagery to represent the themes of nothingness, annihilation, aspiration of eternal life and bliss which seem to be unachievable. According to Graphetics and Graphology, it can be seen that Keats used commas and hyphenated word to create a flow between the main themes of annihilation, death and eternal bliss. Moreover, the usage of hyphenated words created more meaningful combination of words packed with emotions and symbolic meanings. This study found, with the help of CompleatLextutor Software, the Vocabulary profile in which some off-list vocabulary other than British National Corpus was found, however, 425 words were from BNC-COCA-1000, hence were easily understandable for most of the readers.

MAT Tagger Analysis of the Ode:-

According to MAT Tagger, the genre of this ode reveals the following results.



This ode is closest to general narrative exposition with the features expressed in the above two diagram generated according to MAT tagger software.

III. RESULTS

This study depicts the stylistic features of John Keats' poetic style by analyzing the stylistic devices of 8 major levels of stylistics; the major discernable features are use of nouns,

adjectives, mythical allusions of Hellenism, hyphenated words, off-list unique words with symmetrical alliterations, assonances and consonances, with a systematic rhyme scheme and described the thought provoking themes of annihilation, nothingness and death. It is very clear from the biography of the poet that he confronted ultimate tragedy and adversity in his very short life span which compelled him to wish for eternal bliss, immortality and divine link with Greek Deities. In fact, Keats unprecedented and unparalleled style have made him alive eternally till the end of this world.

Annex:-

Text of the Poem:-

ODE TO A NIGHTINGALE

I

My heart aches, and a drowsy numbness pains
My sense, as though of hemlock I had drunk,
Or emptied some dull opiate to the drains
One minute past, and Lethe-wards had sunk:
'Tis not through envy of thy happy lot,
But being too happy in thine happiness,
That thou, light-winged Dryad of the trees,
In some melodious plot
Of beechen green, and shadows numberless,
Singest of summer in full-throated ease.

II

O, for a draught of vintage! that hath been
Cool'd a long age in the deep-delved earth,
Tasting of Flora and the country green,
Dance, and Provencal song, and sunburnt mirth!
O for a beaker full of the warm South,
Full of the true, the blushful Hippocrene,
With beaded bubbles winking at the brim,
And purple-stained mouth;
That I might drink, and leave the world unseen,
And with thee fade away into the forest dim:

III

Fade far away, dissolve, and quite forget
What thou among the leaves hast never known,
The weariness, the fever, and the fret
Here, where men sit and hear each other groan;
Where palsy shakes a few, sad, last gray hairs,
Where youth grows pale, and spectre-thin, and dies;
Where but to think is to be full of sorrow
And leaden-eyed despairs,
Where Beauty cannot keep her lustrous eyes,
Or new Love pine at them beyond to-morrow.

IV

Away! away! for I will fly to thee,
Not charioted by Bacchus and his pards,
But on the viewless wings of Poesy,
Though the dull brain perplexes and retards:
Already with thee! tender is the night,
And haply the Queen-Moon is on her throne,
Cluster'd around by all her starry Fays;
But here there is no light,
Save what from heaven is with the breezes blown
Through verdurous glooms and winding mossy ways.

V

I cannot see what flowers are at my feet,
Nor what soft incense hangs upon the boughs,
But, in embalmed darkness, guess each sweet
Wherewith the seasonable month endows
The grass, the thicket, and the fruit-tree wild;
White hawthorn, and the pastoral eglantine;
Fast fading violets cover'd up in leaves;
And mid-May's eldest child,
The coming musk-rose, full of dewy wine,
The murmurous haunt of flies on summer eves.

VI

Darkling I listen; and, for many a time
I have been half in love with easeful Death,
Call'd him soft names in many a mused rhyme,
To take into the air my quiet breath;
Now more than ever seems it rich to die,
To cease upon the midnight with no pain,
While thou art pouring forth thy soul abroad
In such an ecstasy!
Still wouldst thou sing, and I have ears in vain
To thy high requiem become a sod.

VII

Thou wast not born for death, immortal Bird!
No hungry generations tread thee down;
The voice I hear this passing night was heard
In ancient days by emperor and clown:
Perhaps the self-same song that found a path
Through the sad heart of Ruth, when, sick for home,
She stood in tears amid the alien corn;
The same that oft-times hath
Charm'd magic casements, opening on the foam
Of perilous seas, in faery lands forlorn.

VIII

Forlorn! the very word is like a bell
To toll me back from thee to my sole self!
Adieu! the fancy cannot cheat so well
As she is fam'd to do, deceiving elf.
Adieu! adieu! thy plaintive anthem fades
Past the near meadows, over the still stream,
Up the hill-side; and now 'tis buried deep
In the next valley-glades:
Was it a vision, or a waking dream?
Fled is that music:- Do I wake or sleep?

REFERENCES

- [1] Turner G. W. Stylistics. England: Penguin Books, 1973.
- [2] Chapman, Raymond. Linguistics and Literature: An Introduction to Literary Stylistics. London: Edward Arnold, 1973.
- [3] Widdowson. H. G. Stylistic: the Teaching of Literature. London: Longmans, 1975.
- [4] Wales. Dictionary of Stylistics. 2001.
- [5] The Cambridge Companion to Keats, 2001.
- [6] Hough G. Style and Stylistics. London :Routledge and Kegan Paul, 1969.
- [7] Stillinger, Jack. ed. The Poems of John Keats, ed. Cambridge: Harvard University Press, 1987.
- [8] Stillinger, Jack. ed. The Poems of John Keats, ed. Cambridge: Harvard University Press, 1987.

- [9] Bate W. J. (ed.) Keats: A Collection of Critical Essays. New York: Prentice Hall, 1964.
- [10] Dr. S. C. Mundra (1996). John Keats, Selected Poems. 7th edition.
- [11] Grant F. Scott (2002). Selected Letters of John Keats. Harvard University Press.
- [12] H. Buxton Forman (1907). The Complete Poetical Works of John Keats. Oxford University Press.
- [13] Compleatextutor , Vocabulary Profiler
- [14] ntconc Software
- [15] MAT Tagger
- [16] Free CLAWS POS Tagger C5 Tagset
- [17] SPSS

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