

# International Journal of Scientific and Research Publications

Print Version, Volume 8, Issue 8  
August 2018 Edition  
ISSN 2250-3153



IJSRP Inc.  
[www.ijsrp.org](http://www.ijsrp.org)



DOI: 10.29322/ijsrp

# International Journal of Scientific and Research Publications

## **GENERAL INFORMAIION:**

IJSRP, International Journal of Scientific and Research Publications publish monthly journal under ISSN 2250-3153.

## **ONLINE VERSION**

<http://www.ijsrp.org/e-journal.php>

## **PRINT VERSION (E-book)**

<http://www.ijsrp.org/print-journal.php>

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# The Effect of Job Stress Toward Employee Performance Through Job Satisfaction of PT Muara Alam Sejahtera Employees

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DOI: 10.29322/IJSRP.8.8.2018.p8002

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8002>

**Abstract-** The purpose of this study to analyze the effect of job stress on performance, the effect of job stress on job satisfaction, the effect of job satisfaction on performance, and the effect of job stress on performance through job satisfaction. Job stress is a condition of psychological distress felt by employees as a result of organizational stressors. Job stress can affect job satisfaction and employee performance. Job satisfaction as a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences. Using the survey data on 126 employees of PT MAS, data analysis in this research using Structural Equation Model (SEM) in model and hypothesis testing.

This study finding that there is a significant effect of job stress on performance and job satisfaction, there is a significant effect of job satisfaction on performance, and there is effect of job stress on performance through job satisfaction. So it can be concluded that all results of the proposed hypothesis can be accepted.

**Index Terms-** Job Stress, Job Satisfaction, Employee Performance

## I. INTRODUCTION

Job stress is a condition of psychological pressure which is vulnerable in a competitive and volatile work environment as it is happening currently. In addition to work environment, the demands and targets of the company, to be achieved by the employees is also the main source of the cause of job stress. Job stress can affect the employee performance. Excessive employee's job stress should be avoided, as it can lead to a lot of absenteeism, errors in work, low performance and loss of company reputation caused by uncomfortable work environment (Seňová and Antořová, 2014). However, job stress, which can be handled well and still at low levels, can be a factor that motivates employees to work better (Halkos and Bousinakis, 2010).

Currently, employee performance is strongly influenced by job satisfaction and the levels of job stress the employee experiences. Relevant studies obtained the findings that 50-60% of job stress is a major cause of low employee performance (Choobineh, Ghanavati, and Hosseini, 2016). By the existence of the goals and objectives to be achieved by an organization, the employees

must be able to adapt many demands in their jobs. It can lead to stress for the employees. Long-term stress may overwhelm a person with demands that he/she cannot meet, resulting in job dissatisfaction and a low performance (Robbins and Judge, 2017).

Excessive stress can increase job dissatisfaction (Reilly, Dhingra, and Boduszek, 2014). Job dissatisfaction may relate with a number of dysfunctional outcomes including employee turnover, increased employee absenteeism and declining employee performance (Kreitner and Kinicki, 2014). Job satisfaction involves reaction or cognitive, effective and evaluative characters. Job satisfaction is a state of happy or positive emotions that comes from a person's job assessment or work experience. Job satisfaction not only can reduce stress but also help in improving performance, reducing employee turnover, and reducing absenteeism (Luthans, 2006). An employee who gets job satisfaction will carry out his/her work well so that the performance will increase. Meanwhile, an employee who does not get job satisfaction will be frustrated and it will affect the declining performance.

PT MAS is a subsidiary of Baramulti Group engaged in coal mining in Lahat, South Sumatra. In the preliminary study, it is known that in PT MAS there is a low performance of absenteeism and high turn over. Performance degradation was assessed as a result of stressors from excessive workload, over-demanding leadership and layoffs. Other causes of employee dissatisfaction due to uncomfortable work environment and small promotion opportunities that exist.

Researches regarding the effect of job stress on performance through job satisfaction had been conducted by some previous researchers. De Simone, Cicotto, and Lampis (2016), who conducted research on employees in the Italian pharmaceutical industry, found that job stress had a negative effect on job satisfaction and performance. Similar results were obtained by Darsono (2015), Seňová & Antořová (2014), Arshadi and Damiri (2013), Yozgat, Yurtkoru and Bilginoglu (2013), Charisma (2014) and Putri (2014). However, different findings were found by Hoboubi, et al (2017) who found that there was no effect between job stress and performance and there was a significant positive correlation between job satisfaction and performance. The findings of this research were also supported by Sutrisno

(2014) who obtained the result that job stress had no effect on employee performance due to high character of personality and morale. Due to differences from the findings of researches that

**Job Stress** – According to Kreitner and Kinicki (2014), stress is an adaptive response, related to individual psychological characteristics and/or processes, which are a consequence of any external action, situation, or event that places a person's psychological and/or physical demands. According to Robbins and Judge (2017), in an organization there are several factors that may cause stress including: (a) task demands that include the design of individual work (autonomy, task diversity, degree of automation), working conditions, and physical layout of work; (b) role demands relating to the pressure that a person exerts as a particular function he or she plays in the organization. Role conflict creates expectations that may be difficult to complete or meet. Excessive workload and too little workload are stress generators; (c) interpersonal demands are pressures created by other employees in the organization. Unclear communication between one employee and others will lead to unhealthy communication.

**Model of Stress-Performance** – The pattern studied the most regarding the stress literature on performance is the Inverted-U Relationship. The logic underlying the Inverted-U is that low-to-moderate stress levels stimulate the body and improve the ability to work better, diligently, and quickly. However, excessive stress can burden a person with unfulfilled demands, resulting in lower performance.

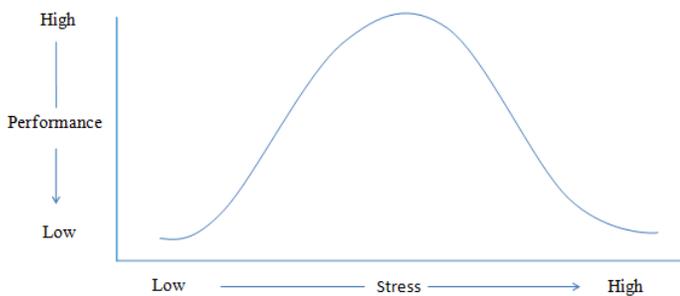


Figure 1

U-inverted Relationship between Stress and Performance

**Job Satisfaction** – Locke in Luthans (2006) provides a comprehensive definition of job satisfaction that includes cognitive, affective and evaluative reactions or attitudes which state that satisfaction is a pleasure or positive feeling that comes from employee's perception of how well their work is and is considered important. The main factors affecting job satisfaction are:

1. The job itself, jobs that have the characteristics of challenging, not boring and support creativity can increase employee job satisfaction.
2. Wages, Employees view wages as a reflection of how management values their contribution to the company. Wages that are not in accordance with the given workload can trigger discontent from employees.

had been done before, the author is interested in conducting research on this topic.

## II. LITERATURE REVIEW

3. Promotion, promotions made on the basis of performance will give more job satisfaction than promotions on the basis of seniority.

4. Supervision, There are two dimensions of supervision that affect job satisfaction namely (1) focusing on the needs of employees. (2) The dimension of participation allows employees to participate in decisions that affect their work.

5. Working conditions/environment, if good working conditions (clean and attractive environment) then employees will be more eager to do their work, but if the working conditions are fragile (hot and noisy environment) for example, employees will be more difficult to complete their work.

**Performance** – According to Malthis and Jackson (2006), performance is what employees do or do not do. Employee performance is what affects how much they contribute to the organization. According to Robbins and Judge (2017), there are six indicators to individually measure the employee performance, namely:

1. Quality, the quality of work is measured by employee perceptions of the quality of work produced and the perfection of tasks to the skills and abilities of employees.
2. Punctuality, is the activity level completed at the beginning of the stated time, viewed from the point of coordination with the output and maximizing the time available for other activities.
3. Effectiveness, the level of use of organizational resources (energy, money, technology, raw materials) maximized with the intention of increasing the yield of each unit in the use of resources.
4. Independence, the level of independence of an employee who will be able to perform its work function
5. Work commitment. a level where employees have loyalty and responsibility to the company.

Employee performance is what affects how much they contribute to the organization, (Malthis and Jackson, 2006). Currently, employee performance is very affected by job satisfaction and level of job stress experienced by employees. One of the psychic symptoms caused by job stress is the occurrence of job dissatisfaction, while the behavioral symptom that arises is the declining employee performance (Robins and Judge, 2017).

**Hypotheses** – There are several hypotheses to be tested in this research, consisting of:

- H1: Job stress affects the performance of PT Muara Alam Sejahtera employees
- H2: Job stress affects the job satisfaction of PT Muara Alam Sejahtera employees
- H3: Job satisfaction affects the performance of PT Muara Alam Sejahtera employees
- H4: Job stress indirectly affects the performance through job satisfaction of PT Muara Alam Sejahtera employees

### III. METHOD

This study was conducted at MAS located in South Sumatera. Data collection was carried out by using questionnaires distributed to the respondents i.e. all employees of PT. MAS totaling 126 people. Each item statement of the questionnaire has five alternative answers with the following scores: strongly agree with the score of 5, agree with the score of 4, neutral with the score of 3, do not agree with the score of 2, strongly disagree with the score of 1. The data was processed using Structural Equation Model (SEM) with Partial Least Square (PLS) software.

### IV. FINDINGS AND DISCUSSIONS

#### 1. Outer Model Test (Measurement Model)

##### a) Discriminant Validity

Table 1 : Loading Factor and Average Variance Extracted (AVE) Value

Variables	Indicators	Symbol	Factor Loading	AVE Value	
Job Stress	Work Load	X1	0.901	0.809	
		X2	0.740		
	Role Conflicts	X3	0.848		
		X4	0.795		
		X5	0.886		
	Role Ambiguity	X6	0.746		
		X7	0.642		
	Skill	X8	0.702		
		Restructurisation	X9		0.772
			X10		0.689
Job Satisfaction	The job itself	Y1	0.951	0.825	
		Wages	Y2		0.979
	Y3		0.811		
	Promotion		Y4		0.720
		Y5	0.985		
	Supervision	Y6	0.973		
		Y7	0.741		
	Environment	Y8	0.983		
Performance		Quality	Y9	0.875	0.603
	Y10		0.956		
	Punctuality	Y11	0.910		
		Y12	0.868		
	Effectiveness	Y13	0.869		
		Independence	Y14	0.961	
	Commitment		Y15	0.953	
Y16		0.833			
Y17	0.927				

Y18 0.925

Based on the above table it can be seen that most of the loading factor produce value > 0.7, but on indicator X7 (0.642) and X10 (0.689) has a loading factor value < 0.7, but we do not need to discard the indicator. According to Abdillah and Jogianto (2015: 206), the indicator should be maintained when the AVE value is > 0.5. From the calculation result, the AVE value of all indicators, generated above 0.5. So it can be concluded that there is no convergence validity problem on the model under test.

##### b) Reliability

Table 2 : Composite Reliability and Cronbachs Alpha Value

Variabel	Composite Reliability	Cronbachs Alpha
Job Stress	0.938	0.925
Job Satisfaction	0.971	0.964
Performance	0.979	0.976

The table above shows that all variables have CR > 0.7 and Cronbach Alpha > 0.6. So it can be concluded that no reliability problems found in this study.

#### 2. Inner Model Test (Structural Model)

Table 3 : R-Square Value

Variabel	R Square
Job Stress to Job Satisfaction	0.251
Job Stress to Performance	0.337

Based on the above table, it is known that job stress affect the job satisfaction of 25.1% and the remaining 74.1% influenced by other variables not included in the study. This means that job stress has a weak effect on employee job satisfaction (< 33,3%). Job stress affect the performance of 33.7% and the remaining 66.3% influenced by other variables not included in the study. It can be concluded that job stress has a moderate effect on employee performance (33,3 % - 66,6%).

#### 3. Hypoteses Test

Table 4 : Result Test of Correlation and Signification

Parameter	Original Sample	T Statistics	P Values	Result
Job Stress to Performance	0.635	3.707	0.000	Significant
Job Stress to Job satisfaction	-0.501	2.961	0.003	Significant
Job satisfaction to Performance	0.506	5.694	0.000	Significant
Job Stress to Performance Through Job Satisfaction	-0.254	3.157	0.002	Significant

Based on the findings of the first hypothesis test, it is known that there is a positive and significant effect of job stress toward performance. These findings indicate that when job stress is at the low level, it can affect the improvement of employee performance. This supports the research findings conducted by Amoako, et al (2017) and Blumenthal (2003). Based on the theory of Inverted-U Relationship, it is known that when the job stress is at the low and intermediate level, then employees tend to produce better performance by performing tasks better, diligent, and faster.

Based on the results of the second hypothesis test, it is known that there is a negative and significant effect of job stress toward job satisfaction. These findings indicate that when job stress is at the low level, it can decrease employee job satisfaction. This supports the research conducted by Khamisa et al. (2017), Ramos, Alés, Sierra (2014), Khalatbari, Ghorbanshiroudi, & Firouzbakhsh and Trivellas, Reclitis, & Platis (2013) who mentioned that job stress had a negative and significant effect on employee job satisfaction. According to Ramos, Ales and Sierra (2014), role stressors such as role ambiguity and role conflict had negative correlation with job satisfaction.

Based on the results of the third hypothesis test, it is known that there is a positive effect on job satisfaction toward employee performance. This supports the research conducted by Kadir, Kamariah, & Saleh (2017), Bakotić (2016), Inuwa (2016) and Platis, Reclitis, & Zimeras (2015) who obtain the research findings that job satisfaction had a positive correlation or directly proportional to the performance. Thus, the higher the level of job satisfaction perceived by employees, the higher the performance results obtained by the company. Employees who get job satisfaction will carry out their work well so that it improves their performances, while employees who do not get job satisfaction will be frustrated and have an impact on their declining performances. Unsatisfied employees will have more daydreaming, have low morale, get tired and bored easily, unstable emotions, more absenteeism and activities that have nothing to do with their work (Luthans, 2006)

Based on the research findings, it is known that job stress indirectly affect the decline in performance through employee job satisfaction. It shows that job stress will have a greater impact on the declining employee performance when employees also feel a job dissatisfaction compared to the decline in work that will occur when the job stress is not accompanied by job dissatisfaction. The findings of this research support the research conducted by Sugama (2017), Hanim (2016) and Kusuma (2015) stating that job stress has an indirect effect on performance through job satisfaction. The indirect effect of job stress on employee performance through job satisfaction shows that despite the existence of job stress, if it is supported by high job satisfaction then the employee performance will remain optimal. It shows that if employees get low job stress and is supported by high job satisfaction then they will try to work their best.

## V. CONCLUSION

Based on the results of research that has been described and discussed in the previous, it can be concluded as follows:

1. Job stress positively affects the performance of PT Muara Alam Sejahtera employees.
2. Job stress negatively affects the job satisfaction of PT Muara Alam Sejahtera employees.
3. Job satisfaction positively affects the performance of PT. Muara Alam Sejahtera employees.
4. Job stress indirectly affects the performance through job satisfaction of PT. Muara Alam Sejahtera employees.

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# Assessing the influence of process interventions of community health volunteers on use of community based health management information systems in selected counties, Kenya.

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DOI: 10.29322/IJSRP.8.8.2018.p8003

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8003>

**Abstract** - The World Health Organization (WHO) identified information as one of the six key pillars of an effective health system. In this context, the need to strengthen community health information has been felt globally. African countries have faced the greatest challenges in collecting, analyzing, evaluating and interpreting indicator data to guide evidence based policy-making. The generation of health information starts at the community level through the Community-Based health information system (CbHMIS) (Kaburu, Kaburi, & Okero, 2016). At the community level, this source of information is complete in coverage and in planning and action-oriented (Odhiambo-Otieno, 2005). High health threats characterized by low levels of life expectancy, deteriorating healthcare facilities, high disease incidences, high levels of infant mortality (73/1000) and maternal mortality (488/100,000) specifically on communicable diseases are currently facing Kenya (Flora, Margaret, & Dan, 2017). The importance of effective information use is still a key impediment to these problems, hence affecting greatly the health care service delivery at all levels, and the worst level in its information use is level 1 – the community. In Kenya, According to a situation analysis on the state of Community Health Services in year 2014, the functionality of CbHIS was said to be at 64% which came down considerably to 55% in year 2015 documented by USAID, and that access to quality data was not guaranteed through the current CbHMIS. Some known and assumed barriers include: lack of proper processes, lack of physical access, lack of awareness of what is available; lack of relevance of available information (i.e. not meeting peoples' needs in terms of scope, style or format); lack of time and incentives to access information; and lack of interpretation skills (Flora *et al.*, 2017). Processes forms an integral part of performance (Aqil *et al.*, 2009). In Kenya, the Kenyan Health Information System has had several weaknesses which include weak linkages, data sharing, inadequate feedback, and lack of an operational CBHMIS manual, among others. The purpose of the study was to assess the influence of process interventions of the CHVs on CBHIS use in Kiambu, Kajiado

and Nairobi Counties, Kenya. The study objectives were to 1. examine the influence community units assessments on CbHMIS use; 2. Assess the influence of feedback on CbHMIS use; 3. Assess dialogue and action days influence on CbHMIS use; 4. Determine the influence of reporting channels on CbHMIS use. A cross-sectional analytical study design was adopted, utilizing both quantitative and qualitative approaches. The target population was 156 active CUs from the 3 counties, from whence a total sample of 122 CUs was derived. Multistage sampling was used to identify the CUs, and systematic random sampling to identify 366 respondents. One Focus Group Discussion with the members of the community health committees and two Key Informant Interviews (KIIs) were conducted in each of the three counties. The respondents in the KIIs were County Community Strategy Coordinators and Sub-county Community Strategy Officers. Quantitative data was analyzed using SPSS to generate univariate and bivariate analysis at  $p < 0.05$  significance level and results were presented in form of graphs, frequency tables, figures, and narration. Qualitative data was analyzed using content analysis based on key themes generated from the objectives. Majority were Females 72.4%  $n=265$ ; majority attained secondary level education 42.6% ( $n=156$ ); Non-formal occupation stood at 84.7% ( $n=310$ ); Use of CBHMIS stood at 56.6% ( $n=207$ ). Process interventions, 36% of the respondents agreed that the Sub-county team and CU leadership are quick to act on the feedback of our MIS reports. Process interventions ( $X_4$ ) explains 67.4% of total variation in CbHMIS use. ( $R^2 = .674$ ). Attention should be given to reporting channels by ensuring that CUs are technologically enabled to be reporting in a timely manner. The study recommends that CUs should be provided with enabling technology and further capacity development in technical, computer and electronic reporting skills.

**Index Terms:** Process interventions; Community Health Volunteers; Community based Health Management Information Systems; Use

## INTRODUCTION

### Process Interventions

Information is any entity or form that resolves uncertainty or provides the answer to a question of some kind. It is thus related to data and knowledge, as data represents values attributed to parameters, and knowledge signifies understanding of real things or abstract concepts. Information is not an end in itself, but a means to better decision making in policy design, health planning, management, monitoring and evaluation of health programs and services including patient care (Jeremie *et al.*, 2014a). Decision makers in many developing countries lack the required data needed for evidence-based health care management. One reason for this is that the routine national health management information systems (HMIS) do not extend to the 'last mile', the communities and the informal setting of villages, where a significant proportion of health events occur (Asangansi, 2012). A Community based health Information System (CBHIS) is a type of health information system that is based in the rural community and informal settlements of urban areas. The development of comprehensive community based health information systems is increasingly becoming important for measuring and improving the quality of health services. In Sub Saharan Africa (SSA), there is recognition of the importance of Health Information Systems (HIS) in the generation of reliable data and information. Little change is evident in the use of data to improve health care despite an increase data production at the community level. Many developing countries including Kenya have made efforts to strengthen their national health information systems to provide information for decision-making in managing health care services (Jeremie *et al.*, 2014a). Processes form an integral part of performance (Aqil *et al.*, 2009). Performance of Routine Information System Management (PRISM) framework was developed to improve routine health information systems (RHIS) and data use (Aqil *et al.*, 2009). The framework is innovative in that it puts emphasis on RHIS performance and the three interrelated determinants of that performance: technical, behavioral, and organizational determinants. Process intervention components in this study was evaluated using the following indicators : Assessments; feedback; dialogue and action days; and reporting channels.

**Assessments:** Cheburet and Odhiambo-Otieno, (2016a) has found out that assessments promotes strategies for increasing the use of data in decision making that are generated from evaluation research. According to several researches the frequency of supportive supervision to health facilities on the other hand assisted in provision of feedback and cross checked the data quality and helped them make informed decision to avoid future errors (Mate, Bennett, Mphatswe, Barker, & Rollins, 2009) . However, Odhiambo-Otieno (2005) in his assessment stated that the objective of data collection by CHVs was to improve their own work, management and output but such an arrangement, would enable the community address some of its health-related problems with its own resources for example, construction of latrines and other health-related problems required assistance from the health system for example, immunization of infants (Mate *et al.*, 2009).

**Feedback:** The role of feedback in ensuring good and high quality information in supporting the delivery of better healthcare is well documented (Kihuba, et al., 2014). While this invariably includes better data collection, the adoption of better data collection systems at the primary healthcare level is not always synonymous with the generation of information that can help in supporting decisions at the primary healthcare level. This situation was observed in Uganda, where the strengthening of data collection systems did not result in better utilization of the information at the primary healthcare level since all the efforts were directed towards better data collection, and none to analysis (Kihuba, et al., 2014). A caution regarding the of health information systems is that the information must be made relevant to the clinician as he answers to the needs of patients and should not just be relevant to epidemiology and other high level consumers of the information (Wright, O'Mahony, & Cilliers, 2017). This position is shared by who adapt it not just to the clinician, but also to the community. They indicate that the community should be able to access and use health data collected locally to make decisions regarding community health (Maden, Sahay, & Sudan, 2007). These views indicate that the consumers of information generated via community based health information systems are varied and can span both the providers and consumers of healthcare, individually and in concert. This position, when presented from the information needs view would then indicate that various players within the health information system will have different information needs (WHO, 2008). The decision making power available from health systems is indeed a useful and practical way of getting value from existing health systems.

**Dialogue and Action days:** Dialogue and action days refer to scheduled events that bring together the CHVs through community units and other community members including other players at level one together, and where health information is passed discussed and passed on. One of the benefits of community dialogue and action days is that they support the dissemination of key health indicators at community level (Jeremie *et al.*, 2014a). Community dialogues are planned and done in a quarterly basis while the the action days are conducted monthly to respond to issues outlined as priority health issues in the community. Dissemination of health information is one of the benefits that should accrue from the implementation of the CbHMIS since the system should deliver higher quality information compared where it is lacking. In addition, the dialogue and action days play a major role in influencing the habits of health consumers in regards to their access to health services (Jeremie *et al.*, 2014a). This can be attributed to the power of information to affect behavior, and in this case, the information is local and has an immediate local appeal.

**Reporting Channels:** Processes form an integral part of performance (Aqil *et al.*, 2009). Performance of Routine Information System Management (PRISM) framework was developed to improve routine health information systems (RHIS) and data use (Aqil *et al.*, 2009). The framework is innovative in

that it puts emphasis on RHIS performance and the three interrelated determinants of that performance: technical, behavioral, and organizational determinants. The data collection processes, systems, and methods, the behaviors of data users and how data are used for problem solving and program improvement, organizational structure and processes of the organizations that use the resulting information determine the performance of any system. The PRISM emphasizes that specific technical, behavioral, and organizational activities need to be implemented to improve demand for, analysis, review, and use of routine health data in decision making (Aqil *et al.*, 2009). Majority of the staffs feel that analysis and direct utilization of health data/information were left for higher levels and their duty were only collecting and passing the data to the next levels

**METHODOLOGY**

The study adopted a cross-sectional analytical design, employing both quantitative and qualitative approaches. Kiambu, Kajiado and Nairobi counties formed the study location where a target population of 156 active Community Units (CU) was considered to arrive at a total sample of 122 CUs was derived using Mugenda formula of populations below 10,000 (Sample =  $nf = n/(1+n/N)$ ). Multistage sampling was used to identify the CUs, and systematic random sampling to identify 366 respondents. Quantitative data tools were semi-structured closed ended questionnaires; qualitative data tools included observation checklist, Focus Group Discussion (FGD) and Key Informant Interviews (KIIs) guides. Three

**RESULTS:**

**Process interventions indicators**

The findings indicate that, on assessments, the respondents disagreed with the statement on the sub-county team assesses and ensures the management information system is working well (composite mean score, 2.98); that we have a technical support team who ensure the systems are working well (composite mean score, 3.17); and that our volunteers are ready to learn from past experiences and improve on the services that we offer (composite mean score, 4.08). On feedback, the respondents disagreed: Sub-county team and CU leadership are quick to act on the feedback of our MIS reports

(Abajebel *et al.*, 2011). According to Abajebel *et al.*, 2011, the organization and support supervision was an important component that was not taken seriously. Two out of five of the CHVs were able to be visited once. The level of efforts required for reinforcing report submission from the CHVs for collection and analysis was beyond the CHEWs capacities. This compromises the quality of data submitted by CHEWs since they have additional roles. This was also supported by Odhiambo-Otieno (2005) in his study that supervision empowered the community by ensuring that information was regularly fed back to the community and that community members were trained to interpret data through the spot-checks.

FGDs with the members of the community health committees (one from each county) and Six KII were conducted (two from each County; Community Strategy Coordinators and Sub-county Community Strategy Officers were the KIIs). Quantitative data was analyzed using SPSS to generate univariate and bivariate analysis at  $p < 0.05$  significance level; Qualitative data was analyzed using content analysis based on key themes generated from the objectives. Results were presented in form of graphs, tables, figures, and narration

(composite mean score, 3.12), however, they agreed that we disseminate information in a way that it is understandable to our community (4.10). On Dialogues and Action meetings: the respondents strongly agreed with the statement that our community unit always holds review meetings monthly (composite mean score, 4.14). On reporting channels: respondents agreed with the statement that our community unit has a strategic plan in place that guides our activities (composite mean score, 3.52) as shown in table 1 below.

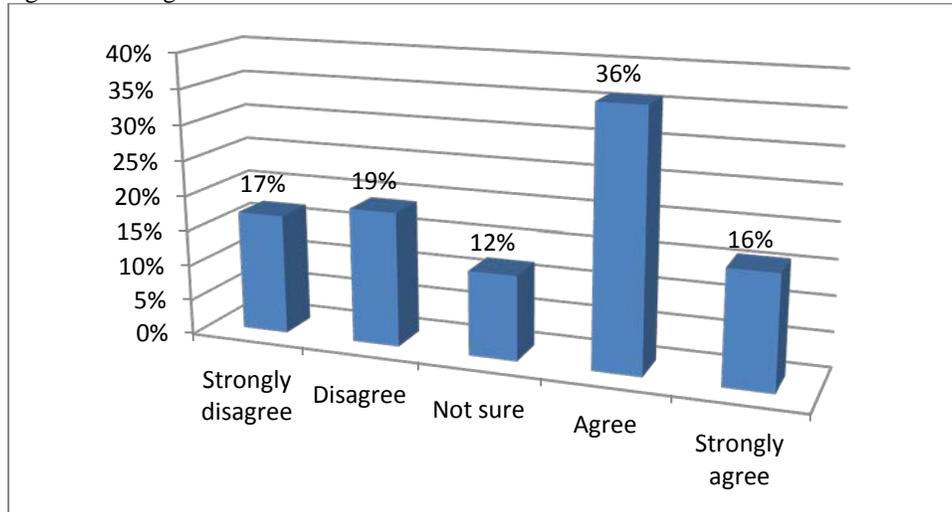
**Table 1: Process Interventions indicators**

Indicator	Construct	N	Mean	Std. Deviation
Assesments	The sub-county team assesses and ensures the management information system is working well	365	2.98	1.31971
Assesments	We have a technical support team who ensure the systems are working well	363	3.17	1.16352
Assesments	Our volunteers are ready to learn from past experiences and improve on the services that we offer	362	4.08	0.94322
Feedback	Sub-county team and CU leadership are quick to act on the feedback of our MIS reports	363	3.12	1.36594
Feedback	We disseminate information in a way that it is understandable to our community	364	4.10	0.76569

Dialogues and action	Our community unit always holds review meetings monthly	361	4.14	1.06952
Reporting channels	Our community unit has a strategic plan in place that guides our activities	359	3.52	1.06696

**Quick Feedback on the MIS Reports**

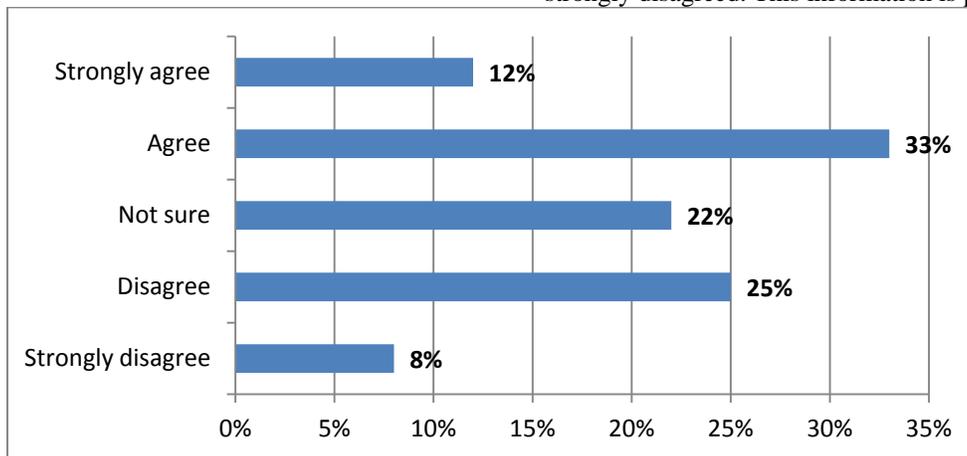
36% of the respondents said that the Sub-county team and CU leadership are quick to act on the feedback of our MIS reports while 17% of them disagreed as in figure 1.



*Figure 1: Sub-county team and CU leadership are quick to act on the feedback of our MIS reports*

**Assessments of Community Units**

On assessments, 33% agreed to having a technical support team who ensure the systems are working well while only 8% strongly disagreed. This information is presented in figure 2.



*Figure 2: We have a technical support team who ensure the systems are working well*

**Relationship between process interventions and CbHMIS use:**

The Bivariate correlations in Table 2: indicated that there is a positive and significant influence of process interventions of Community Units on the use of CbHMIS in Kenya across all parameters measured. However, reporting channels had the

weakest relationship with use of CbHMIS ( $r = .252^{**}$ ,  $P = .001$ ). This implies that attention to reporting channels will increase the use of CbHMIS by Community Units (CU). Similarly, CbHMIS improves significantly when the community units have implemented certain process interventions.

*Table 2: Relationship between process interventions and CbHMIS use*

S#	Indicator	CbHMIS Use	P Value	n
1	Assessments	.369**	.000	366
2	Feedback	.697**	.000	366
3	Dialogue	.372**	.000	366
4	Reporting Channels	.252**	.000	366
5	Process-interventions Composite	.660**	.000	366

**Process Interventions predictor of CbHMIS use: Regression**

Significant parameters at Pearson correlation level were subjected to stepwise linear regression analysis and two were predictive (feedback and reporting channels) to use of CbHMIS, as shown in table 3. These findings were subjected to further analysis where a univariate linear regression model  $Y = \beta_0 + \beta_4 X_4 + \epsilon$  was used to determine the influence of organizational factors on use of CbHMIS by CUs. Results in Table 3 shows that the model is valid ( $F_{(1, 363)} = 106.619$ ,  $P = .001$ ) hence the explanatory variable ( $X_4$ , Process interventions) is good in explaining total variations in Use of CbHMIS by community units..

The study further showed that the process interventions of community units ( $X_4$ ) explains 67.4% of the total variation in the use of information by community units in CbHMIS ( $R^2 = .674$ ). The value of the constant in the Table 3 shows that the process interventions of community units will always exist at a certain minimum ( $\beta_0 = 2.255$ ,  $P < .001$ ). The process interventions of community units were found to influence the use of CbHMIS positively and significantly ( $\beta_1 = .367$ ,  $P < .001$ ). This confirms the findings of the bivariate correlations which indicated that when the process intervention factors of the community units are well implemented, the use of CbHMIS will improve.

**Table 3: Model summary on process interventions - Regression**

Model summary					
R	R square	Adj. R square	Std. Error of the Estimate (SEE)		
.821 <sup>c</sup>	.674	.671	.33568		
Full regression model					
Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	84.202	3	28.067	249.081	.000 <sup>d</sup>
Residual	40.791	362	.113		

Total	124.993	365			
Process predictors with CbHMIS use					
Model	Unstandardized Coefficients		Standardized coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.098	.103		10.666	.000
Feedback	.261	.022	.428	11.613	.000
process interventions composite	.620	.051	.663	12.214	.000
Reporting channels	-.136	.027	-.246	-4.990	.000
Assessments			.028 <sup>d</sup>	.586	.558
Community Dialogues and Action days			-.034 <sup>d</sup>	-.586	.558

\*p<0.05

## DISCUSSION

The study findings indicate that process intervention factors for community units have a positive and significant influence on the use of CbHMIS by community units in Kenya. This means that the more the community units implement different interventions the more they improve the use of CbHMIS.

It is evident that majority of the respondents (CHVs) in the community units in Kenya always hold review meetings (Dialogues and Action days). However, this study established that the review meetings are conducted quarterly as opposed to monthly as stipulated in the community strategy manual. These findings contradict a study by Pepela and Odhiambo where they found out that community units provided feedback through monthly review meetings (Pepela & Odhiambo-Otieno, 2016). In an FGD, the Community units cited that they are not able to hold monthly meetings due to logistical issues, however, they also noted that data is analyzed by the community health assistant but they are only able to make sense of it and hold action days quarterly.

The results showed that community units' feedback system is good in that the community units disseminate information to the community through ways that the communities are able to understand. However, feedback it was also established that the Sub-County teams and the community units leadership are not very quick to act on the feedback that they receive from the MIS reports. These findings concur with Aqil *et al.*, that Feedback is an important process for identifying problems for resolution, for regulating and improving performance at individual and system levels, and for identifying opportunities for learning (Aqil *et al.*, 2009). However, feedback remains a weak process of CBHIS in many developing countries.

The results showed strong a self-assessment nature by the community units on their activities including their CbHMIS however, It also noted that there are weak vertical assessments from the sub-county teams in that they also lack a team from <http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8003>

the sub-county to assess their data and information needs. They also stated data tools stock outs and some of the tools are completely unavailable (MOH 517-Referral form) especially in Kajiado and Kiambu Counties. These results concur with a study by Pepela and Odhiambo that the process was majorly hindered by inadequate data collection and reporting tools (Pepela & Odhiambo-Otieno, 2016). Furthermore, Odhiambo-Otieno, (2005b); underscore that the design of HMIS and its implementation at the various level of health system require users expectation to inform data collection tools design. The tools being used in HMIS can either be paper-based or a combination of electronic data collection tools at facility level based on minimum dataset (Cheburet & Odhiambo-Otieno, 2016a) and (Odhiambo-Otieno, 2005b).

With the realization that processes are the backbone of performance (Aqil, Lippeveld, & Hozumi, 2009). Being that health systems are complex and dynamic, health system and health system strengthening frameworks have been developed to promote a common understanding among stakeholders. Frameworks can set realistic expectations and help prioritize investments across critical health system layers. Additionally, they can aid to identify where bottlenecks and problems exist, where and why investment is needed, what will happen as a result of efforts, and by what means change can be monitored. Nonetheless, the diversity of frameworks and the lack of common global consensus is confusion (Lenette, 2014)

Assuring measurement quality is not possible without establishing a formal process for checking data quality. Similarly, how well data are displayed reflects whether the data have been transformed into information (van Lohuizen and Kochen 1986), and shows its relevance for management, monitoring or planning purposes. Feedback is an important process for identifying problems for resolution, for regulating and improving performance at individual and system levels, and for identifying opportunities for learning (Knight 1995; Rothwell *et al.* 1995). However, feedback remains a weak process of RHIS in many developing countries. Feedback is

considered across/horizontal lower levels (CU to CU) and upper or vertical upper levels (Community to Subcounty and County). Facility staff receive feedback from self-assessing their performance using their own records and reports, and from the district management. The same process could be repeated at district or higher administrative levels

Community engagement is key to strengthening interventions that improve health outcomes. In particular, community based interventions are recognized as playing an important role in improving maternal, newborn and child health. Nevertheless, community-based systems have been largely ignored in health system frameworks (Lenette, 2014).

The study, therefore, concludes that process intervention factors of community units have a significant positive relationship influence on the use of CbHMIS in Kenya.

It is evident that majority of the respondents (CHVs) in the community units in Kenya always hold review meetings (Dialogues and Action days). However, this study established that the review meetings are conducted quarterly as opposed to monthly as stipulated in the community strategy manual.

The results showed that community units' feedback system is good in that the community units disseminate information to the community through ways that the communities are able to understand. However, feedback it was also established that the Sub-County teams and the community units leadership are not very quick to act on the feedback that they receive from the MIS reports.

The study revealed a strong a self-assessment nature by the community units on their activities including their CbHMIS however, It also noted that there are weak vertical assessments from the sub-county teams in that they also lack a team from the sub-county to assess their data and information needs. They also stated data tools stock outs and some of the tools are completely unavailable (MOH 517-Referral form) especially in Kajiado and Kiambu Counties.

Processes are a back-borne of any achievement, implementation of the right processes efficiently and effectively can improve the use of CbHMIS greatly. If process intervention factors of the community units are well implemented, the use of CbHMIS improves as indicated in this study.

It was also established that the Sub-County teams and the community units leadership are not very quick to act on the feedback that they receive from the MIS reports. The study revealed that there are weak vertical assessments from the sub-county teams in that they also lack a team from the sub-county to assess their data and information needs. Data tools stock outs and some of the tools being completely unavailable (MOH 517-Referral form) especially in Kajiado and Kiambu Counties was noted. This study therefore recommends that the counties to ensure that data tools.

Generally the use of the CbHMIS system (both manual and electronic) in the selected counties is very low. The electronic system is almost non-existent in all selected counties. The low use is attributed to the system quality, individual and institutional factors discussed above. There is limited use of computers as equipment in the facility due to the limited number.

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# Response of Yield and Yield Components of Field Pea (*Pisum sativum* L.) to Application of Nitrogen and Phosphorus Fertilizers.

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DOI: 10.29322/IJSRP.8.8.2018.p8004  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8004>

**Abstract:** A field experiment was conducted during the 2015, 2016 and 2017 growing seasons at the National Root Crop Research Institute experimental farm Vom Plateau State, Nigeria to study the response of Field pea (*Pisum sativum* L.) yield and its components to application of nitrogen and phosphorus fertilizers. The treatment consisted of three nitrogen rates viz; 0, 20 and 40 kg N ha<sup>-1</sup> and three phosphorus rates viz; 0, 30 and 60 kg P ha<sup>-1</sup> which were factorially laid in a randomized complete block design and replicated three times. The characters studied were; number of pods, pod length (cm), pod weight (g), pod yield (kg ha<sup>-1</sup>), number of seeds, 100 seed weight (g), seed yield (kg ha<sup>-1</sup>) and harvest index (%). Results revealed that there was a significant ( $P \leq 0.05$ ) and positive response of these characters to application of nitrogen and phosphorus rates during the period under investigation. Application of 40 kg N ha<sup>-1</sup> recorded higher seed yield than the other rates used, similarly, phosphorus application at 60 kg P ha<sup>-1</sup> recorded higher seed yield compared to 30 kg P ha<sup>-1</sup> and control plots. Regardless of the factor used, the lowest values in respect to the characters measured were obtained from control plots. The interaction of 40 kg N and 30 kg P ha<sup>-1</sup> gave significantly highest seed yield than other treatments used and seem more promising for optimum seed yield.

Field pea, Nitrogen, Phosphorus, Yield components

## 1. INTRODUCTION

Field pea (*Pisum sativum* L.) is a temperate crop that is now grown in most climatic zones including the tropical highlands, where it is grown under cooler conditions at higher elevations. It is an important grain legume crop in human and animal nutrition. The crop is a major source of protein (21% - 25%) with high levels of amino acids, lysine and tryptophan that have high nutritional value (Bhat *et al.* 2013; Gregory *et al.* 2016). In Nigeria, very little is known about the production of field pea crop, however, the cultivation of the crop is gaining popularity in Jos plateau during the recent years

## 2. MATERIALS AND METHODS

### 2.1 Description of Study Area

mainly because the climatic condition of the area is more of temperate than other parts of the country, so also that the demand of the crop is increasing in the market. Despite its nutritional, yield potential, agronomic benefits and economic value, the productivity of the crop is generally low. The low productivity is attributed to poor soil fertility (due to tin mining, erosion of topsoil by intense rainfall and continuous cultivation of the land) and agronomic practices by farmers, hence yield under farmer's condition is often below optimal (Nannim *et al.*, 2018).

The management of fertilizer is very important and can greatly affects the growth and yield attributes of field pea. Nitrogen and phosphorus are among the major yield limiting factors of field pea and these nutrients are almost deficient in most soils in the tropics and Africa. Field pea is highly efficient nitrogen-fixing crops and may obtain its total nitrogen requirement from fixation under good condition. However, due to the lag period between rhizobium root colonization and the onset of nodule functioning, the young legume plants may require an additional N to achieve vigorous growth and establish the N-fixing symbiosis especially when the crop is sown on land with less than 13.6 kg h<sup>-1</sup> of available nitrate N in the top 2 feet of the soil profile (Gan *et al.*, 2004; Gregory *et al.* 2016). Lal *et al.* (2004) found that the application of nitrogen at 0, 20, 40 and 60 kg N ha<sup>-1</sup> resulted in increased seed yield kg ha<sup>-1</sup>.

Phosphorus has also been identified as one of the most limiting nutrient elements to crop production in tropical soils. Deficiency of phosphorus has also been shown to be an important fertility constraint limiting legume production in the tropics. Getachew *et al.* (2003) and Amare *et al.* (2005) in their work reported a significantly increased in grain yield due to application of phosphorus fertilizer. Work regarding the response of nitrogen and phosphorus fertilizer on the productivity of field pea has not been conducted under local condition. Therefore, this research was initiated to determine the response of field pea yield and its component to application of nitrogen and phosphorus rate.

The study was conducted during the 2015, 2016 and 2017 growing season at the National Root Crop Research Institute experimental area in Vom Plateau State, Nigeria located at a latitude of 90 41'36.27 N longitude 80 52'16.33 E

and altitude of 1242m above sea level. Average minimum temperature in the area is about 10.40C during the dry season (December to February) and 150C during the raining season (May to August) while maximum temperature rarely exceeds 34.40C with an average rainfall of about 1400mm (Nigeria meteorological office Jos).

## 2.2 Experimental Design and Treatments

The treatments consisted of three rates of nitrogen viz. 0, 20 and 40 kg ha<sup>-1</sup> and three rates of phosphorus viz. 0, 30 and 60 P kg ha<sup>-1</sup>, which were factorially combined and laid in a Randomized Complete Block Design (RCBD) with three replications. A plot size of 9m<sup>2</sup> containing 10 rows was maintained from which a sampling unit of 3.6m<sup>2</sup> with 4 rows as net plot was determined at the middle of each plot in both seasons for measurement of the yield and yield components. Two seeds per hole of field pea were sown at a depth of 4 cm with 25 and 30cm intra and inter row spacing. The sources of nitrogen and phosphorus were urea and single super phosphate. The N rates were applied at five days after emergence, while the P treatments were applied at sowing. Both fertilizers during application were incorporated into the soil and covered properly.

## 2.3 Data collection

Data on number of pods plant<sup>-1</sup>, pod length (cm), weight of pod plant<sup>-1</sup> (g), pod yield (kg ha<sup>-1</sup>), number of seeds pod<sup>-1</sup>, 100 seed weight (g), seed yield (kg ha<sup>-1</sup>) and harvest index (%), designated as; NP, PL, WP, PY, NS, SW, SY and HI were taken at physiological maturity. The field pea stands were harvested within the net plot (3.6m<sup>2</sup>) when about 85% of pods had turned brown. Ten plants were randomly taken from the net plot of each treatment (plot) in all the replicates. Pods from the samples stands were counted and the average value recorded. Pod length (cm) was measured by placing a measuring tape at one end of the pod to the other end and the average value of ten samples was recorded accordingly. To obtain pod weight plant<sup>-1</sup>, pods from the ten (10) randomly selected plants were picked and weighed. The values obtained were then averaged. Pod yield (kg ha<sup>-1</sup>) on the other was obtained from all the stands within the net plots. The pods were first weighed and the average was recorded and later converted to pod yield in kilogram per hectare. Seeds per pod was counted from ten randomly selected plants from the net plot and the average value was recorded as number of seeds per pod and was considered on per plant basis. One hundred seeds were first counted randomly for each plot and then weighed and the average values were then recorded. To obtain grain yield data, all plants in the net plots were harvested dried, threshed and clean from any dirt, weighed and the average values were recorded according to the treatments and later converted to seed yield per hectare. Harvest Index was however, obtained by Economic yield (seed) / Biological Yield (total biomass) x 100. Weight of pods plant<sup>-1</sup>, pod yield and grain yield were both measured using digital scale (M<sub>X</sub>-RADY electronic balance).

## 2.4 Data analysis

Data collected for the three years of the experiment were subjected to analysis of variance using SPSS Statistics v. 20 (software) and means observed to be significantly different were however, separated by Least Significant Difference

(LSD) at 5% probability level using Duncan's Multiple Range Test (DMRT).

## 3. RESULTS AND DISCUSSION

### 3.1 Soil

The soil where the experiment was conducted was loam, low in organic matter (0.95%), total nitrogen (0.07%), available phosphorus (3.60 mg kg<sup>-1</sup>) and available K (198 mg kg<sup>-1</sup>) and pH of 5.65 (table 1). Generally, the soil analysis indicates that the soil was depleted, hence in such soils the amount of the primary nutrient that could immediately be available to the crop becomes inadequate.

### 3.2 Response of Field pea Yield and its Components to Application of Nitrogen and Phosphorus

Response of yield and yield components of field pea to application of nitrogen in the three growing seasons of 2015, 2016 and 2017 is presented in tables 2, 3 and 4. The tables indicated that throughout the three-year trial, increase in application of nitrogen from 0 to 40 kg N ha<sup>-1</sup> resulted in significant ( $P \leq 0.05$ ) and progressive increase in number of pods, pod length, pod weight, pod yield, number of seeds, 100 seed weight and seed yield. Higher values of all the characters measured were obtained from the application of 40 kg N ha<sup>-1</sup> except for number of seed pod<sup>-1</sup> and 100 seed weight which was significantly at par with 20 kg N in 2016 and 2017 seasons. The control plots on the other, produced the lowest values for all the characters studied. Significantly higher seed yield observed at 40 kg N ha<sup>-1</sup> could be due to greater partitioning of dry matter into the economic portion i.e., to seed and favourable growth nutrient uptake, higher number of seeds plant<sup>-1</sup> and heavier seed. This was evident by the consistent results exhibited by application nitrogen in all the seasons. Lal *et al.* (2004) found that the application of nitrogen (at 0, 20, 40 and 60 kg N ha<sup>-1</sup>) on seed yield of pea and bean resulted in increased seed yield kg ha<sup>-1</sup>. Low pod yield recorded under control plots during the study could be due to insufficient essential element at certain growth stages like that of flowering, seed formation and seed maturity.

Similar to the effect of nitrogen application, field pea responded positively to application of phosphorus during the trials (Tables 2, 3 and 4). Increase in phosphorus application from 0 up to 60 kg ha<sup>-1</sup> also led to an increase in number of pods, pod length, pod weight, pod yield, number of seeds, 100 seed weight and seed yield table 2, 3 and 4. Significantly ( $P \leq 0.05$ ) higher value of these characters were observed with the application of phosphorus at 60 kg ha<sup>-1</sup>. Higher number of seed obtained with the 60 kg P ha<sup>-1</sup> was however, at par with 30 kg P ha<sup>-1</sup> in 2015 season. On the other hand, phosphorus application had no significant effect on number of seed pod<sup>-1</sup> and 100 seed weight in 2016 and 2017 growing seasons, and on weight of pod plant<sup>-1</sup> 2017 season only. Control plots had the least values for all the characters measured throughout the study period. Generally, field pea develops poorly when grown in phosphorus deficient soil and its low rate may lead to low productivity which may be the case with yield under the control plot in this study. Increase in the values of the characters studied with increasing P application from 0 up to 60 kg P ha<sup>-1</sup> indicates the essentiality of phosphorus as an essential nutrient for field pea. Higher values from plots treated with 60 kg P ha<sup>-1</sup> shows that increase rate of

phosphorus leads to better and efficient nodulation, which resulted in increased assimilation of nitrogen, well filled pods and higher yield. The result was in agreement with the findings of Nadeem *et al.* (2003) and Uniyal and Mishra (2009) who reported that increasing rate of phosphorus to field pea resulted in a corresponding increase in yield and yield parameters such as number of pod, pod length, number of grains per pod and pod weight. Maximum seed yield kg ha<sup>-1</sup> recorded as a result of highest rate of phosphorus applied in this study concord with the findings of Sinha *et al.* (2000), Getachew *et al.* (2003), Lal *et al.* (2004) and Amare *et al.* (2005).

Harvest index varied significantly ( $P \leq 0.05$ ) with the application of nitrogen and phosphorus in three years of the investigation (tables 2,3 and 4). The results indicated that application of at 40 kg N ha<sup>-1</sup> led to the production of higher harvest index, however, the different between the value obtained from the application of 20 and 40 kg N ha<sup>-1</sup> was found non-significant. Sinclair (2004) reported that increasing seed yield and crop harvest index with high nitrogen grain requires a concomitant increase in crop nitrogen accumulation. At the different phosphorus rates tested, significant difference was also observed in the three-year study. Maximum mean harvest index was obtained from application of 60 kg P ha<sup>-1</sup>, which was higher than the other rates used. Increase harvest index as a result of increase in phosphorus rate could be due to the influence of greater fruit and seed setting than above ground biomass yield. The result found in this study was in agreement with that of Malik *et al.* (2006) who reported that harvest index was significantly influenced by increased in applied phosphorus rate in soybean crop. Chanda *et al.* (2002) also reported that significantly higher harvest index could be due to comparatively higher increase of grain yield than that of respective vegetative yield of the crop. Irrespective of nitrogen or phosphorus rate used, control plots recorded the least harvest index in all the seasons.

### 3.3 Interaction of Nitrogen and Phosphorus rates (Pooled over three years)

Results of interaction between the factors under investigation shows a significant ( $P \leq 0.05$ ) effect on all the characters measured except on number of seed pod<sup>-1</sup> and harvest index (table 5). Combined application of 40 kg N ha<sup>-1</sup> and 60 kg P ha<sup>-1</sup> produced higher number of pods plant<sup>-1</sup> which was at par with interaction of 40 kg N and 30 kg P ha<sup>-1</sup>. Similarly, the interaction between 40 kg N and 60 kg P ha<sup>-1</sup> P ha<sup>-1</sup> produced longer pods than the other combination. However, the value obtained did not differ significantly from the interaction between 40 kg N ha<sup>-1</sup> and 30 kg P ha<sup>-1</sup>, 40 kg N and 0 kg P ha<sup>-1</sup>, 20 kg N and 60 kg P ha<sup>-1</sup>, and 20 kg N and 30 kg P ha<sup>-1</sup> respectively. Significantly heavier pods plant<sup>-1</sup> and higher pod yield kg ha<sup>-1</sup> were recorded from the interaction of 40 kg N and 60 kg P ha<sup>-1</sup>. Heavier 100 seeds were produced from the interaction between 20 kg N and 30 kg P ha<sup>-1</sup>, this was however, at par with the values obtained from the interaction between 20 kg N and 60 kg P ha<sup>-1</sup>, 40 kg N and 30 kg P ha<sup>-1</sup>, 40 kg N and 60 kg P ha<sup>-1</sup>, and 40 kg N and 0 kg P ha<sup>-1</sup> respectively. With regard to seed yield kg ha<sup>-1</sup>, the table shows that interaction of nitrogen and phosphorus at 40 and 30 kg ha<sup>-1</sup> and that of 40 and 60 kg ha<sup>-1</sup> do not differ significantly. Control application of both factors led to the production of lower seed yield among all the treatment combination applied. The positive interaction between nitrogen and phosphorus rates on number of pods, pod length, pod weight, pod yield, 100 seed weight and seed yield could be a proof of better uptake and assimilation of available nutrients by the plants during the entire growth period therefore, meeting the demand of the crop for development and yield of field pea crop (Kumar *et al.* 2009 and Valenciano *et al.* 2010). Waseem *et al.*, (2008) also observed that the application of balance nutrients promotes vigorous growth of the plant which ultimately increase the size of pod as well as seed.

Table 1: Some soil properties (0-30 cm) of experimental field at Vom, prior to sowing

	Value at 0 – 30cm depth		
	2015	2016	2017
<b>Particle Size Distribution (gkg<sup>-1</sup>)</b>			
Sand	46.84	46.84	47.00
Silt	29.00	29.00	28.60
Clay	24.16	24.16	24.40
Textural class	Loam	Loam	Loam
<b>Chemical property</b>			
pH	5.65	6.40	6.14
EC(dsm/m)	0.12	0.17	0.18
Organic Matter (gkg <sup>-1</sup> )	0.95	0.93	0.86
Total N (%)	0.10	0.07	0.08
Available P (mg kg <sup>-1</sup> )	3.60	4.89	6.21
Available K (mg kg <sup>-1</sup> )	198	201	199

Table 2: Response of Field pea (*Pisum sativum* L.) yield and its components to application of nitrogen rates during the 2015 rainy seasons

Treatment	Yield and yield components							
	NP	PL	WP	PY	NS	SW	SY	HI
<b>N (kg ha<sup>-1</sup>)</b>								
0	10.44c	4.94c	15.94c	1288.11c	4.61c	22.61c	1076.72c	27.28c
20	14.44b	6.33b	21.72b	1914.94b	5.17b	24.30b	1810.00b	33.76a
40	17.00a	6.78a	26.33a	2279.28a	5.61a	25.17a	2064.20a	33.33a
	*	*	*	*	*	*	*	*
<b>P (kg ha<sup>-1</sup>)</b>								
0	9.72c	5.67c	19.61c	1302.11c	4.77b	23.30c	1090.61c	24.13c
30	13.11b	5.94b	21.50b	1709.89b	5.28a	24.00b	1584.00b	34.33b
60	15.06a	6.44a	22.89a	1870.33a	5.33a	24.33a	1791.28a	36.13a
	*	*	*	*	*	*	*	*
SE±	0.31	0.10	0.64	60.31	0.18	0.15	36.92	0.50

Means followed by same letter (s) on the same column do not differ significantly at 5% probability level by Duncan Multiple Range Test. N = Nitrogen P = Phosphorus \*=Significant

Table 3: Response of Field pea (*Pisum sativum* L.) yield and its components to application of nitrogen rates during the 2016 rainy seasons

Treatment	Yield and yield components							
	NP	PL	WP	PY	NS	SW	SY	HI
<b>N (kg ha<sup>-1</sup>)</b>								
0	9.83c	5.56c	16.44c	1410.78c	4.33b	23.61b	1211.06c	26.43c
20	14.22b	6.50b	22.16b	2046.67b	5.22a	24.17a	1926.83b	34.36a
40	16.67a	6.94a	26.22a	2251.89a	5.22a	24.22a	2109.67a	34.72a
	*	*	*	*	*	*	*	*
<b>P (kg ha<sup>-1</sup>)</b>								
0	10.06c	5.21c	20.22c	1263.22c	4.71	23.94	1155.88c	28.15c
30	14.12b	6.11b	21.72b	1789.20b	4.94	24.00	1629.67b	34.26b
60	15.00a	6.48a	22.87a	2156.94a	5.06	24.00	1857.00a	36.54a
LS	*	*	*	*	NS	NS	*	*
SE±	0.37	0.10	0.67	56.30	0.13	0.16	46.37	0.80

Means followed by same letter (s) on the same column do not differ significantly at 5% probability level by Duncan Multiple Range Test. N = Nitrogen P = Phosphorus \*=Significant NS= Not Significant

Table 4: Response of Field pea (*Pisum sativum* L.) yield and its components to application of nitrogen rates during the 2017 rainy seasons

Treatment	Yield and yield components							
	NP	PL	WP	PY	NS	SW	SY	HI

<b>N (kg ha<sup>-1</sup>)</b>								
0	9.67c	5.22c	15.11c	1496.82c	5.21b	22.83c	1284.22c	24.36c
20	15.89b	6.33b	18.83b	2066.20b	6.00a	23.22a	1860.28b	36.56a
40	17.06a	6.44a	23.33a	2228.06a	6.22a	23.40a	2065.22a	38.12a
	*	*	*	*	*	*	*	*
<b>P (kg ha<sup>-1</sup>)</b>								
0	12.83c	5.83b	17.11	1366.50c	5.72	23.00	1183.61c	29.00c
30	13.83b	5.89b	19.61	1937.50b	5.83	23.00	1654.28b	32.16b
60	15.94a	6.28a	20.26	2087.11a	5.89	23.22	1889.83a	36.48a
LS	*	*	NS	*	NS	NS	*	*
SE±	0.32	0.10	0.81	44.88	0.10	0.15	43.10	0.80

Means followed by same letter (s) on the same column do not differ significantly at 5% probability level by Duncan Multiple Range Test. N = Nitrogen P = Phosphorus \*=Significant NS= Not Significant

Table 5: Interaction of nitrogen and phosphorus rates on number of pods plant<sup>-1</sup>, pod length, weight of pod, 100 seed weight and seed yield (Pooled over three years)

Treatment	Yield and yield components							
	NP	PL	WP	PY	NS	SW	SY	HI
N <sub>0</sub> P <sub>0</sub>	9.72f	4.56d	10.56e	912.06g	4.22	22.00d	743.22f	20.50
N <sub>0</sub> P <sub>30</sub>	10.00e	5.44c	16.11d	1477.33f	5.15	23.24c	1283.55e	26.44
N <sub>0</sub> P <sub>60</sub>	12.22d	5.52c	19.00bc	1806.39d	5.45	23.35bc	1621.56d	31.89
N <sub>20</sub> P <sub>0</sub>	14.00cd	6.03b	20.56b	1835.78d	5.50	23.48bc	1734.11cd	29.22
N <sub>20</sub> P <sub>30</sub>	13.86d	6.56a	19.33c	2012.94c	5.50	24.89a	2017.78b	34.78
N <sub>20</sub> P <sub>60</sub>	16.11b	6.58a	22.33b	2209.06b	5.39	24.43a	2128.17b	37.28
N <sub>40</sub> P <sub>0</sub>	15.22bc	6.67a	22.89b	2035.00c	5.72	24.11ab	1917.66bc	31.67
N <sub>40</sub> P <sub>30</sub>	16.89ab	6.78a	22.78b	2246.28b	5.67	24.45a	2365.33a	38.78
N <sub>40</sub> P <sub>60</sub>	18.44a	6.89a	25.00a	2428.94a	5.67	24.44a	2359.00a	39.22
	*	*	*	*	NS	*	*	NS
SE ±	0.67	0.17	0.37	54.38	0.13	0.27	75.12	0.91

Means followed by same letter (s) on the same column do not differ significantly at 5% probability level by Duncan Multiple Range Test. N= Nitrogen P= Phosphorus \*=Significant NS= Not Significant

#### 4. CONCLUSION

The three-year results obtained revealed that increasing the rate of nitrogen and also that of phosphorus fertilizer up to 40 kg ha<sup>-1</sup> and 60 kg ha<sup>-1</sup> respectively exerted positive effect on field pea yield and its components. Similarly, combined application of the two at 40 kg N ha<sup>-1</sup> and 30 kg P ha<sup>-1</sup> could lead to better pod and seed yield of the crop.

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8004>

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# Factors Affecting Rehabilitation of Food Security: A Study in Earthquake - Affected Districts in Nepal<sup>1</sup>

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July 2018

DOI: 10.29322/IJSRP.8.8.2018.p8005  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8005>

## List of Acronyms and Abbreviation

CBS	Central Bureau of Statistics
COBN	Cost of Basic Needs
FAO	Food and Agriculture Organization
FGD	Focus Group Discussion
HH	Household
INGOs	International Non-Governmental Organization
MOAD	Ministry of Agriculture Development
MOLE	Ministry of Labour and Employment
MOEST	Ministry of Science, Environment and Technology
NDHS	National Demographic and Health Survey
PCPY/D	Per Capita Per Year/Day
Rs	Rupees (Nepali currency)
USD	United States Dollar ( <i>1 USD= approx Rs 110 in July 2018</i> )
WVI/N	World Vision International/ Nepal
WB	World Bank

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## Abstract

*Half of Nepalese people are not able to feed themselves with the food they need for healthy life. This is either due to food not being available at the household or they do not have economic or physical access to buy the required amount or type of food for the nutritional requirement. The mega earthquake on 25th April 2015 and its powerful aftershock on 12<sup>th</sup> May disrupted living conditions of people in about ten districts. Thousands of people were rendered homeless. To respond to the disaster, aid agencies, government, civil societies, informal groups and individuals distributed necessary relief items to the affected people. Subsequent to the relief phase, the government bodies, international non-government organizations and UN agencies worked for recovery and rehabilitation in the different sectors in the most affected districts; aiming to help the communities to restore to normal life by rehabilitating livelihoods, facilities and networks. World Vision International Nepal (WVIN) worked in the sectors of Livelihood, Water Supply, Shelter and Education during the recovery and rehabilitation phases. Food security was integral part of the WVIN's Livelihoods Rehabilitation Project.*

*This research is based on some of the data, which were collected with the direct beneficiaries of different sectors, before conducting qualitative part of final evaluation. The survey was conducted in three highly earthquake- affected WVIN working districts in April 2018, just after the three years of the earthquake. The aim of the research is to assess the situation of food security and analyze key socio-economic factors regarding access to food security for the affected households during the rehabilitation.*

*The findings reveal that significant proportion of households were able to recover, restore or even improve access to food; as a result of their individual efforts and organizational support. However, some level of food insecurity remains with a certain bottom groups, which are culturally disadvantaged or having limited livelihood strategies. Not surprisingly, the food insecurity prevails with the households with limited off-farm options. Moreover, there is a question mark on the sustainability on the level of the food security achieved by the household during the rehabilitation phase.*

**Key words:** food security, economic access, livelihood, rehabilitation, disaster, earthquake, affected, Nepal, sustainability, World Vision

### 1. Overview of Food Security and Situation of Nepal

According to FAO definition; "Food security is a situation that exists when all people at all times have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." (FAO, 1998). Reutlinger & Knapp (1980) define the

magnitude of food security as 'enough food as minimum level of food consumption'. Similarly, as per World Bank definition, food security is considered as 'enough for active healthy life.', as cited in Maxwell & Smith (1992). FAO (1998) provides a better framework with four dimensions of food security, viz. availability, access, utilization and stability.

Global Hunger Index Report - 2017, conducted by Concern World Wide (2017), presents that despite the global hunger dropping by 27 percent in the last 15 years, UN is likely to fail in achieving the 'eradication hunger target' by 2030. The hunger prevails with around 800 million people (Concern World Wide, 2016). For under developed or least developed country, this scenario poses a challenges in assuring food security for the vulnerable population. Food is fundamental need for survival, growth and development but the fact, that 36 percentage of under five children in Nepal are malnourished (MoH, New ERA, & ICF, 2017), indicates an alarming situation of food insecurity in Nepal.

Expanded over the area of 147,141 square kilometers, Nepal is a landlocked country, surrounded by China in the north and India in the east, south and west. About 68 percentage of people depend on agriculture (MoAD, 2016). But the farming system of Nepal yet inclined to subsistence type; and commercialization of the farming is yet to develop. Agriculture and remittance are the biggest sources of household income and are the two biggest contributors to the GDP, with a share of 34.0 and 27.7 percentage of GDP respectively (MoAD, 2015; and MoLE, 2015). With the extreme altitude ranging from 60 meter to 8848 meter from the sea level, Nepal is divided in three ecological zones; viz. Terai (the southern alluvial plain), the hilly area, and the Himalaya (mountaineous area), which cover the area of 23 percentage, 43 percentage and 34 percentage respectively. The Terai has a fertile soil for production; therefore Terai is called *annako bhandar* (food basket). But the hill has only 10 percentage of area under cultivation (MoEST, 2015).

According to the national research entitled, 'National Demographic and Health Survey (NDHS) - 2017' conducted by (MoH, New ERA & ICF, 2018); only half (52%) of the households in Nepal are food secure. Because lack of food security affects negatively on physiological, mental and social arena of human-being

(Hamelin, Habicht & Beaudry, 1999); it is important to assure that people have access to food all the time for their healthy life.

On 25<sup>th</sup> April, a powerful earthquake with 7.8 magnitude struck Nepal, with its epicenter in Gorkha. The biggest aftershock occurred on 12<sup>th</sup> May with its epicenter in Sindhupalchowk. It was estimated that approximately 8,000,000 living in affected ten districts were negatively affected by the earthquake and aftershock as per post disaster needs assessment (NPC, 2015). Close to 9,000 people were killed. The earthquake pushed an additional 2.5-3.5 percentage of Nepalese population into the poverty through the following year (NPC, 2015). Due to damage of the houses, fully (488,852) and partially (256,697); the households were displaced, their sources of subsistence were disrupted; and children, women and adults became economically, physically and psychologically vulnerable. To respond to the situation, different aid agencies worked in the affected districts with relief, early recovery and rehabilitation programmes. The recovery and rehabilitation focused on bringing lives to normal situation and on building resilience. Above all, individual effort of the people to recover and rehabilitate themselves is an important aspect.

This research focuses on the three districts, which were severely affected by the mega earthquake. The communities of this research are from hilly and mountainous areas.

## **2. Methodology and Process**

### **2.1- About the Context of the Survey:**

As the earthquake affected people and disrupted their living, government and International Non-Governmental Organizations (INGOs) were actively involved in assistance of relief, followed by implementation of recovery and rehabilitation programmes. World Vision International (WVI) initiated relief operations in 10 districts; and recovery and rehabilitation programmes in 5 districts, mostly affected by the earthquake. WVI is relief and development organization, committed for well-being of children, their families and communities.

This research utilizes some of the data that came from a comprehensive survey, conducted with 2,026 households in the three earthquake affected districts: Gorkha, Nuwakot and Sindhupalchowk. Under the leadership of this researcher; the MEAL & Strategy - department, conducted the survey with use of mobile based application named FieldTask, in order to assess the changes in the project specific indicators before the qualitative evaluation. Using the systematic sampling method, the survey was conducted at household level. On the top of the survey, this research also reflects the interactions i.e. FGDs, that this researcher carried with the community after the survey.

## 2.2- Method, Sample Size and Data Analysis

This research basically includes the analysis of a few number of the variables out of the multi-sectoral data which were collected for the evaluation of Rehabilitation Programme implemented by World World Vision International Nepal (WVIN). The sample size for the survey was determined using the equation that Cochran (1977) provided. For each of the three research districts, the following three steps were taken to calculate sample size:

Step-1: Calculation of sample size without known population per research area

$$S' = Z^2 \times P \times Q \div C^2 \text{ -----1)}$$

Where,  $S'$  = Sample size of research area

$Z$  = Z value for confidence level (adopted: 1.96 for 95%)

$P$  = Probability of picking a choice in fraction (adopted 0.5)

$Q$  = Probability of not picking a choice in fraction (ie.  $1-P=1-0.5=0.5$ )

$C$  = Margin of error, expressed in decimal (Adopted 0.05 i.e. 5%)

Step-2: Adjusted sample size for given population.

$$S = S' \div [1+(S'-1) \div N] \text{ -----2)}$$

Where,  $N$  = Population in the research area in the given district

$S$  = Adjusted sample size for given population for the research area in the given district

### 2.3- Outcome Variable and Predictive Variables

The Household Food Insecurity Access Scale (HFIAS); propounded by Coates, Swindale & Bilinsky (2007); provides a simple and helpful tool to measure household food security and to categorize the food insecure HHs in the three different levels : mild, moderate and severe. The HFIAS is commonly being used by Demographic and Health Surveys (NDHS) to be conducted in every five years. Given that a single indicator is not adequate to represent the situation of food security, there are various models for different perspectives. HFIAS is convenient model to more easily capture the food security with access perspective. The responses in the nine perception based questions of HFIAS were triangulated by the other questions viz. months of food shortage, income and coping mechanism during the data collection and analysis.

As per the various literatures, livelihood sources, income from farm-based or off-farm based activities; and access to market are the common determinants on access to food. According to the previous studies; off-farm (FAO, 1999; Haile, Alemu, & Kudhlande, 2005); livestock (Haile, Alemu, & Kudhlande, (2005); agricultural inputs (Haile, Alemu, & Kudhlande; 2005); income (Zhou, Shah, Ali, Ahmad, Din, & Ilyas, 2017; Odunivi, 2018; Adeyefa, 2016); access to credit (Zhou, Shah, Ali, Ahmad, Din, & Ilyas ; 2017); are the variables are considered to bring about significant economic access to food security. Regarding the household characteristics; education level (Haile, Alemu, & Kudhlande, 2005; Ojogho, 2010; Zhou, Shah, Ali, Ahmad, Din, & Ilyas, 2017); illness in the household (Zhou, Shah, Ali, Ahmad, Din, & Ilyas ; 2017); gender (Babatunde, Omotesho, Olorunsanya, & Owotoki, 2008; Ojogho, 2010; Oduniyi, 2018; and Adeyefa, 2016); age of household head (Ojogho, 2010; and Oduniyi, 2018), household size (Ojogho, 2010; Haile, Alemu, & Kudhlande, 2005; Adeyefa, 2016) and so forth are key factors used in various researches.

This research also included test if the caste (Dalit vs Non-Dalit) predicts the food security. Because Dalits are socially and economically disadvantaged caste groups in Nepal, due to tradition of stratified caste system in Nepal where Dalits are considered as unclean, untouchable, and are discriminated in the society many ways; despite the fact that caste based discrimination is illegal in the paper. Nationally, the poverty rate is

higher for Dalit caste, by almost two times of average prevalence of poverty. All the variables that this researcher selected from the dataset are presented in the Table-1 below.

## 2.4- Emperical Model

For the analysis, binary logistic regression (logit) model was adopted because this is recognized as the suitable model when the outcome variable is of binary type. The functional form of logistic regression model can be given as equation below:

$[P_i/(1-P_i)] = B_0 + B_1X_{i1} + \dots + B_kX_{ki} \dots (1)$  Where, P=probability of the outcome;  $i = i^{th}$  observation in the sample;  $B_0$  = intercept term;  $B_1, \dots, B_k$  = Co-efficients associated with each independent variable  $X_1, \dots, X_k$

Converting it to exponential function,  $\ln[P_i/(1-P_i)] = E(B_0 + B_1X_{i1} + \dots + B_kX_{ki}) \dots (2)$  where, E= Exponential.

SPSS-20 was used to run this analysis. The odds ratio in the outcome variable represents the ratio between the probability of occurrence (i.e. food secure) to the probability of non-occurrence (i.e. food insecure). In the case that a predictive variable is of binary nature, the exponential of the respective coefficient represents the the times that outcome variable will household likely to turn to be food secure from the insecure, corresponding to shift in the condition of predictive variable. Furthermore, in the case that a predictive variables is continuous or interval, the odds ratio is governed by one unit change in the predictive variable. Table-1 presents the list of predictive variables (independent variables), their types and the outcome variable (dependant variable).

Table-1  
**Outcome Variables and Predictive Variables for Logit Test**

SN	Variable	Coding for Logit	Type of Variable
<b>Dependent Variable</b>			
0	Food Insecure (0)/ Secure (1)		Binary
<b>Independent Variables</b>			
<b>1.- Access: Geographic and Household Characteristics and Economic Access</b>			
1.1	Dalit vs Other Ethnic Groups	0: Dalit, 1: Others	Binary
1.2	Gender of HH head	0: Female, 1: Male	Binary
1.3	Age of HH head	<30, 30-45, 45-60, >60	Ordinal
1.4	HH size	(Intiger)	Continuous

2.- Socio-Economic Variables				
2.1	Livelihood - Farming		0: False, 1:True	Binary
2.2.	Livelihood - Livestock		0: False, 1:True	Binary
2.3.	Livelihood - Unskilled labour		0: False, 1:True	Binary
2.4	Livelihood - Skilled labour		0: False, 1:True	Binary
2.5	Livelihood - Small business		0: False, 1:True	Binary
2.6	Livelihood - Remittance		0: False, 1:True	Binary
2.7	Access to Credit		0: False, 1:True	Binary
2.8	Training/ Equipments/ Inputs assistance by INGO (WVIN)		0: False, 1:True	Binary

In the process of running logit, Omnibus Tests of Model Coefficients, Step-1 (Step, Block, Model) with Chi-square value of 402.20 at 18 degree of freedom with significance indicated by  $p=0.00 < 0.05$  shows accuracy of model improves when explanatory variables are added. Similarly, the model summary produced by SPSS shows: a) -2 Log Likelihood = 1492.211; b) Cox and Snell R Square = 0.192; c) Nagelkerke R Square = 0.270. The Nagelkerke R Square value tells that 14 independent variables used in this model together account for 27 percentage of the variation of the dependent variable . Therefore, this model is acceptable.

The purpose of Hosmer and Lemeshow Test is to assess whether or not the observed event- rates match expected event- rates in the sub-groups of the model population. Hence in this model, the Hosmer and Lemeshow Test gave the Chi-square value of 6.41 at 8 degrees of freedom; which gives the significance  $p=0.60 > 0.05$ . This value indicates that the model is suitable to apply.

### 3. Findings

#### 3.1- Result and Interpretation of Logit Test

The logit result is presented in Table-2.

Table-2  
Output Table of Logistic Regression

Variables	B	S.E.	Wald **	Sig.	E(B)
<b>Socio Economic Factors</b>					
Farm (livelihood)	0.01	0.14	0.01	0.93	1.01
Livestock (livelihood)	-0.32	0.12	25.62	0.10	0.72
Skilled Labour (livelihood) (x)	0.45	0.16	7.64	0.01	1.56
Unskilled Labour (livelihood) (x)	0.40	0.19	4.41	0.04	1.49

Variables	B	S.E.	Wald **	Sig.	E(B)
Remittance (livelihood) (x)	1.31	0.20	43.68	0.00	3.70
Small Business (livelihood) (x)	1.34	0.23	35.16	0.00	3.86
Salaried Employment (livelihood) (x)	1.13	0.17	43.75	0.00	3.12
Pension (x)	0.86	0.30	8.19	0.00	2.38
Access to credit	0.30	0.06	24.51	0.10	1.35
Training/ Inputs from INGO (WVIN) (x)	0.30	0.13	5.78	0.02	1.45
<b>HH &amp; Demographic Characteristics</b>					
Gender	0.18	0.12	2.25	0.13	1.19
Dalit and Other Caste (x)	1.67	0.14	151.29	0.00	5.26
HH size	0.04	0.03	3.12	0.08	1.04
HH Head Age (x)	-0.02	0.00	27.54	0.01	0.98
Constant	-6.86	0.72	91.90	0.00	0.01

Source: Data Analyzed in SPSS v.16 from WVIN Field Survey- 2018

Note: 1) \*\*: Degree of Freedom is 1 for each of these

2) x: As per the test, these variable show significance (i.e.  $p < 0.05$ )

The result of the test for each variables is interpreted below. No. 1-10 are related with the economic access and 11-14 are related with demographic & household characteristics. Provided that all other variables are controlled, at 5% significance level, a HH who ....

1.- .... has a skilled labour as livelihood source, as opposed to a household who has not this, has the probability of being food secure by 1.56 times than being food insecure.

2.- ....has an unskilled labour as livelihood source, as opposed to a household who has not this, has the probability of being food secure by 1.49 times than being food insecure.

3.- .... has a foreign remittance as livelihoods source, as opposed to a household who has not this, has the probability of being food secure by 3.70 times than being food insecure.

4.- .... has salaried employment as livelihood source, as opposed to a household who has not this, has the probability of being food secure by 3.12 times than being food insecure.

5.- .... has pension as livelihood source, as opposed to a household who has not this, has the probability of being food secure by 2.38 times than being food insecure.

6.- .... has farming as a livelihood source, is not necessarily be food secure.

7.- .... has livestock as a livelihood source, is not necessarily be food secure.

8.- .... has an off-farm business as livelihood source as opposed to a household who has not this has the probability of being food secure 3.86 times than being food insecure.

- 9.- .... has access to formal or informal credit is not significant contributor to the food security.
- 10.- ....received support from WVIN’ Livelihoods Project (training, inputs, small equipments) as apposed to non-receiptant, is probable to be food secure 1.45 times than being food insecure.
- 11.- ....has male or female to head the HH does not significantly affect food security.
- 12.- .... is Dalit carries 5.26 times greater probability than of Non-Dalit to be food insecure against the chance to be food secure.
- 13.- ... has big or small HH size does affect significantly to food security.
- 14.- ... has yonger HH head is likely to become food secure compared to the older head.

### 3.2- Prevalence of Food Security

A 29.7% of the HHs are found food insecure: with a break down of 34.6 percentage in Gorkha, 16.3 percentage in Nuwakot and 44.9 percentage in Sindhupalchowk. Table-3 presents the status of overall food security/ insecurity of the research area.

Table- 3  
**Food Security Status of Earthquake Affected Households in 2018**

Food Security Situation	Frequency	Percentage
Insecure	590	29.1%
Secure	1436	70.9%
Total	2026	100.0

Source: Field Survey of WVIN, 2018

In the absence of comparable survey on food security before the earthquake, it makes it difficult to track the extent of the change that took place. However, according to the comparative measurement of some proxy indicators as baseline and evaluation; particularly: a) increase in ‘absorptive and adaptive resillience capacity of HHs’; b) increase in ‘HH’s ability to meet food expenditure’; c) increase in ‘crop production’ (WVIN, 2018) are helpful to figure out the significance of change. As these indicators shows the singificant positive changes in the economic well-being of the households; these also indicate a good progress on the access and availability of food.

Table-4 here presents the categorical prevalence of food security/ insecurity. This tells that among the food insecure HHs, the significant majority of them fall under the ‘mildly insecure’. Moderately food insecure (6.3%) and severely food insecure (1.9%) altogether makes 8.2 percentage of HHs, who need to be focus for the development projects.

Table-4  
**Food Security/ Insecurity Level of Earthquake Affected Households in 2018**

Level of Food Security	Number	Percentage
Secure	1436	70.9%
Mildly Food Insecure	423	20.9%
Moderately Insucrue	127	6.3%
Mildly Insecure	39	1.9%
Total	2026	100.0%

Source: Field Survey of WVIN, 2018

### 3.3- Demgraphic and Household Factors

**Household Size:** Average HH size is 5.1; and disability rate is 2.1 percentage of the population. The test showed that HH size is not the significant predictor of food security. The study has shown that with the larger HH sizes, the HH members can be engaged in larger variety of works. Number of children would have increased the dependancy ratio. Under five children are only 11 percent among the total population.

**Livelihood Sources:** About 90% of the HHs have someone from their families to earn for the households and 10% do not have. In the household size of 5.1, an average of 1.4 people earn somewhere outside the subsistence farming. The earning includes skilled labour, unskilled labour, livestock selling, selling farm produces in small or medium scale, small or micro off-farm business, pension, salaried employment and so forth. People keep livestock basically for household consumption, which is important for household nutritional purpose. But a few percentage of of the HHs sell the livestock produces as source of some earning for the HHs.

**Age of Household Head:** Analyzing the distribution according to age of HH head, 14.7 percentage are in the age group of 18-30 years, 32.2 percentage in 30-45 years, 31.1 percentage in 45-60 years, and 22.0 percentage above 60 years. The logit test has proved that yonger HH heads contribute to food security than the

older heads. However, during FGDs, it was also found that youth are more inclined to go abroad for employment.

**Dalits:** Almost 3 times more prevalence of food insecurity stays with Dalits than the other castes; as presented in Table-5. Dalit, means ‘*oppressed*’ who are traditionally discriminated. Dalits also represent a variety of social groups such as Kami, Damai, Sarki, Sunar etc.; who are considered as lowest caste in the stratified caste system. Each of these social groups traditionally had pre-defined occupations, but which are gradually fading away. Table-5 below shows strong association between insecurity and Dalit.

Table-5  
**Crosstab between Food Secure/ Insecure HH and Dalits/ Other Caste**

Food Security Status	Dalit Caste Group	Other Castes	Total (N=2026)
Food Insecure (I)	59.5%	21.9%	29.1%
Food Secure (S)	40.5%	78.1%	70.9%
Sub-Total (I+S)	100.0%	100.0%	100.0%
Share of Caste Groups	19.1%	80.9%	100.0%
Pearson’s Chi Square Test	Value=215.20, df=1, p=0.00, i.e. <0.05		

Source: Field Survey of WVIN, 2018

**Female Headed Households:** More than one third of the HHs are headed by women; which is generally unusual in the context of male –dominant society of Nepal. Moreover, it is generally speculated that women headed households have weaker economy than male headed HHs; given the limitations that the women have in the patriarchal society. However, the Table-6 here shows that there is very little difference in term of food security between male led and femlae led HHs. Further, both the logit and bivariate tests demonstrate that gender of the hosuehold head cannot predict food security/ insecurity.

Table-6  
**Crosstab between Food Security/ Insecurity and Male/ Female Headed Households**

Food Security Status	Male	Female	Total (N=2026)
Food Insecure (I)	28.7%	29.9%	29.1%
Food Secure (S)	73.3%	70.1%	70.9%
Sub-Total (I+S)	100.0%	100.0%	100.0%
Share of Gender	36.0%	64.0%	100.0%
Pearson’s Chi Square Test	Value=0.304, df=1, p=0.58, i.e. >0.05		

Source: Field Survey of WVIN, 2018

## 4. Discussions

### 4.1- Food Self-Sufficiency

From the analysis of central tendency, average months of food self-sufficiency of the staple food, from the HH's own production, is like this: Nuwakot: 8.1, Sindhupalchowk: 7.2 and Gorkha: 6.7 months.

To buy the staple food for the deficit periods and to buy other food items for nutritional requirement; the households need to have strong enough economic access. Cash income is primary source of access to food; given 38 % of HHs cannot grow adequate quantity of food for all year round as per the data. More importantly, since the farmers are in the beginning stage of commercialization of the farming, it will be more cost effective to focus on cash crops for marketing purpose rather than producing variety. Therefore transition to commercial farming from subsistence farming will be important.

### 4.2.- Income and Food Security

With mean analysis, average daily income of the HHs in the research areas is Rs 101 (i.e. USD 0.90) per capita per day (PCPD), on top of the kinds produced at HH. But as per the thresholds set by National Planning Commission in 2011; on Cost of Basic Need (COBN) approach; the thresholds are : a) Rs 19261 PCPY for 'poverty line' (i.e. USD 0.50 PCPD now); b) Rs 11929 for 'food poverty line' (i.e. USD 0.30 PCPD now); and c) Rs 7332 for 'non-food poverty line' (i.e. USD 0.18 PCPD now).

Therefore, when compared to the threshold on COBN for a Nepalese, the average earning of the study area exceeds the threshold. All the same, these average figures cannot tell the situation of the bottom 30 percent people. But analyzing the vulnerability of bottom 30 percent households, average food deficit months is 6.8 months. Furthermore, the average cash income of these bottom 30% is approximately Rs. 30 (USD 0.27) PCPD only. This little earning can hardly can give them option to buy foods to meet household nutritional requirement especially during the food deficit months. Hence, low food self-sufficiency coupled with low income has placed the households into trap of food insecurity.

To conclude, as compared to the national average, the food security in these three districts is stronger; and the proportion of severely food insecure (1.9%) is quite lower than the national average (10%) as per the NDHS. The main reason behind improvement of food security in these communities is due to the supports from INGOs/ NGOs; and the demand in the job market since post earthquake reconstruction has increased. However, questions arise around the sustainability of these benefits or changes.

#### 4.3.- Livelihood Strategies and Food Security

Table-7 presents that almost two thirds of households depend on farming; followed by livestock. However, the logit-test has indicated neither the farming nor livestock-keeping is contributing significantly to food security. However, it is important to recognize the importance of farming for food security. Because, for many of the houses, agriculture is the main source of kind and cash income. From the mean analysis, it is found that 7.5 months of food requirement per annum is covered from the farming in this population. The Table-7 presents the distribution of various livelihood sources of the households in descending order.

Table-7  
**Proportion of HHs According to Livelihood Sources**

Livelihood Sources	No. of HH	Percentage
Farming	1306	64.5%
Livestock incl. poultry	596	29.5%
Salaried Employment	414	20.4%
Unskilled Labour	344	17.0%
Foreign Remittance	321	15.8%
Small/ Micro Off/Non-farm Business	250	12.3%
Skilled Labour	205	10.1%
Others: informal contractor, middle men etc.	117	5.8%
Pension	91	4.5%

Source: WVIN Field Survey- 2018

Based on the FGDs, farmers resumed their cultivation after a few months of earthquake. Role of individuals to rehabilitate the food security should be recognized. WV supported the farmers with training, agricultural inputs and equipments (FGDs, Gorkha).

Since many cattles were killed and the many cowsheds were damaged by the earthquake, many of the farmers had difficulty to resume livestock in the previous scale. But some of them were able to either resume or expand the poultry.

Due to increase in the private and public construction works in the community; it was easy for the people the job in their communities or in the vicinities. Many of the youth also received vocational trainings provided by different organizations. This made them either to be employed or self-employed (FGDs, Gorkha).

#### 4.4.- Food Availability and Food Utilization

According to small area estimation of food security and undernutrition in Nepal, when the threshold of 2750 kilocalories per adult equivalent per day is not met, the HH falls into the ‘undernourished’ category (Haslett, Jones, Isidro, Sefton, 2014). Low kilocalorie intake prevalence are estimated to be 0.382, 0.364 and 0.237 in mountain, hills and Terai respectively. In the context of Nepal, malnutrition is quite heavily associated with food inadeqecy (FAO, 2016).

From the data of these three districts, the cross-tabulation below shows that almost one forth of the households with under five children are food insecure. This indicates that significant proportion of children are at the risk of malnutrition as their households are food insecure.

Table- 8

#### Crosstab between Food Security/ Insecurity and HHs having Under Five Children

Food Security	HHs with U5 Children	HHs without U5 Children	Total (N=2026)
Food Insecure (I)	25.0%	31.1%	31.2%
Food Secure (S)	75.0%	68.9%	68.8%
Sub-Total (I+S)	100.0%	100.0%	100.0

Source: Field Survey of WVIN, 2018

The pre-disaster situation of calorie intake in the three districts was : Nuwakot - 37 percentage, Gorkha – 31 percentage, and Sindhupalchowk – 35 percentage (CBS, 2012).

From this research, the data on food consumption is as presented in the table below. The food category on food consumption quick survey included : a) Cereal Crops, b) Fruits and Vegetables, c) Pulse and Legumes, d) Animal sources products. Out of these four categories majority have eaten from two categories; and very low

proportion has eaten from four categories. Only 39.6 percentage has taken from three categories or more.

Table-9 presents the status of food consumption.

Table- 9  
**Distribution of HHs According to Categories of Food Consumed in the Past 24 Hours**

Categories of food	1 type	2 types	3 types	4 types
Number of HH	435	789	659	144
Percentage	21.5%	38.9%	32.5%	7.1%
Cumulative % : 'more than' basis	100.0%	78.5%	39.6%	7.1%

Source: WVIN Field Survey- 2018

As per the further analysis, the most common food is cereals (91%), followed by vegetables and fruits (63%). Overall, the low food dietary diversity is due to low food self-sufficiency at the household level; less variety of crops and low HH income. The other reason is: inadequate awareness about the balanced diet that is required for children, pregnant women, lactating mothers and adults (Joshi, Agho, Dibley, Senarath, & Tiwari; 2012; Taruvinga, Muchenje, & Mushunje; 2013). This scenario triggers that people are yet to be educated regarding the importance of nutrition and food diversity.

#### **4.5.- Remittance as source of income and contributor to food security:**

From the regression analysis, the remittance is the second biggest contributor to the food security among the off-farm based livelihood- source. More people would have gone to abroad for foreign employment if the opportunities were not available after the earthquake within the communities, local communities or vicinities (FGD, Gorkha).

In fact, Nepal is one of the world's highest recipients of remittances, Nepal totaled some US\$5.1 billion from Nepalese living abroad in 2012; and yet, almost 80 percentage of remittance income is used for daily consumption, and 7 percentage is used for loan repayment (Nepal Economic Forum, 2012). As a livelihood strategy, remittance is a good contributor to household economy and food security. But the question arise what would the migrant workers do after they return home.

#### 4.6.- Contributrion from INGO (WVIN)

The purpose of this section is to assess the effect of livelihood rehabilitation in improving food security in post disaster context. Farmers are in need of technical advice, agricultural inputs and markets. WVIN implemented Livelihood, WASH, Education, Shelter and Health Programmes during recovery and rehabilitation. The sampled 2026 respondents are the direct beneficiaries of one or more projects.

Livelihood Recovery and Rehabilitation Projects implemented by WVIN included farm-based and off-farm training; vocational trainings; distribution of agricultural inputs and equipment’s; livestock support; facilitation of business plan; promoting saving groups; market facilitation; cash programming for community assets such as irrigation, foot trail; and so forth. Evaluation report (section 3.1) tells that 81 percent direct beneficiaries were able to meet the food needs whereas baseline value just two years ago was 60 percent. The evaluation report also captures that 74 percent of the Livelihood Project beneficiaries were able to increase agricultural production during the project phase. The following cross-tabulation provides the analysis on the effect due to support made by WVIN through Livelihood Project. While WVIN aimed to support for the most vulnerable in the community (WVIN, 2018), WVIN support has stood up as a significant determinant to food security in the regression test.

Table- 10  
**Crosstab between Food Security/ Insecurity and Participants/ Non-Participants of Livelihood Rehabilitation Project**

Food Security Status	Participants	Non-participants	Total (N=2026)
Food Insecure (I)	26.1%	73.9 %	31.2%
Food Secure (S)	73.9%	29.1%	68.8%
Sub-Total (I+S)	100.0%	100.0%	100.0
Pearson’s Chi Square Test	Value=8.79, df=1, p=0.01, i.e. < 0.05		

Source: Field Survey of WVIN, 2018

#### 5. Conclusions

Food security situation has increased in the earthquake affected areas due to a number of enablers. The enablers include but not limited to efforts of individual households; and service rendered by INGOs (WVIN in its working area) and the supportive role played by the local governments. The role of government was basically on coordination, planning monitoring of work of INGOs and NGOs on top of regular government

services. Moreover, government has been providing financial and technical support to the affected families to build safe houses, in replacement of the damaged houses. Based on FGDs and WVIN (2018), farm-based production has increased among the direct recipients of the Livelihood Project. This success on Livelihood Project implemented by the INGO also indicates that households can improve their situation if they get the proper technical and material assistance. Therefore it proves how important it is to have agricultural extension programmes focusing on productivity, commercialization and ensuring food security. Lack of inadequate infra-structures especially roads and collection centres is major barrier to marketing of the products. Similarly, livestock is important source of nutrition but the farmers are not able to commercialize it. Unless infra-structures and market networks are established, farming and livestock keeping cannot turn as profitable sector in the long term.

One of strongest factor of food security was off-farm based means of subsistence. But soon after reconstruction of housing will be over in the communities, the demand for the unskilled and skilled labour is likely to decline. Therefore, the government needs to devise strategy to create economic opportunities. On the other side, foreign employment (eg. in gulf countries, Malaysia, India) may not be beneficial long-run; whilst remittance is one of the greatest contributor of food security; especially for 14% of the HHs in the research area. Here again it is important for policy makers to carry out research on commercialization of farming and maximizing economic opportunities in non/ off-farm base.

With the establishment of stable government following the three elections over the past one year, the government's agenda on prosperity sounds a great idea; but it will be important to pay attention to bottom 30%. The new development agenda propounded by Sustainable Development Goals (SDGs), cited 'Leave No One Behind' has to be embraced by local, federal and central government for the betterment of the bottom segment of society. Furthermore, social campaigns need to be formulated to end caste based discrimination.

It is important to increase household and community resilience to absorb shocks, adapt to the changing situation and ultimately enable them to quickly recover them from shock. As per Constan, M., Frankenberger, T., & Hoddinott, J., 'Food security = f (vulnerability, resilience capacity, shocks)' (2014, p.6). For the poor

communities, awareness about the preparedness; involvement into different groups and networks such as producers group, farmers group, saving and credit groups can also increase their resilience and lower the vulnerabilities. Service providers need to provide attention on it.

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# Project Management Training: A Determinant of Project Implementation by Grass-root Support Non-Governmental Organizations in Embu County, Kenya

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DOI: 10.29322/IJSRP.8.8.2018.p8006

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8006>

**Abstract-** This Literature Review intended to highlight Project Management Training as a determinant of project implementation by Grass-root Support Non-Governmental Organisations in Embu County, Kenya. The reviewer had studied grass-root support NGOs with projects in the fields of Agriculture, Micro-Finance, Education, Health and Nutrition and found that majority of staff in these organisations did not have any basic training in Project Management. Findings from various studies have indicated that organizations in diverse industries have embraced Project Management but the implementation process remains a challenge, resulting in well-formulated strategies failing at the implementation stage because of a myriad of factors ranging from unrealistic expectations, poor methodology, poor requirements, inadequate resources, poor project management, untrained teams, unrealistic budgets, to poor communication and more. Despite many studies having been done on success factors of projects, they were very general due to the multidisciplinary nature of projects, which acquire different and varied meanings

depending on the field in which they are applied. Few studies have been specific to

Project Management Training as a factor, as it was largely assumed that all projects were the same, yet effective Project Implementation may require different approaches which are acquired through training. An organization may have the best plans, great resources, a strong team, but without knowledge and skills of implementation through sound Project Management training there is no project. This review intends to reduce the knowledge gap in the area of crucial project management training factors affecting implementation of projects.

**Index Terms-** Mentoring, PM Coaching, Problem solving, Project Management Training, Evaluation

## I. INTRODUCTION

One can hardly find organizations that do not try to follow the practice of successful project management mentoring and project

staff training because the modern competitive environment dictates to organizations to have educated and skilled employees who can do daily tasks and perform project activities with less time and money consumed. Through practicing project management mentoring and training, any organization can direct and coordinate its human and material resources throughout the project life-cycle to accomplish established goals within the scope, expected quality, time and budget, while meeting expectations of the stakeholders (Wong, 2013). Excellence in planning and implementing projects will be achieved if the organization owns training personnel that has earned project management certifications and accomplished project management certificate programs.

## II. THE PROCESS

The process of project staff training refers to a complex of measures to educate project team members. There are three stages for developing skills and abilities of project staff: Tutoring, Coaching and Mentoring. Typically, tutoring in projects refers to a process of educating project staff through teaching them and enhancing their skills and knowledge (Biggs & Tang, 2011). Project management tutoring tends to make project staff more educated by showing the basics of project planning and management. It is the first stage of the project staff training process aimed at creating the fundamental knowledge about projects and the basic processes of project management. Tutoring often includes organization of project management classes, seminars and meetings to educate project staff.

Coaching is a method of project management training focused on developing competency and skills of project staff through providing team members with professional advice and help. This project

management training method assumes implementing a complex of tools for goals setting and results tracking that “raise the bar” upon completion of the preset goals. A PM Coach regularly reviews and updates the goals and then assigns project management classes and seminars in order to educate team members and move them towards achieving desired results (van Kessel, 2006). Project management coaching is the second stage of the project staff training process.

Staff mentoring is a complex of relationships between the mentor and the team. The mentor works on unlocking the factors required to let the team develop, generate creative solutions and find new ways to succeed in performing projects. Project management mentoring is the third stage of the project staff training process giving the most effective education tools to organize project management e-learning and plan for staff mentoring courses and online workshops (Biggs & Tang, 2011). The major benefits from implementing PM mentoring and training courses are many:

The team becomes more skilled in less time. The team can create new insights and discover new knowledge in the field of managing projects. The team gets access to people, project mentoring workshops, training sessions and other learning opportunities. Mentoring improves skills and competency of project team members. Mentors can hone their skills and enhance academic guidelines, becoming more effective. Mentor communicates with the mentee receiving feedback. Mentors and staff trainers will become more skilled at providing qualified help.

More sophisticated hybrid education processes will greatly assist to develop adaptable project managers and leaders. The stronger blend of academic and practitioner concepts embedded within a language of PM

develops richer insights into the soft and hard skills required to be effective and efficient project managers in an increasingly complex world. Project managers and leaders who can reflect more deeply on their own project experiences will develop their own capabilities (Biggs & Tang, 2011). In doing so, they will become more capable of constructively leveraging the collective abilities of their team members and building the capabilities of their organisations. Embedding the language of PM practice into an experiential learning environment that necessitates application of theories as they are being learnt, with reflection about their impact, increases the relevancy of the learning and retention of the knowledge. According to Bredillet, Conboy, Davidson and Walker (2013), the students exposed to this approach, so far, have been highly appreciative of the learning experience and have indicated it is a more engaging and effective way to become better project professionals.

Training is the process of transmitting and receiving information to problem solving (Nadeem, 2010). Sackman (2006) sees training as any process concerned with the development of aptitudes, skills and abilities of employees to perform specific jobs with a view to increase productivity. An organisation may have employees with the ability and determination, with the appropriate equipment and managerial support yet productivity falls below expected standards. The missing link in many cases is the lack of adequate skills, and knowledge, which is acquired through training and development. According to Bredillet et al. (2013) the purpose of training is mainly to improve knowledge and skills, and to change attitudes or behavior. It is one of the most important potential motivators which can lead to many possible benefits for both individuals and the organization. Changing technology requires that

employees possess the knowledge, skills and abilities needed to cope with new processes and production techniques. Bredillet et al. (2013) further argued that training brings a sense of security at the workplace which reduces labor turnover and absenteeism is avoided; change management training helps to manage change by increasing the understanding and involvement of employees in the change process and also provides the skills and abilities needed to adjust to new situations; Provide recognition, enhanced responsibility and the possibility of increased pay and promotion; Give a feeling of personal satisfaction and achievement, and broaden opportunities for career progression; and help to improve the availability and quality of staff. According to Woodhead (2011) no matter how carefully job applicants are screened, typically a gap remains between what the employee does know and what they should know.

An organization which desires to gain the competitive edge in its respective industry, needs among other things, extensive and effective training of its human resources. Training is therefore a key element for improved organizational performance; it increases the level of individual and organizational competences. It helps to reconcile the gap between what should happen and what is happening between desired targets or standards and actual levels of work performance. Although many employers continue to have reservations about the cost and extent of tangible business returns from training, the development of skills has been identified as a key factor in sharpening competitiveness. According to Shuttleworth, (2008), the economic and technological trends, the pace of innovation, change and development are growing faster year-by-year and as a result, provide clear signals that training and development are so relevant that both

organizations and individual stakeholders must give a serious attention to.

### III. EFFECT OF VARIOUS TRAINING METHODS

The selection of method for training need to be based on identified training needs, training objectives, an understanding on the part of the trainees, the resources available and an awareness of learning principles. Critten & Critten (2008) explained that the most popular training methods used by organizations can be classified as either on-the-job or off-the-job. On the job training is the most widely used training method in comparison. It is simple and less costly to operate. Observing this method critically, the training places the employee in actual work situations and makes them appear to be immediately productive (Biggs & Tang, 2011). The disadvantages are that the senior worker is not usually trained in the skills and methods of training therefore it can be a process that may be time consuming as a new comer struggles to cope with the senior worker's explanations. Far more successful is to use a senior or experienced worker who has been trained in instruction or training method and whose teaching skills are coordinated with a developed program linked to off-the-job courses. Here, there is a close collaboration between trainer and learner.

There are three common methods that are used in on-the-job training and these are; learning by doing, mentoring and shadowing and job rotation. A variety of methods could be adopted to carry out a training needs analysis (Cicmil et al. 2009b). Job analysis, interview with managers and supervisors and performance appraisal are methods commonly used. Despite the available

variety of methods, an organization has to be cautious when selecting training methods for its use. A careful use of training methods can be a very cost-effective investment. Although one of the most important stages in the training process, monitoring and evaluation, is often the most neglected or least adequately carried out part.

Mentoring is another version of the system whereby a senior or experienced employee takes charge of the training of a new employee. This suggests a much closer association than master/apprentice and elements of a father/son relationship can exist whereby the mentor acts as an advisor and protector to the trainee (Nixon et al. 2012). Here, some of the methods used in the assessment centers include business games, in-basket, simulation, problem-centered cases, and many others, to enable the trainee learn the behaviors appropriate for the job through role-playing. The use of behavior modeling is based on social theory, and it is in particular an effective method for interpersonal or social skills training. This method of training incorporates the use of videos to clearly demonstrate the way things ought to be done, what behaviors are to be avoided. Behavior modeling is often based on the demonstration of the right and effective way to behave and as a result, trainees are provided with facilities to practice this. Roberts, (2013) asserts that behavior modeling is where target behaviors are selected and videos on each of the behaviors produced, showing competent persons achieving success by following specific guidelines. Key points are displayed on screen and are backed by trainer-led discussions. Learning here is trainer enforced through role play.

Job rotation is another version of training that became popular in the 1970s to help relieve boredom and thereby raise the productivity of shop floor workers. It is a

management technique used to rotate incumbents from job to job or from department to department or from one plant to another in different geographical areas. The rotation is done on co-ordinate basis with a view to exposing the executives and trainees to new challenges and problems. It is also aimed at giving executives broad outlook and diversified skills.

### **Training Policies**

Scores of Literature available on training indicate that traditionally, training in an organization involved systematic approach which generally follows a sequence of activities involving the establishment of a training policy, followed by training needs identification, training plans and programs design and implementation, evaluation and training feedback for further action. Johnson *et al.* (2008) makes a point that to enhance employee performance, companies should have different policies for training depending on the class or level of employment or level of employees to be trained. They pointed out that training policies are necessary for the following reasons: To provide guidelines for those responsible for planning and implementing training; to ensure that a company's training resources are allocated to pre-determined requirements; to provide for equality of opportunity for training throughout the company; and to inform employees of training and development opportunities.

For any enterprise to function effectively, it must have money, materials, supplies, equipment, ideas about the services or products to offer those who might use its outputs and finally people, which is the human resource, to run the enterprise. Reiss (2012) define Human Resource Management as the involvement of all management decisions and actions that affect the nature of the relationship between

the organization and its employees-the human resources. According to Kelleher (2007), general management make important decisions daily that affect this relationship, and this leads to a map of human resource management territory, the core of which they refer to as the four Cs and these are; competence of employees: high competence creates a positive attitude towards learning and development. Commitment of employees: high commitment means that employees was motivated to hear, understand and respond to management's communication relating to the organization of work. Congruence between the goals of employees and those of the organization: higher congruence is a reflection of policies and practices which bring about a higher coincidence of interest among management, shareholders and workers alike. Cost effectiveness of Human Resource Management practices: means that the organization's human resource cost, that is wages, benefits, training and indirect costs such as strikes, turnover and grievances, have been kept equal to or less than those of competitors. As much as these policies seem to be accurate, they are silent on the elements of budgetary provision and top management support for training. According to Armstrong, (1996), training policies are expressions of the training philosophy of the organization.

### **IV. QUALITY OF TRAINING AND EMPLOYEE PERFORMANCE**

The quality of employees and their development through training are major factors in determining long-term profitability and optimum performance of organizations. To hire and keep quality employees, it is good policy to invest in the development of their skills, knowledge and abilities so that individual and ultimately organizational productivity can increase. Traditionally, training is given to new employees only.

This is a mistake as NGO training for existing employees helps them adjust rapidly to changing job requirements. Organizations that are committed to quality invest in training and development of its employees (Evans & Lindsay, 1999). A new hire training program provides a fundamental understanding of the position and how the position fits within the organizational structure. The more background knowledge the new associate has about how one workgroup interrelates with ancillary departments, the more the new associate will understand his or her impact on the organization. Another aspect of a comprehensive employee training program is continuing education. The most effective employee training programs make continuing education an NGO responsibility of one person in the department. This is an important function that will keep all staff members current about policies, procedures and the technology used in the department. A solid new hire training program begins with the creation of an employee training manual, in either notebook format or online. This manual acts as a building block of practical and technical skills needed to prepare the new individual for his or her position (Psacharopoulos & Woodhall, 1997).

Odekunle (2001) argues that much of today's employee training and reference material belongs online these days in a company Intranet. But, if the organization is not ready to embrace the online world, keep the manuals up-to-date and interesting the quality of training was substandard. When possible, in computer training, visual images of the computer screen (multi-media screen capture) to illustrate functions, examples, and how to should be incorporated.

### **Training Evaluation and Performance**

Upon checking the effectiveness of training, Woodhead (2011) stated that the training program should be reviewed during and after its completion by the training officer, the line manager, and if necessary, by the trainees themselves. Evaluation differs from validation in that it attempts to measure the overall cost benefit of the training program and not just the achievement of its laid down objectives. McNamara (2008) advocated that until control measures are taken to correct any deficiencies after the training, evaluation has not been completed and thereby ineffective. Evaluation is an integral feature of training, but it could be difficult because it is often hard to set measurable objectives. He cited some of the methods as follows; questionnaires (feedback forms): this is a common way of eliciting trainee responses to courses and programs. Tests or examinations: these are common on formal courses, especially those that result in certification for instance a diploma in word processing skills.

### **V. RECOMMENDATIONS**

Based on this review, the reviewer has the following recommendations:

1. Owners of organisations of all types in Embu should put great effort to encourage and ensure they engage staff trained in Project Management to improve their chances of implementing projects effectively.
2. Organisations with staff who specialize in other important areas of management should put in place programmes for training them in basic courses in Project Management.
3. Organisations should put in place effective training policies. This ensures that all workers understand what they are expected to do. This motivates the staff and improves the standards of work ethics, performance and working environment.

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# Perspective of Manager and Expert Practitioner on User Needs of City Park in the Framework of Sustainability of Public Open Space Management of Malang City East Java Indonesia

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DOI: 10.29322/IJSRP.8.8.2018.p8007

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8007>

**Abstract-** Urban park as public open space that sustaining pillars of environmental, economic, and social of urban sustainability is a place managed by user needs approach as input, and target it as part of long-term objectives and values [2]. This qualitative research used two-parks case study approach in Malang City studied through the perspective of the manager and professional landscape architect. The objective of this study are to describe the attributes of urban park user needs commonly considered in urban park management; and (2) to reveal the implementation of that value within its management framework. In-depth interviews and previous research studies were combined to explore and investigate data, then filled in the frame work analysis instruments which include the use of user needs data and supporting resources as inputs; programs or activities,

## I. INTRODUCTION

The role and function of city parks as public open spaces in urban areas is known to be very important. Some of them are related to the addition of the economic value of an area, improving the mental and physical health of the community, creating a better bond between individuals in social relations, and even evidence of its existence can suppress crime events [1]. The existence of the park is also part of the city's sustainability indicators, i.e. an increase in biodiversity [2]. Furthermore, the value of experience of its use by the public in the form of city imaging is part of the principle of city integrity [3]. In Indonesia, the role of City Park in certain levels is known to affect the improvement of the quality of community life [4].

approaches and related indicators as output; and related management objectives or goals as outcomes. The result showed that the urban park management was considered through the attributes of user needs that are general, specific, and enriching according to stakeholder precedent. The framework analysis shows that urban park management based on user needs, implemented with an orientation of annual work program fulfillment. A higher goal objective (long-term) is required, as measured by a broader indicator of the performance of the park (key performance indicator) to achieve the sustainability of the public open space.

**Key words-** Authority, Decentralization, Regional Government, Nature Tourist Park

The mismanagement of urban parks as an imprecise public space can lead to decreased quality. It is characterized from the following situations: abandoned garden, low of visitor number full of garbage, many destroyed facilities and unhealthy plants. As a result of research in Medan City Park comparing several aspects of the functionality and completeness of city parks through user perceptions, it shows that park visits are also influenced by the convenience of existing facilities [5]. It is referred to as the result of unsustainable management [6]; [7]. Some contextual factors such as user needs and aspirations, place characteristics, partnerships, governance, policies, funding and evaluation have not been thoroughly planned [6]; [8].

The complexity of the reality of urban public space to be faced is also higher, and there is a tendency to shift the approach from performative

and behavior toward alternative models that combine the two [9]. Some of the fundamental issues involved include an understanding of the public space terminology used [10], management capacity [11], and understanding of managers and stakeholders in establishing of long-term management values or goals [11]. It can be said, however, that the most important dimension to be addressed at the same time as a foothold in public open space management is the user's need; which concerns his perceptions, behaviors, and aspirations, which are contextually related to local cultural and cultural reflections [12].

Furthermore, from the above description, the challenge in sustainability of urban park management as a public space-if purred as the most basic framework-lies in its revitalization efforts that reflect social life and interactions among individuals concerning motivation, perception, diversity, and background as the distinctive character that appears to the place [13]. It also serve as the supporting parties' role in ensuring public stability, enabling long-term management contracts and contributing resources [11]; [14]; including the suitability of user data used in further decision making [15].

In the context of the development of Malang City, Indonesia, the local government has announced that increasing the number of parks as green open spaces in every sub-district is a benchmark of success in environmental governance performance. Regardless of the debate over the amount of green open space needed to achieve the mandate of the law and government regulations as a national standard [16], and its safeguarding of land-use transfers in the form of asset management [17], the Malang City Government manage more than 9.6% of green open spaces [18]. The 34.6 ha of them are urban parks, both as active park (69,999 m<sup>2</sup>) that can be enjoyed directly by the community for activity, and passive park (284,240 m<sup>2</sup>) as reinforcement of decoration of Malang City. How many of these parks is the result of the development and development efforts (transfer) of the built and un-built areas, as well as the results of the green open space revitalization activities of the partnership funding program. Thus, the management of a good city park is an important activity that requires thinking and work of many parties, as a form of best service to the community, especially residents of Malang.

Previous research on user behavior, especially in the context of the parks of Malang City, is not widely found. The enrichment of results is still limited to observations, perceptions and user preferences (visitors) to the pattern and arrangement of park facilities. The results are also

not harmonized with the utilization by related parties and the level of influence on the framework of public space management of Malang City.

Therefore, the following research is partly an effort to lay the foundations of city park management as a public open space in a sustainable manner through knowledge support and a deep understanding of the aspects of user needs (visitors) for further management decisions. The achievement is done by reviewing the manager's and professional's point of view to the user's needs and the level of their implementation within the framework of managing the city park as a public open space. The outcomes are the solving direction for the gap between the expectations of the users (visitors) and the professional managers and practitioners, namely in the form of (1) identification of user needs attributes commonly considered in management activities, and (2) evaluation of their application within the park management framework of Malang City.

Previous research explores the response of physically disabled users and users who can not use impassioned hands-feet against three background objects; Merdeka Square, Gajayana Square and Rampal Field. The result is Merdeka Malang Square has a better inviting factor than the other two settings. Among these are comfort factors for shade, seating, easy location and proximity to other public facilities [19].

User behavior research in Town Square Malang also been implemented by Winansih and Adhitama. The result is a dominantly visible user activity that is exercising, eating, drinking, socializing, and stopping for exploration [20]. While Adhitama shows that physical settings that affect behavior patterns are shade, seating, lighting, accessibility, a place to eat and drink, and plaza [21].

Research Putri et.al at Trunojoyo Park was conducted using behavior mapping techniques, through observation of users and setting of park attributes. The study aims to examine the pattern of user activity on the site attribute setting. Important results include the need for space for sports, seating, and socializing. The addition and subtraction of the site attributes will affect behavior setting control activities [22]. The objective of this study are to describe the attributes of urban park user needs commonly considered in urban park management; and (2) to reveal the implementation of that value within its management framework.

## II. MATERIAL AND METHOD

The search results are based on matching keywords on internet browsers and easily accessible printed libraries. Adequacy is based on the limited accessible resources, which it may be admitted may be the implications of subsequent research.

This research uses descriptive qualitative approach. The proposed construct is the variety of perspectives on the needs of users in public open spaces, affecting the management framework. The assumptions that are built are; (1) interested parties use various means to explore user needs data as inputs in public open space management activities; and (2) interested parties have a particular way of working in order to achieve the management objectives in a specific place context. The selected case study object is the public space of the public park (park / park) category used actively by the community (active park), the object mentioned by the main literature (previous research on user behavior in Malang City Park).

This study explored primary data from two groups of participants (stakeholders of city park); i. e. managers and professionals, through deep interviews. The management group is the work unit of Malang City Government, which has the scope of duties and authority related to the management of the city park, namely 1 person from the Housing and Settlement Service (P1), and 1 person from the Planning, Research and Development Agency (P2). While the professional group is a person who has experience in urban park management work for at least 2 years, namely landscape architects who have certificate of expertise and work in Malang City (A1, A2, A3). Other stakeholder networks such as economic actors and civic organizations as defined by *Stadlers (2014)*, are not included in data collection, and are not included in the scope of the study [23].

**Method of collecting data**

Participants were surveyed with open interviews. The same question was asked to each group of participants in two categories, namely introductory questions and deep questions. The second grouping of questions involves a focus on deep opinions, critical thinking on user needs in urban parks and their sustainability management framework, including more detailed questions (evolving using two case study objects), which involve an overview of responses and informant views. While questioner is added to be used as an opening tool (introduction) in forming mutual understanding to research purpose between researcher and informant in interview session.

To achieve the objectives of the first study, the researcher developed cross references technique at preliminary questioner examination session with interview result, then discussed with previous research through matrix of suitability of user requirement from case study object. Opening questions proposed related to the four categories of user needs as follows: a). part of park that motivate users, b) The motivation to visit city park, c) Facilities those support user activities, d) situations those inhibit users from activities.

Discussions were developed related to; (1) a list of user needs attributes commonly considered by participants in park management activities; (2) the degree of conformity attribute of findings with previous research based on two case study objects; and (3) differences of views between the two groups of participants to attribute the needs of users in the city park.

The in-depth interview design is prepared by referring to the basic categories of framework analysis, including management objectives, approaches and indicators, resources used, and support programs or activities. The whole is divided into ten key questions, consisting of 6 basic questions and 4 negative questions to check and confirm the answers.

A literature study was done against a reliable secondary source in the form of 4 scientific articles concerning users in the context of Malang's public spaces, 2 written reports covering approaches in public open case studies in extensive case studies, several articles on attribute user needs in public space, plus some textbooks that present basic theories of public space management (Table 1).

**Table 1.** Aspect of assessment in the main literature

Study aspects	Sources
User needs in the public space of Malang City	Kurniawan (2010) [19]; Winansih (2010) [20]; Adhitama (2013) [21]; Putri et.al (2017) [22]
Frameworks and approaches in public space management	SF Planning (2014) [24]; IVAR (2016) [25]
Theory and concept of public space management	Porteous (1977) [14]; Carr et.al (1992) [12]; Carmona et.al (2008) [7]; Zakaria

	(2017) [18]; Standler (2014) [23]
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A logical framework analysis (LFA) method is used to understand the linearity of the user needs aspect with management goals or objectives. LFAs can provide an appropriate overview of the objectives of an activity and pay close attention to the level of upper-middle justification, including external circumstances and information needs of monitoring and evaluation activities [26]. Research with LFA may mean verification of the logical verification or verification of the work system (operational verification) that can use all sources in search of relationships, either through literature review or oral explanations [27]. The basic framework of LFA research is developed through the use of relationships of the three aspects of logic thinking; inputs, outputs, and outcomes.

### III. RESULT AND DISCUSSION

#### 1) Profile of Management of Malang City Park

The Office of Housing and Settlement Area of Malang City performs the task of managing the city park through the organizational unit of field of gardening. Duties and responsibilities of this office in general is to manage the green open space area as defined in the regulation of Mayor of Malang, which formulate policies, plan development and structuring, carry out maintenance of green space, and carry out guidance to the environment community.

The Planning, Research and Development Board of Malang has a broader scope of work, which does not directly carry out the tasks of city park management in terms of coordination of asset / infrastructure management and study of social, environmental, and economic aspects as an influential aspect for the progress of Malang City. Merdeka Square has changed several times since it was first built in 1882. The last revitalization was implemented in 2015 by the Government of Malang City in cooperation with Bank Rakyat Indonesia (Indonesian People Bank) in the corporate social responsibility funding scheme. Some of the facilities that can be found on Merdeka Square were a dance fountain with light beam, bird feeding spot, photo booth (Figure 1), skateboard area, street dance / break dance area, playground, gazebo and park bench, *wifi* access, around parks, pedestrian paths, special nursing rooms, and scattered trash cans.

The latest revitalization of Trunojoyo Park as an intelligent park implemented in 2014 through

corporate social responsibility (CSR) funding program Bentoel Prima Co.Ltd. Trunojoyo Park consisted of two parts; namely the north and south side of the park. The north side park is equipped with gazebo facilities, a library, a reflexology area, a playground area, and a water fountain. While the south side park is an area to eat - drink in the form of food court.



Figure 1. Photo booth is the innovation to increase high interest for city park users

#### 2) Considered User Considerations in Park City Management

In-depth interviews with managers and professional Landscape Architects on the needs of Malang City Park users result in different perspectives. These differences appear as a disparity in either the introductory session in the form of a free question or after being confirmed from an in-depth interview. Table 2 presents the complexities of the managers and expert practitioners' perspectives, evolving following a common and specific user requirement attribute framework.

The shade park element (MA 1), in the managers' and professional's way of view is the shade of canopy trees in the park, which is considered important because it reflects the function of the park as green open space. In another perspective, some public space managers usually assume that trees are not an absolute element of public open space, since the main function expected is where to build social interactions beyond environmental interests [28]. Furthermore, professional participants gave the view that the shade of tree shade provides the thermal comfort preferred by the user.

The uniqueness of the park (MA6) is an attribute of decor in the park that is viewed by the manager as an effort to promote the park. It is also seen as important by professionals, seeing the fact that the uniqueness approach is able to invite an effective park visit, although it is recognized to have limited time due to boredom so that it demands continuous decoration innovation.

Table 2. Matrix of Conformity of Expert View and Practitioner Expert on Attribute of Park User Needs with Prior Research

Categories	Codes	Attributes	Participant Perspective					Result
			P1	P2	A1	A2	A3	
Motivation Aspect (MA)	MA1	Shade	●	●	●	●	●	+++
	MA2	Sunlight			●	●		+
	MA3	A land of grass	●	●	●	●	●	+++
	MA4	Amenities	●	●	●	●	●	+++
	MA5	Neighborhood			●	●	●	++
	MA6	The uniqueness of the garden	●	●	●	●	●	+++
	MA7	The existence of park parking			●			+
Motivation Factors (MF)	MF1	Health	●	●	●	●	●	+++
	MF2	Eating and drinking			●	●	●	++
	MF3	Enjoy the crowds		●	●	●	●	+++
	MF4	Family and friend relationship	●		●	●	●	+++
	MF5	Play / activity	●	●	●	●	●	+++
Supporting Mode (SM)	SM1	Pedestrian path	●	●	●	●	●	+++
	SM2	Sports Facilities	●	●	●	●		+++
	SM3	Seat	●	●	●	●	●	+++
	SM4	Lighting		●		●	●	+
	SM5	Sanitation			●	●	●	+
	SM6	Smoking area	●	●	●			+
	SM7	Play ground	●	●	●	●	●	+++
	SM8	Photo area	●		●			+
	SM9	Wifi (internet access)			●			+
	SM10	Gazebo			●			+
Repellent Mode (RM)	RM1	Accessibility within the park	●	●	●	●	●	+++
	RM2	Garden facilities	●	●	●	●	●	+++
	RM3	Cleanliness			●	●	●	++
	RM4	Security / image of the place			●	●	●	++

Note: \*) +++ = approved by almost all participants in two case study objects; ++ = is agreed differently on two case study objects; + = considered as a custom attribute; and - = attributes that are poorly considered

Table 3. Differences of Management and Professional Views of Some of the City Park User Needs Attributes

Manager perspective	Professional perspective
List of park elements that motivate visitors (MA)	
Environmental friendliness (MA5) is an unruly attribute, especially if the park is in a less accessible location	Environmental friendliness (MA5) gives more reasons for users to plan park visit activities
List of visitor's internal motivation to visit (MF)	
Eating - drinking (MF2) is an attribute that invites the existence of street vendors, which are considered disturbing the order.	Eating - drinking (MF2) is a natural instinct that must be fulfilled in the most humane way, in addition to forming a contribution to the local economy, also forming social ties between the seller and the buyer. Professional presence for professionals is a common practice that affects the level of park user visits

List of causes of visitor inconvenience to activity	
Cleanliness (RM3); for some maintenance actions are still often exacerbated by visitor behavior that does not maintain cleanliness and order (difficult to control)	Cleanliness (RM3); is an inviting quality that affects comfort.
Site image / security (RM4); disorderly behavior of the user is difficult to control. It still needs the rules that govern it.	Site image / security (RM4); is part of the user experience that creates a good and bad perception of a place. A good image will certainly invite more visitors.

The management and landscape architect of Malang City differs in view of attribute of user requirement, especially facility aspect which supports user activity on two object of case study submitted to them. Most of these views are attributed to attributes as special considerations that arise as development ideas because of their different design goals. Both groups of participants agree that each city park has a different purpose of existence, so the park can be referred to as a theme park. But in its application-what are the facilities that need to be accommodated in them-the two groups are different views.

Sunlight exposure attributes (MA2) and the existence of park parking (MA7) are important attributes but only if the development site allows. Curb of sunlight is generally required by users of the elderly to get energy in the morning [21]. However, if the coverage area is more dominant and access to the location is also low, then this attribute becomes less important. Merdeka Square is a great example of such attributes, and otherwise less good for Trunojoyo Park. The

existence of parking for the landscape architects is a major consideration caused as an element of convenience that invites visitors, but on the contrary, for the manager it is constrained by the expanse of the developed park. Parking facilities for the manager is a fulfillment that can arise from the surrounding environment.

Attribute supporting facility of user activity; (lighting) SM4, (sanitation) SM5, (Photo area) SM8, (wifi) SM9, and (gazebo) SM10, are viewed differently by the participants. Generally these attributes are a support facility added when possible, or a thematic tendency, that is part of the demands of a small number of users (certain communities) and in accordance with the theme / purpose of the park's development. However, all participants agreed that it was common in park sites with high intensity and number of visits.

Table 4. Tabulation of Management and Professional Input Indicating the Urban Park Management Framework

Code	Participant perspective	Parameter explanation
	User needs data	
P1	Data collection: involves a park development unit that digs data for development activities; ask for input from academics and experts in FGD	Use field data
P2	essential attribute needs; MA3, MA4, MF1, MF5, SM2, SM7, AM2	Use limited field data
A1	Data collection: utilizing data reports and user research results (social community) is limited in the context of the area (urban planning)	Use limited field data
A2	essential attribute needs; MA3, MA4, MF4, MF5, SM3, SM7, SM8, AM2	Use limited field data
A3	Data collection: utilizing literature data in park design activities, and user observation in the field	Use limited field data
	Resources	
P1	Important user requirement attributes: MA1, MA6, MA7, MF1, MF2, MF4, MF5, SM2, SM8, SM9, SM10, AM1, AM4	Own resources with limited funds
P2	Data collection: utilizing supporting party data, plus simple survey in design activities	Own resources with limited funds
A1	Important user requirement attributes: MA1, MA5, MF4, MF5, SM1, SM3, SM4, SM5, SM7, AM1, AM2	Own resources with limited funds
A2	Data collection: utilizing supporting party-related data and literature in planning activities	Own resources with limited funds
A3	Attributes of important user needs: MA1, MA4, MA6, MF1, MF5, MF3, SM2, SM3, SM5, AM2, AM4	Resources are not yet sufficient

Table 5. Manager and Professional Output Indicating the Urban Park Management Framework

Code	Participant perspective	Parameter explanation
	Programs/activities	
P1	Important programs: CSR funding, park socialization, and facilities / decoration, cleanliness and neatness	Activity-oriented garden progress
P2	Important activities: cooperation with related parties, facility revitalization, cleanliness and neatness	Activity-oriented garden progress
A1	Programs are considered important: socialization of parks, revitalizing parks, extracting ideas from the community, funding partnerships, park events	Activity-oriented garden progress
A2	Programs are considered important: socialization of parks, facilities and decoration	Activity-oriented garden progress
A3	Programs are considered important: socialization of parks, facilities, private fundraising	Activity-oriented garden progress
	Approaches and indicators	
P1	Approach: routine maintenance, decoration innovation, park event Maintenance indicator: grass health Important user indicators: number of visitors, number of damaged facilities, user satisfaction, number of violations of local regulations	Approaches are relevant to indicators that meet user needs
P2	Approach: routine maintenance, decoration innovation Important user indicators: number of visitors, user satisfaction	Approaches are relevant to indicators appropriate to user needs
A1	approaches are considered important: routine maintenance, event, innovation - general management indicators: biodiversity, money circulation, thermal comfort level - important user indicators: number of activities, number of visitors, level of community engagement	Approaches are relevant to improving environmental quality
A2	- Approaches are considered important: maintenance-based design, event, innovation - general management indicators: conformity of design objectives, green links garden, - important user indicators: easy accessibility, number of activities, social interaction, security, visitor satisfaction	Approaches are relevant to indicators that meet user needs
A3	- Approaches are considered important: regulatory sanctions, ideal maintenance, innovation, park events, CSR cooperation - General management indicators: number of activities, state of the park facilities - Important user indicator: visitor convenience	Approaches are relevant to indicators that meet user needs

Table 6. Tabulation of Management and Professional Outcome Indicating the Urban Park Management Framework

Code	Participant perspective	Parameter explanation
P1	Goal: coordinate the development activities of the city in the form of decoration and completeness of facilities, and maintenance for community use Important value of user needs: unearthed at the beginning of park development activities (project) Common style view; visitor enthusiasm is high, but the sense of having it is low	Has a goal-oriented work objective to achieve the program
P2	Target: to provide results of research on social and evaluation field that advances Malang Important value of user needs: inputs in evaluation activities are limited. The details are in the relevant departments Common style view: the user consists of many groups that need to be accommodated for their interests	Has a goal-oriented work objective to achieve the program
A1	Goal: make the park useful for the whole community and on target An important value of user needs: the management process must be bottom up, exploring the	Has a job target oriented to user satisfaction

	opinions of many parties General view: Malang garden users are happy with the culinary experience	
A2	Target: facilitate the existence of a functional park and good maintainers An important value of the user's needs: the user's need to be a supporter of the idea of related parties, the usual technical aspects considered in the beginning Common style view: high user heterogeneity, almost all products are the adoption of the outer style. Culinary, social chaos, and innovation are essential	Has a goal-oriented work objective to achieve the program
A3	Target: creating and maintaining a comfortable park for all levels of society An important value of user needs: user needs are identified from growing trends that support stakeholder ideas. Common view: the user of the city park is unhappy with the public crowd	Has a goal-oriented work objective to achieve the program
Work goals and targets		
P1	Goal: coordinate the development activities of the city in the form of decoration and completeness of facilities, and maintenance for community use Important value of user needs: unearthed at the beginning of park development activities (project) Common style view; visitor enthusiasm is high, but the sense of having it is low	Has a goal-oriented work objective to achieve the program
P2	Target: to provide results of research on social and evaluation field that advances Malang Important value of user needs: inputs in evaluation activities are limited. The details are in the relevant departments Common style view: the user consists of many groups that need to be accommodated for their interests	Has a goal-oriented work objective to achieve the program
A1	Goal: to make the park beneficial to the entire community and on target Important value of user needs: the management process must be bottom up, exploring the opinions of many parties General view: Malang garden users are happy with the culinary experience	Has a job target oriented to user satisfaction
A2	Target: facilitate the existence of a functional park and good maintainers An important value of user needs: the user's need to be a supporter of the idea of related parties, the usual technical aspects considered in the beginning Common feature view: high user heterogeneity, almost all products are the adoption of the outer style. Culinary, social chaos, and innovation are essential	Has a goal-oriented work objective to achieve the program
A3	Target: creating and maintaining a comfortable park for all levels of society An important value of user needs: user needs are identified from growing trends that support stakeholder ideas. General view: the user of the city park is unhappy with the public crowd	Has a goal-oriented work objective to achieve the program

### 3) Evaluation of Malang City Park Management Framework

Ten questions asked to participants through in-depth interviews showed slightly different outcomes among them on how city park user data were extracted and utilized, resources used, essential management programs, approaches, and intended targets. The results lead to an input framework: (a) limited use of field data of user needs, (b) resources with limited funds ; outputs framework(Table 4): (a) park-oriented programs, with (b) a relevant approach to indicators according to user needs (Table 5); and outcomes: (a) goal-oriented work objectives (Table 6).

The utilization of user needs data is generally considered to be sufficient by utilizing the results of the reports prepared by the managers and the completeness of the technical guidance collected through the collection of various parties' opinions in the planned discussion (FGD). Managers in such a perspective understand that accommodating the needs of users means presenting innovative innovations on the procurement of park facilities and decorations as part of inviting visitors. The development program is arranged with the direction of promoting the park as part of pride of

Malang City. Similarly, the perspective built by landscape architects. With some breadth of insight into the needs of users-as a result of access to literature-supporting literature-they agree that user satisfaction is also created with their self-image that is united to the pride of Malang City through a great interest in innovative park elements. Landscape managers and architects feel it is important to review appeals in the form of adoption-design development in efforts to advance the city park.

Landscape Architect see that the adequacy of funds is an important aspect of city park management. Limited funding creates its own difficulties for park maintenance activities. Financing for daily freight and tool rejuvenation is a common constraint affecting maintenance activities. On the other hand, human resources are also viewed by landscape architects as a constraint that influences in terms of the effectiveness of maintenance activities, namely due to land status and individual capacity. Managers in this regard argue the solution can be done by formalization, namely strengthening local regulations  
Landscape managers and architects have limited views on possible approaches to park management and indicators

designed to check their success. A common approach that is seen as important is limited to routine maintenance, decoration innovation, CSR funding, and park events.

Indicators of successful management of Taman Kota Malang can be mentioned by participants in a limited way. It is generally seen that the important management indicators are the number of visitors, the number of damaged facilities, the number of park activities, and the level of user satisfaction. However, on the other side the breadth of the indicator

the following for the landscape architect may also affect the park's performance and the indirect needs of the user, namely biodiversity, thermal comfort level, money circulation, design level of compliance with maintenance objectives, the amount of activity, social interaction, and the incidence of violations in the park.

The views on city park management objectives lead to program-oriented targets, which appear to be dominantly in the interest of providing facilities for ongoing renewals. This is because most participants perceive that the user's needs are considered as a supporter of the idea of a party related to the general pattern of following a growing societal social trends. Almost all participants convey the idea of the goal of managing the city park is to make the park can be enjoyed by the community. The target view towards improving the quality of the park as urban green spaces and even an increase in social economic aspects has not been found in most of the participants.

Nam's research identifies a user group that builds a stakeholder network within a public open space. In that case, users consisting of permanent users and potential users-are related to others such as certain communities, academics, and institutions / organizations that are entirely within the professional group, and the group of businesspeople in it [8]. While Chitrakar study entering the user in the aspect of regulation of public space management because of potential conflict of potential that is in it. This together is recognized as an aspiration input in its management [29].

Kurniawan's research explores the response of physically disabled users and users who can not use impassioned hands-feet against three background objects; Merdeka Square, Gajayana Square and Rampal Field. The result is Merdeka Malang Square has a better inviting factor than the other two settings. Among these are comfort factors for shade, seating, easy location and proximity to other public facilities [21].

User behavior research in Town Square Malang also been implemented by Winansih and Adhitama. The result is a dominantly visible user activity that is exercising, eating, drinking, socializing, and stopping for exploration [20]. While Adhitama shows that physical settings that affect behavior patterns are shade, seating, lighting, accessibility, a place to eat and drink, and plaza [21].

#### IV. CONCLUSION

1. The management of Taman Kota Malang can consider the attributes of user needs as input in the perspective of a general attribute, a special attribute, or based on the precedents of various stakeholders.

2. Evaluation of a user-oriented urban park management framework can be approached by an analytical logical framework of input consisting of data and utilization; outputs consisting of programs (activities) and approaches

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8007>

and indicators; and outcomes consisting of the goals or objectives of the management of the city park.

3. Sustainable urban park management requires a higher understanding of the value and objectives of its management (long-term), by translating it into relevant approaches and indicators, useful for checking, reviewing, monitoring and evaluating management activities.

Further research development is needed primarily within the scope of the following themes:

1. Research environmental behavior widely on different place context and user groups.
2. Development of performance rigid indicators (key performance indicators) of city park management or urban park assessment models.
3. Investigation of the level of effectiveness of self-management (government) and the potential value of its decentralization through community roles.

#### ACKNOWLEDGEMENT

The author would like to thank to Rector of Tribhuwana Tunggal University for allowing and funding of the study, to the research supervisors on the richness of their point of view and scientific experience, and to the research participants for their help and co-operation.

We thank to Director of Postgraduate School, Universitas Brawijaya who were given permission for the research and team of journal clinic of Postgraduate Program Universitas Brawijaya who helped in revising initial manuscript.

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# Design and Manufacturing Process of Plastic Injection Mold

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DOI: 10.29322/IJSRP.8.8.2018.p8008

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8008>

**Abstract-** One of the most common methods in producing plastic products is injection molding for many purposes ranging from a daily product to high-tech equipment. This paper is to display how to design a complete mold and to examine the material, forecast the possible defects, and optimize the design to achieve the maximum outcome of the products with minimum cycle time in each production cycle. The CAD/CAM software is applied as the analysis tool for the particular chosen product “Clothes-hanger”. In this paper, it will describe the behavior of plastic material starting from the filling phase until the end of the cooling phase in the injection process. The final result shows the possibility of having cavity designs of “Clothes-hanger” in one mold plate of the size 330mm×458mm×53mm.

**Index Terms-** Mold design, filling phase, cooling phase, Clothes-hanger, CAD/CAM software

## I. INTRODUCTION

Injection molding is commonly used for manufacturing a variety of parts from the smallest components to entire body panels of cars[1]. This technique has developed from the production of the simple things like combs and buttons to major consumer, bottle cups, clothes-hanger and outdoor furniture [5]. The mold design for injection molding has developed a very critical aspect to achieve the optimum use of a mold plate [1]. In this time and condition, injection molding simulation software is the right tool to be incorporated in the mold process. It is that helps the mold designer and mold maker to get the maximum output of a mold plate for a certain product design [6]. The “Clothes-hanger” product is designed by using CAD/CAM software. In this paper, manufacture process have been proposed which can make medium carbon steel injection mold. This mold is built by using CNC milling machine.

## II. DESIGN CONSIDERATION OF AN INJECTION MOLD

The choice of material to build a mold is mainly one of economics. Gates are a transition zone between the runner system and the cavity. The great importance is location of gate for the properties and appearance of the finished part. The runner is various for distribution of thermo plastic melt form the machine nozzle to the cavities. The sprue bushing and runners must be as short as possible to ensure limited.

Cooling system is very important to remove efficiently and dissipate the heat of the molding rapidly and uniformly. For efficient molding, the temperature of the mold must be controlled and this is done by passing a fluid through a correct arranged channel in the mold.

A number of several cooling channel schemes or layouts are usually used in injection molding. Cooling channels layout must be reasonable. When the wall thickness of the part is uniform, the distance of each channel to the surface of parts should be level. The injection mold cooling channel can be closer to the part to improve the cooling effect when the thickness wall areas need more cooling. The Fourier number is

$$F_0 = \frac{kt}{\rho C_p X_m^2}$$

Where  $F_0$ = Fourier number,  $k$ = thermal conductivity,  $t$ = time,  $\rho$ = melt density,  $C_p$ = heat capacity,  $X_m$ = the distance from the surface to the center.

$$\frac{T_m - T_0}{T_i - T_0}$$

Where  $T_m$ = mid plane temperature,  $T_i$ = the initial temperature of the material,  $T_0$ = the suddenly imposed surface temperature.

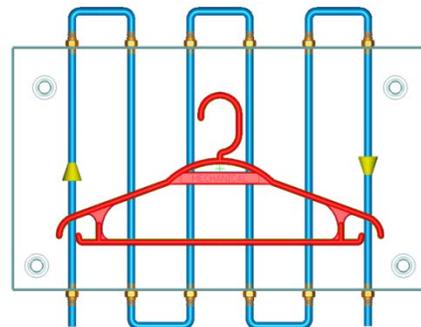


Figure 1. Cooling Line Layout

Venting system is the process of removing trapped air from the closed mold and volatile gases from the processed molten plastic. The mold can be corrosion if inadequate venting.

## III. INJECTION MOLD DESIGN

In an injection molding machine of Polypropylene are molded per hour:  
Melting plastic temperature:  $m^{\circ} = 20$  kg/hr  
Mold surface temperature:  $T_1 = 180^{\circ}\text{C}$  (entering)  
 $T_2 = 40^{\circ}\text{C}$  (cooling water)

Temperature of the mold is not to exceed 5°C  
 Polypropylene Heat Capacity:  $C_p = 2200 \text{ J/kg}^\circ\text{C}$   
 Liquid of Heat Capacity:  $C_p = 4182 \text{ J/kg}^\circ\text{C}$   
 Heat of Fusion:  $\Delta H_f = 210000 \text{ J/kg}$

This is a straightforward application of the first law of thermodynamics that is the principle of conservation of energy. The heat for coming off the solidifying plastic in the mold must be taken away by the water.

$$Q_{\text{plastic}} = Q_{\text{water}}$$

The heat removed from the plastic is equal to the heat given off as the plastic temperature drops from 180°C to 40°C plus the heat of solidification which is equal to the heat of fusion but opposite in sign. As the plastic solidifies and the molecules stop moving randomly, heat is liberated.

$$Q_{\text{plastic}} = m^\circ C_p \Delta T + m^\circ \Delta H_f$$

$$= 20 \frac{\text{kg}}{\text{hr}} \times \frac{1\text{hr}}{3600\text{s}} \times 2200 \frac{\text{J}}{\text{kg}^\circ\text{C}} \times (180^\circ\text{C} - 40^\circ\text{C}) + 20 \frac{\text{kg}}{\text{hr}} \times \frac{1\text{hr}}{3600\text{s}} \times 210000 \frac{\text{J}}{\text{kg}}$$

$$= 2877.77 \text{ J/s}$$

The heat taken up by the water undergoing a 5°C temperature change is

$$Q_{\text{water}} = m^\circ C_p \Delta T$$

$$Q_{\text{plastic}} = m^\circ C_p \Delta T$$

$$m^\circ = \frac{Q_{\text{plastic}}}{C_p \Delta T} = \frac{2877.77 \text{ J/s}}{4182 \frac{\text{J}}{\text{kg}^\circ\text{C}} \times (40 - 5)^\circ\text{C}} = 19.6609 \times 10^{-3} \text{ kg/s}$$

Therefore:

$$m^\circ = 19.6609 \times 10^{-3} \text{ kg/s} \times \frac{3600\text{s}}{1\text{hr}} = 70.779 \text{ kg/hr}$$

The amount of water required to cool the plastic and keep the mold at 40°C,

$$m^\circ = 70.779 \text{ kg/hr}$$

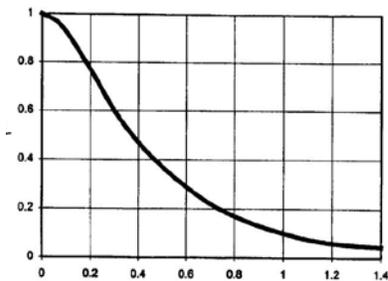


Figure 2. Flow Chart Time for Solidification of Plastic

At Polypropylene plate,

The initial temperature of the material:  $T_i = 180^\circ\text{C}$

The suddenly imposed surface temperature:  $T_o = 40^\circ\text{C}$

Mid plane temperature:  $T_m = 90^\circ\text{C}$

The distance from the surface to the center:  $X_m = 8\text{mm}$   
 $= 8/2$   
 $= 4 \times 10^{-3} \text{ m}$

Fourier Number,  $f_0 = \frac{kt}{\rho C_p X_m^2}$  is the dimensionless Fourier number, and  $t$  represents time and  $X$  the distance from the surface to the center.

From figure 2,

$$\frac{T_m - T_o}{T_i - T_o} = \frac{90 - 40}{180 - 40} = 0.43$$

Therefore,

$$f_0 = 0.39$$

Thermal conductivity:  $k = 0.18 \text{ w/m}^\circ\text{C}$

Melt density:  $\rho = 730 \text{ kg/m}^3$   
 Heat capacity:  $C_p = 2200 \text{ J/kg}^\circ\text{C}$

$$t = \frac{f_0 \rho C_p X_m^2}{k} = \frac{0.39 \times 730 \times 2200 \times 0.004^2}{0.18} = 55.67 \text{ seconds}$$

For the one-dimensional plane

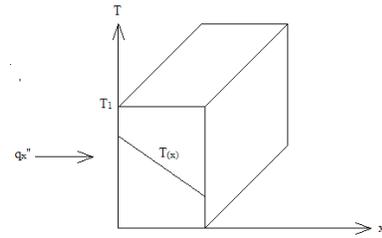


Figure 3. One-dimensional heat transfer conduction

The temperature distribution is linear. The temperature gradient express as,

$$\frac{dT}{dx} = \frac{T_2 - T_1}{L}$$

The heat flux,  $q_x'' = -k \frac{T_2 - T_1}{L}$

$$q_x'' = k \frac{\Delta T}{L}$$

Normal area to the direction of the heat flow:  $A$

Wide of temperature different:  $b = L = 30\text{mm}$

Temperature difference:  $\Delta T$

Thermal conductivity:  $k = 0.2 \text{ w/m}^\circ\text{C}$

$T_1 = 180^\circ\text{C}$

$T_2 = 40^\circ\text{C}$

$$q_x'' = k \frac{\Delta T}{L} = \frac{0.2 \frac{\text{w}}{\text{m}^\circ\text{C}} \times (180 - 40)^\circ\text{C}}{30 \times 10^{-3} \text{ m}} = 933 \text{ W/m}^2$$

#### IV. MOLD MANUFACTURING PROCESS AND SIMULATION RESULT

In this section, the mold manufacturing process must be able to execute directly from a CAD model. In order for this process to be completely automated are:

- Desire the mold cavity with CAM software
- Cutting Tools selection
- Fixture (location supporting, clamping surface, stability and fixture element function)
- Calibration for tools off-set setting and work-piece setting
- Generating Machine Tool paths using Master CAM

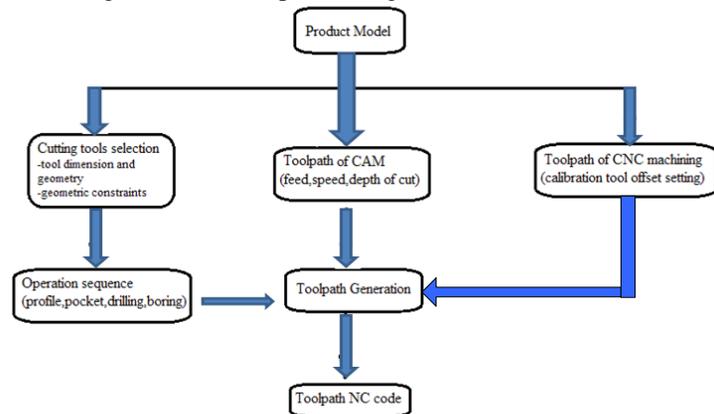
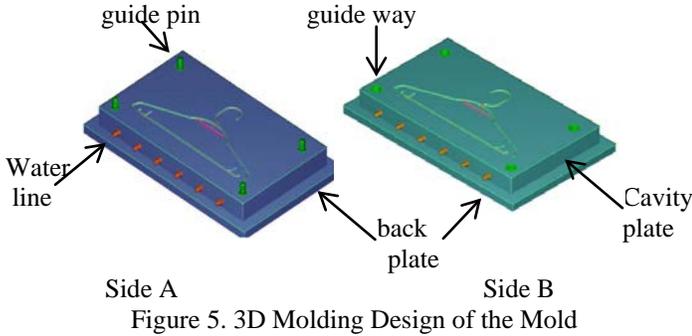


Figure 4. Process Planning Operation in Manufacturing Process

A rectangle single cavity (Clothes-hanger) mold have two half which in Side-A have guide pin and cavity plate, in Side-B have guide bush, cavity plate and injection port. Design for the cavity is handled in two different ways: the size of the part and the size of the mold. The creation of the core and cavity design from the part geometry can be automated by using solid modeling program.



Side A Side B  
 Figure 5. 3D Molding Design of the Mold

The following describes each of option on the way down the path to machining.

- Area to machine
- Strategy
- Raster Angle
- Allowance
- Tolerance

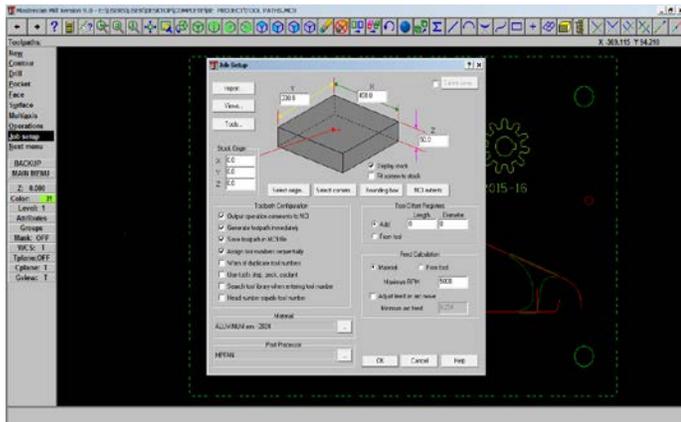


Figure 6. Job set-up Parameter

The Z-heights of the first and last passes establish the starting depth (relative to the 0, 0, 0 point established), and the ending depth of passes. The number of passes in between is calculated based upon the tool's Step Down setting- the distance that the tool will step downward for each new pass. This is set in the tool definition window.

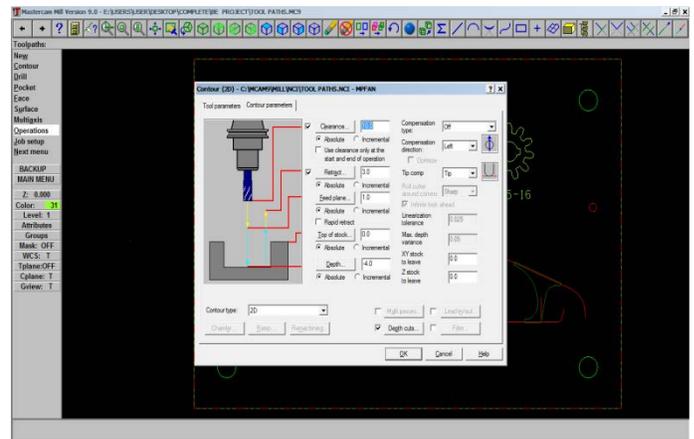


Figure 7. Tool Parameter

This mold is machined by using End mill tool (1/4 inch) and slot drill.

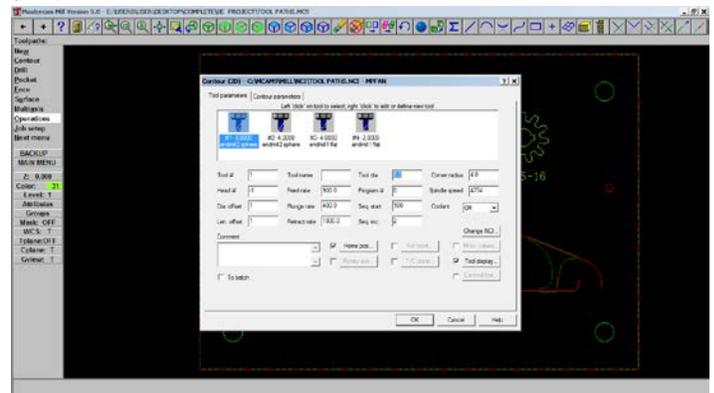


Figure 8. Operation Parameter

The result is that a series of paths traversing the surface of the material, stepping over and stepping down successively to cut away the material. Tool paths are shown graphically on screen in red, and will be written out in code during Posting.

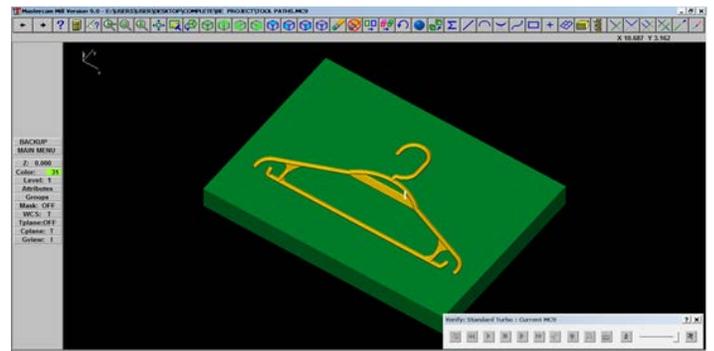


Figure 9. Verify Process

Posting is to be enabling the Milling or Routing machine to actually cut these tool paths out of the material physically, the machining instructions of the tool paths must be sent out to the machine as a coded set of machine instructions called G&M codes.



# Comparison of Cultural Heritage Tourism Towards Sustainable Development Case study: Special Region of Yogyakarta, Indonesia - Bangkok, Thailand

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DOI: 10.29322/IJSRP.8.8.2018.p8063

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8063>

**Abstract**-Tourism is a tourism activity supported by various facilities. Cultural heritage is a cultural legacy in the form of materiality object, it can be in the form of Heritage Objects. Cultural heritage tourism in the Special Region of Yogyakarta, Indonesia and in Bangkok, Thailand have similar characteristics. However, In Southeast Asia, Thailand is a leading country in Cultural Heritage preservation. This study aims to compare tourism management in Yogyakarta, Indonesia with Bangkok, Thailand, based on policy, management and financing aspects by using comparative descriptive method and empirical approach. The focus of research was the object of tourist destinations in Yogyakarta and in Bangkok in the form of buildings cultural heritage. The results showed that the development of tourism activities in Indonesia prioritizes in the economic aspects. On the other hand, the development of tourism activities in Bangkok takes into account the ecological, socio-cultural and economic sustainability of the community. To realize the development of good tourism, it needs to apply the sustainability concept.

**Keywords:** tourism management, cultural, heritage, sustainable

## I. INTRODUCTION

Tourism is a wide range of excursion activities and it is supported by various facilities and services provided by the community, businessmen, the Government and the Regional Government (Law of the Republic of Indonesia No. 10.Tahun 2009 on Tourism). One type of tourism according to (James, Spillane, 1987) based on the objective motive is tourism for culture (cultural tourism). The term cultural heritage is usually associated with cultural heritage tourism activities. Cultural Heritage is a cultural legacy in the form of material object, Buildings, Cultural Structure, Cultural Sites, and Cultural Areas on land and/or water that need to be preserved because it has important value for history, science, education, religion, and/or culture through the process of determination (Law of the Republic of Indonesia Number 11 Year 2010 About Cultural Heritage). Cultural tourism covers all aspects of the journey in which people learn about each other's way of life and thinking. Therefore, tourism is an important means to promote cultural relations and international cooperation. Tourism is also useful for promoting the knowledge, understanding and image of a nation through tourism (Goeldner & Ritchie, 2009).

The concept of tourism activities can be identified based on three factors, namely something to see, something to do, and something to buy (Yoeti, 1985). Something to see is related to the attractions in the tourist destination, something to do relate to tourists' activities and something to buy associated with shopping activities conducted tourists. Cultural tourism is not only about consuming cultural products from the past but also related to knowledge of contemporary life and the culture of today's society (S. Mousavi, N. Doratli, S. Mousavi et al, 2016). The definition of cultural tourism can be divided into 2 (two): The conceptual definition of the movement of people to cultural attractions away from their normal residence, with the intention to collect new information and experiences to meet their cultural needs and technical definition of all the movements of people for certain cultural attractions, such as heritage sites, art and cultural manifestations, art and drama outside their ordinary residence (ATLAS, 2009).

Some aspects that support a tourist destination vary depending on the condition of the area. According to Cooper (2005), they explained that the development framework of tourism destinations consists of the following main components:

- 1) Object of attraction which includes the uniqueness and attractiveness based on nature, culture, and artificial.
- 2) Accessibility includes facilities and transportation system.
- 3) Amenities which includes supporting facilities and tourist support.
- 4) Ancillary Service which support tourism activities.
- 5) Institutions that have the authority, responsibility and role in supporting the implementation of tourism activities.

The cultural heritage tourism management strategy has traditionally focused on the supply side ie, resources and ignoring the demand side of tourists (Timothy, D. J., & Boyd, 2003). Currently, the trend of global heritage tourism management has moved forward from a product development approach (exhibition and education) to a more visitor-oriented development approach. It is a consumer preference and the quality of personal experience (Apostolakis & Jaffry, 2005). On the one hand, to promote a strong national image to attract tourists and tourism developers, tourism is heavily influenced by the public sector, especially in the provision of basic infrastructure (energy, roads, runways, water supply, etc.). On the other hand, tourism sector usually comprises of many small and medium-sized, privately owned and fragmented businesses that are difficult to coordinate and legislate (Robinson & Picard, 2011).

The Thai Law on National Tourism Policy, BE 2551 that has been implemented in 2008 aimed at integrating national and administrative tourism policies at all levels to produce quality and sustainable national tourism development. Thailand's national tourism policy plan reflects the Government's Vision of Thailand to establish an appropriate system for tourism administration and strategies for enhancing tourism competitiveness (Rupjumlong & Ph, 2012). The development of cultural tourism in Thailand is managed by temple managers or those who coordinate directly with the Ministry of Tourism and Sports of Thailand and the Thai kingdom. As Thailand's efforts to develop sustainable tourism, Thailand makes three tourism rules: (1) Sustainable tourism with quality and value-added (Balance: Economic, Social & Environment) (2) Wealth distribution (3) Pride of local heritage.

Indonesia has Law of the Republic of Indonesia Number 10 Year 2009 on Tourism. The basic rules of tourism are governed by the Law. In its elaboration, the regulations on tourism are based on the importance and urgency of each region's tourism. One of the efforts undertaken is the establishment of the National Strategic Tourism Area (KSPN) which has been established by the government. In 2016, the Ministry of Tourism of Indonesia inaugurated cooperation with United Nations World Tourism Organization (UNWTO), through the Sustainable Tourism Observatory (INSTO) program. Indonesia was ranked the second after China in the category of Sustainable Tourism Development (STD).

Cultural Heritage Tourism in Special Region of Yogyakarta, Indonesia and in Bangkok, Thailand has almost the same characteristics. However, Thailand is a leading country in the cultural preservation in Southeast Asia, besides the number of tourists visiting Bangkok is much larger than Yogyakarta. Based on the background that has been proposed, this study aimed to make comparative management of cultural heritage tourism based on policy aspect, management and financing of Cultural Heritage Tourism in Special Region of Yogyakarta, Indonesia and in Bangkok, Thailand, so as to give the benefit as a lesson learn the success of sustainable development in tourism sector.

Research Sites of Yogyakarta Special Region of Indonesia and Bangkok City, Thailand

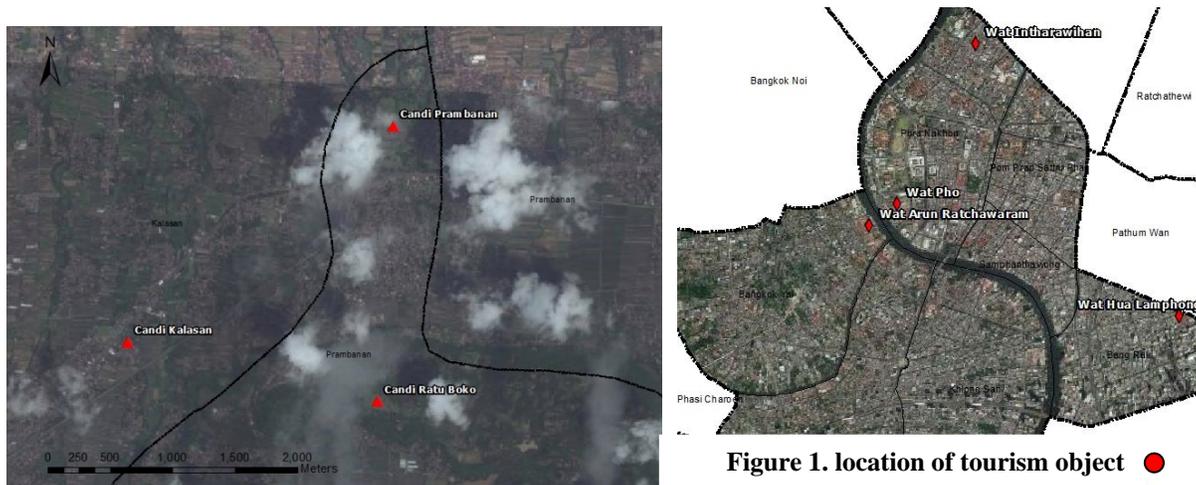


Figure 1. location of tourism object ●

This research used empirical descriptive comparative method and inductive reasoning. Method of data collection was done by random sampling technique through interview and direct observation. The focus of research was the object of tourist destinations of cultural heritage buildings in Yogyakarta Special Region and in Bangkok City that serves as a place of Buddhist/Hindu worship.

### III. RESULTS AND DISCUSSION

#### A. Tourism Development Policy

Analysis of tourism development policy aimed to know the policies applied as the basis for tourism development. Policy analysis was done by comparing the implementation of policy in Yogyakarta and in Bangkok City. The comparative policies are the policies relating to tourism in general.

Table 1. Tourism Development Policy

No.	Yogyakarta, Indonesia	Bangkok, Thailand
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No.	Yogyakarta, Indonesia	Bangkok, Thailand
1.	Indonesian tourism is still oriented to economic activity that is in global technological progress. Tourism in Indonesia is more likely to lead to arts and culture as an important asset for the development of tourism programs	Thai tourism is based on several basic policies, namely the environment and natural beauty, the uniqueness of traditional culture, history and various relics
2.	Increase public awareness of tourism through Penitentiary of <i>Sapta Pesona</i> .	Applying the concept of OTOP (One Tambon, One Product), ie where each village has one of the most favored products so that each village has its own potential and does not compete between one village and another
3.	Tourism development should be linked to national, regional and local economic development. At the national level the tourism sector should act as prime movers and interactively related to the development of other sectors.	Developing and restoring the existing nature, history and culture of the tourist destination; promoting the development of new destinations in the region with the potential to link nature, culture and local lifestyles, in accordance with tourism development plans that set the framework for the development of tourist destinations, and encourage investment by the private sector and local government.
4.	Tourism development should be pursued to involve all stakeholders. In this context the role of the community involved begins in the upstream sector (providing extractive production activities) downstream (production services activities).	Promoting the market for the quality of tourists, both internationally and domestically, through proactive marketing strategies and targeting Thailand to be a world-class tourist destination and an international meeting and exhibition center, as well as a treatment center; improving the efficiency of granting visas, free visa fees for visitors from Thailand's FTA partner countries, or those with trade and investment relations with Thailand.
5.	The development of tourism activities should take into account the direction in the spatial plan made by <i>Bappeda</i> (Regional Development Agency)	The development of tourism activities should come from the BMA development plan
6.	The development of tourism activities is done with the development of physical and non-physical aspects.	The development of tourism activities is done with the development of physical and non-physical aspects.
7.	The government encourages marketing and promotion by providing a more dominant role for tourism businesses.	Not only the government, the private sector also take part in encouraging tourism activities

One of the goals of Yogyakarta City Development is to make the city of culture-based tourism with the diversity of objects, attractions, and tourist attraction. The development of tourist villages in Special Region of Yogyakarta and tourist clusters continues to be developed by the Regional Tourism Office with communities and academics. The goal is to have an economic impact for people around the tourist sites. One concept that is often used to develop tourism is community based tourism (CBT). One form of CBT is the development of tourist villages. Tourism offered is all the potential possessed by rural communities. Rural tourism makes the community more maintain the authenticity of culture and nature in the village to be able to maintain the interest of tourists in the tour in the tourist village. The concept used in CBT is closely related to empowerment, in which the community is empowered first in order to be able to develop its own potential, with community empowerment trained to be able to help themselves (self-help). Hence, in the development of tourist village, the communities are developed and empowered to be able to manage its own tourist village (Ainun, Krisnani, & Darwis, 2014).

In conducting tourism development, Bangkok has made development based on ecological, socio-cultural and community sustainability, and economic sustainability. The whole can be identified from government policies that greatly develop tourism with the main concern is community involvement in tourism development. The community is fostered to manage and be directly involved in the management and marketing of tourism object. It also benefits for Bangkok's revenue from the tourism sector. Empowerment of local business groups is empowered by integrating groups with tourism businesses such as tour and travel. It is expected that the product and the community can develop and the products can be marketed easily, so that the income earned more and can create other jobs.

### B. Management of Tourism Activities

The analysis of tourism activity management aimed to know the system of tourism destination management that has been done. Analysis of tourism management was done by comparing between management in Yogyakarta and the City of Bangkok.



(a) Ratu Boko Temple

(b) Kalasan Temple

(c) Prambanan Temple

**Figure 1 Tourist Attraction (Temple) in Yogyakarta, Indonesia**

Selected tourist attraction for the analysis of tourism activity management is located in Special Region of Yogyakarta that are popular as tourist destinations in Yogyakarta Special Region include: Siwa Temple, Brahma Temple, Wisnu Temple (Prambanan Temple Complex), Ratuboko Temple, and Kalasan Temple and popular tourist destinations which is in the city of Bangkok Wat Pho, Wat Arun, Wat Hua Lamphong, Wat Intharawihan. The cultural heritage object is an interesting objects for tourists. Currently the temples are still used as a place of worship the Gods.



(a) Wat Arun

(b) Wat Intharawihan

(c) Wat Hua Lamphong

**Figure 3 Tourist Attraction (Temple) in Bangkok, Thailand**

**Table 2 Management of Tourism in the Special Territory of Yogyakarta Indonesia and in Bangkok Thailand**

No	Special Region of Yogyakarta, Indonesia	Bangkok, Thailand
1	The tourism management system in Yogyakarta is conducted by the Yogyakarta Tourism Office, all tourism activities are carried out through a one-stop mechanism by the Yogyakarta Tourism Office	The management system in Bangkok City is done by the Ministry and the Kingdom. All the tourism in the city is under the command or support of the Ministry of Tourism and/or the Kingdom
2	The source of fund management of the majority of tourism is from the government, entrance ticket, and private sector	Sources of fund management of tourist destinations are not entirely derived from the government or the kingdom. The funds can be sourced from the people's fund, the family's heritage funds and the funds from tourists
3	Marketing of tourism destinations is done by government, private and social media	Marketing of tourism destinations is done by managers of tourism objects in cooperation with private parties and government and social media.
4	Communities are involved in managing tourist destinations	Communities are involved in managing tourist destinations

The decision-making process in managing cultural heritage tourism has traditionally used a top-down approach (McArthur, S., & Hall, 1993; Timothy, D. J., & Boyd, 2003). Management process of cultural heritage tourism with this approach is considered less appropriate because of less attention to parties whose interests and less consider the condition of reality in the field (tourists and attractions). The management of tourism between Yogyakarta and Bangkok in particular tourism cultural heritage has in common. The government plays a role in directing tourism development, while the private sector and the community are as executor of management in the field. In Yogyakarta, the private sector that invests in tourism objects employs people around the tourism object either as guide or nurse object. People who live in the vicinity of tourist areas are given education/knowledge about the development of tourism object. This can increase tourism potential by utilizing the potential of local resources

### C. Tourism Financing

The analysis of tourism financing aimed to determine the destination financing system. Financing analysis was done by comparing the financing system in tourist destinations in Yogyakarta and in Bangkok City. The selected objects for this analysis are popular tourist destinations in Yogyakarta include: Siwa Temple, Brahma Temple, Wisnu Temple (Prambanan Temple Complex), Ratuboko Temple, and Kalasan Temple and attractions in Wat Pho, Wat Arun, Wat Hua Lamphong, Wat Intharawihan.

**Table 3. Tourism Financing**

No.	Special Region of Yogyakarta, Indonesia	Bangkok, Thailand
1.	Visitors of tourism must pay the entrance fee to the tourist location. Souvenir merchants also have to pay fee to the manager of the government tourism area, because they use the facilities/government land for trading activities	Tourists do not have to pay entrance fees to tourist sites. Souvenir sellers do not pay fee to the Government of Thailand. Because souvenir merchant activity is considered as one tourist attractions.
2.	Tourists Objects Manager must pay a levy/tax to the Local Government in Indonesia because it is considered to use government facilities. This levy is one of the sources of local government revenue.	Most tourism managers do not pay fee to the Thai government. The government considers the existence of tourism object as a strategy to increase public income / government through tourism sector
3.	Tourism potential of Yogyakarta Special Region has reached the international scope, it is estimated that the revenue from the tourism sector reaches Rp 7 trillion per year.	Tourism in Thailand contributes the country's largest revenue by USD 42 billion in 2015 and targets \$ 66 billion in 2016.

### D. Tourism Sustainability Activities

Sustainable development is increasingly becoming a priority issue in the development of tourism in the world. Sustainable tourism needs to be integrated with local area development. The local level needs to be a basic level of problem solving, as well as a medium for local governments to recognize the needs of local communities in tourism (Kapera, 2018). To achieve sustainability objectives in cultural heritage tourism, legacy sites should be managed effectively in ways that ensure the preservation of heritage resources and presentation to the public (Glasson, Godfrey, & Goodey, 1995; McArthur & Hall, 1993, 1996). Tourism is an important element in the growth of a city and country that can increase the amount of revenue and infrastructure improvement through tourism activities and supporting elements such as transportation, accommodation, and other supporting facilities. Tourism activities need to be developed in a sustainable manner. In recent years the tourism industry has become a constantly evolving global phenomenon with various activities and can be a potential source of foreign exchange potential. The phenomenon of soaring tourist visits to Thailand can shift the largest national income from agriculture to tourism. Similarly, what happened in Special Region of Yogyakarta experienced an increase of domestic and foreign tourists.

The essence of tourism is a tourist destination. This variety of destinations is a great potential. Four main aspects that support tourist destinations in the Special Region of Yogyakarta and in Bangkok are:

- 1) Attractions, in the Special Region of Yogyakarta offers cultural attractions and uniqueness of the building, the city of Bangkok also has the same object
- 2) Accessibility, access to tourist areas in Yogyakarta and the City of Bangkok is very good. They have a high level of competence. The location of the tourist area is connected with the transportation facilities that are very supportive.
- 3) Amenities or things that support all the needs of tourists to be important in supporting tourist destinations. In the Special Region of Yogyakarta and in the city of Bangkok there are many hotels and restoring with various prices that can customize the choice of visitors,
- 4) Ancillary or organization or can also be called an institutional system, in the Special Region of Yogyakarta and in the city of Bangkok there are institutions that take care of tourism activities with good performance and organizational systems are structured clearly.

## IV. CONCLUSION

Institutions in Indonesia that manage tourism are decentralized. The Ministry of Tourism delegates authority to the regional tourism office. Unlike with the Bangkok Government which focuses on the authority of tourism to a body called BMA to synchronize tourism

with other urban aspects. Here are the findings of research results Comparison of Tourism Development Cultural Heritage in Special Region of Yogyakarta, Indonesia - Bangkok, Thailand:

- The management of cultural heritage tourism in Bangkok has undertaken development based on ecological, socio-cultural and community sustainability, and economic sustainability. While Indonesia is still based on the economy. However, there are similarities between Bangkok and Yogyakarta in terms of tourism development by involving the community.
- Management of cultural heritage tourism activities in Bangkok and Yogyakarta is conducted in the same way that is managed by government or private sector by involving the community.
- Financing of cultural tourism activity between Bangkok and Yogyakarta has a difference. Visitors of cultural sights in Bangkok are free of charge to enter tourist sites and souvenir sellers do not have to pay a levy to the government, this is in contrast to the conditions in Indonesia

It can be concluded that to develop tourism with the concept of 4A (Attraction, Accessibility, Amenity, Ancillary) should still pay attention to the preservation of cultural heritage so that the development of tourism in accordance with the concept of sustainable development. Sustainability principles refer to the environmental, economic and socio-cultural aspects of tourism development, and a suitable balance must be established between these three dimensions to guarantee its long-term sustainability

### ACKNOWLEDGMENT

The author expresses their gratitude to all those who have contributed to the preparation of this article. Especially to the Students of Undergraduate Program of Department of Urban and Regional Planning, Diponegoro University, all member of Field Work Field Team of 2017 Theme of Tourism. My biggest thanks also submitted to all authors of the articles/journals/books used as cited in the references.

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# Moderating effects of demographic factors on foreign television cartoon programs exposure and children's social behavior in Kenya

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DOI: 10.29322/IJSRP.8.8.2018.p8010  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8010>

**Abstract:** The aim of the study was to examine the moderating effects of demographic factors on foreign television cartoon programs exposure and their influence on Kenyan children social behavior. The study applied cross-sectional research design. The researcher targeted school going children aged 7-10 years and in lower primary (Std.2-4) enrolled in 5 identified private primary schools. Simple random sampling technique was used to select pupils who were issued with questionnaires and included in the final research sample. A total of 350 pupils participated in the research. Of particular interest was how age and gender moderate media effects on children behavior. The study revealed that age and gender of the child did mediate the effects television exposure on their social behavior. Gender influenced the cartoon content children preferred to watch as well as the cartoon characters that the children chose to identify with while age mainly influenced cartoon viewership habits with older children spending less time watching cartoons compared to younger children.

**Index Terms-** Television Cartoons, Demographic Factors, Children, Social Behavior, Media effects

## 1.0 Introduction

Television cartoons are a popular entertainment for children across the globe. Research shows that a child starts watching television cartoons from as early as six months and that by two years; children are ardent viewers (Sudha, 2011). Sudha attributes this cartoons popularity among children due to their fast paced nature characterized by high speed light flashes, rapid color variations and movements which captivates the child. Children are spending considerable amounts of time watching television cartoons; according to (Hassan & Daniyal, 2013) children's physical activities in this day and age have been restricted to excessive television watching more so cartoon watching. This cartoon watching has to some extent affected children's attitudes and behavior such as their fashion and food preferences, language acquisition and interaction patterns. Some studies of media effects suggest that a variety of viewer characteristics, including but not limited to age, gender, socioeconomic status, intelligence levels, can mediate the effects of media especially television on social behavior. This study therefore narrowed on age and gender of Kenyan children and how they could mediate the effects of television on their social behavior.

One essential factor in the association between television viewing and social behavior may be the age of the child. (Wilson, 2008) acknowledges that children may not

necessarily be influenced by media in the same way and that age plays a crucial role with younger children being more vulnerable to media influence than older children. Of the same view is (Meyers, 2002) who states that young children are presumed to be at higher risk for being affected by what they see on the television than are older children due to differences in cognitive maturity where the later can be able to interpret what they watch better than younger children. According to (Strasburger, Wilson, & Jordan, 2009) empathy is a developmental skill as when exposed to a clip of a threatening stimulus or a characters fear in response to a threatening stimulus that was not shown directly; younger children were less physiologically aroused and less frightened by the characters fear than by the fear-provoking stimulus while older children responded emotionally to both clips shown.

A child's gender could also influence how television viewing ultimately affects their social behavior. (Calvert & Kotler, 2003) in their study found out that girls liked educational/informational based programs compared to the boys who liked entertainment themed programs; from these programs, Calvert and Kotler deduce that girls compared to boys learn socio-emotion lessons. Previous research by (Bandura, 2002) indicated that boys performed more aggressive acts than girls after viewing televised violence; (Tan, 1985) attributed this to cultural norms that permit more aggression from males than females and to the reason that boys are more likely to have been rewarded in the past for being aggressive while girls are more likely to have been punished.

Television cartoon viewing may have varying effects on children from diverse socio-economic groups. According to Hutson, Watkins and Kunkel as cited in (White, 1999) watching television is part and parcel in the lives of low income and minority families due to lack of alternative activities. Children from families of lower economic status as outlined in are more likely to act aggressively than children from higher income families regardless of television viewing. Similarly, Comstock and Paik as elaborated in (Kirkorian, Wartella, & Anderson, 2008) reiterate that, children from lower-income homes are likely to spend more time watching television and as a result score lower on measures of academic achievement compared to their equals from higher-income homes. Research study by (Robinson, 2001) also reveals that children from lower socio-economic homes spend more time watching television and at a higher risk of being classified as obese. (Ribner, Fitzpatrick, & Blair, 2017) further note that children from low income families were more likely to be

exposed to television for longer hours and as a result had lower school readiness particularly their math and executive function

**1.1 Research Objective**

The research study sought to examine the moderating effects of demographic factors on foreign television cartoon programs exposure and their influence on children’s social behavior in Kenya

**1.2 Research Hypotheses**

The research study sought to test the following hypotheses:

1. H<sub>01</sub>: There is no significant influence of gender on foreign programs comedic cartoon content preference
2. H<sub>02</sub>: There is no significant influence of gender on foreign programs violent cartoon content preference
3. H<sub>03</sub>: There is no significant influence of gender on foreign programs cartoon characters choice
4. H<sub>04</sub>: There is no significant influence of gender on foreign television cartoons viewership patterns
5. H<sub>05</sub>: There is no significant influence of age on foreign television cartoons viewership patterns

**1.3 Research Methodology**

The study applied cross-sectional research design. The study population was Kenyan children living and schooling in Murang’a County, Kiharu Constituency. The researcher applied purposive sampling where only private schools in Township Ward were considered for the study since this Ward has the highest electricity connectivity. The researcher targeted school going children aged 7-10 years and in lower primary (Std.2-4) enrolled in 5 identified private primary schools. Simple random sampling technique was used to select pupils who were issued with questionnaires and included in the final research sample. A total of 350 pupils participated in the research.

**2.0 Moderating Effects of Gender on Cartoon Content and Children Social Behavior**

From the descriptive statistics, it emerged that there was preference of various cartoon programs based on the children’s gender. It was imperative therefore to further test association of this observation if gender did influence choice of cartoon programs among children surveyed using a chi-square goodness of fit test. Specifically gender preference against comedic cartoon content and violent laced cartoon content was tested.

*H<sub>0</sub>: There is no significant influence of gender on comedic cartoon programs content preference*

**Chi-Square Tests for Childs Gender and Comedic Cartoon Programs preference**

	Value	df	Asymp. Sig. (2-sided)
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Pearson Chi-Square	5.111 <sup>a</sup>	4	.276
Likelihood Ratio	5.149	4	.272
Linear-by-Linear Association	1.995	1	.158
N of Valid Cases	350		

From the chi-square test of association results, gender had no influence on comedic content preference since P>0.05. According to (Vossen, Piotrowski, & Valkenburg, 2014) children in middle-hood stage regardless of their gender have higher preference to entertainment themed cartoon programs as opposed to educational themed ones and enjoy characters they can psychologically relate with such as those with an attractive sense of humor; which supports the chi-square findings that gender didn’t influence preference of comedic content.

*H<sub>0</sub>: There is no significant influence of gender on violent cartoon programs content preference*

**Chi-Square Tests for Child Gender and Violent Cartoon Content Preference**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.749 <sup>a</sup>	2	.001
Likelihood Ratio	18.880	2	.001
Linear-by-Linear Association	18.674	1	.001
N of Valid Cases	350		

From the chi-square test of goodness fit results, gender had influence on violent content preference since P<0.05. This is in tandem with (Ergün, 2012) observation that male children prefer violent-oriented cartoons especially where the characters exhibit super powers.

**Chi-Square Tests on Gender and Likelihood to Learn Verbal and Physical Aggression**

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	83.770 <sup>a</sup>	4	.001
Likelihood Ratio	90.485	4	.001
Linear-by-Linear Association	76.359	1	.001
N of Valid Cases	350		

Having established that gender influenced preference of violent content, it was imperative to determine how this further influenced their behavior. The chi-square test revealed that gender did indeed influence the likelihood to learn physical

and verbal aggression. Previous research by (Bandura, 2002) indicates that boys are more likely to perform aggressive acts than girls after viewing televised violence.

**2.1 Moderating Effects of Gender on Cartoon Characters and Children Social Behavior**

*H<sub>0</sub>: There is no significant influence of gender on cartoon characters preference*

Findings from descriptive statistics revealed a tendency for children to identify with their favorite cartoon characters based on their gender. To further test this finding of children identifying with the cartoon characters based on their gender, a chi-square test of association was carried out. The children's gender was tested against four cartoon characters (two female lead cartoon characters and two male lead cartoon characters)

**Chi-Square Tests for Cartoon Characters preference and Child Gender**

Cartoon Characters		Value	df	Asymp. Sig. (2-sided)
Kion- Lion Guard	Pearson Chi-Square	29.920 <sup>a</sup>	4	.001
Spiderman	Pearson Chi-Square	78.841 <sup>a</sup>	4	.001
Doc Mc Stuffins	Pearson Chi-Square	15.220 <sup>a</sup>	4	.004
Sofia the First	Pearson Chi-Square	69.277 <sup>a</sup>	4	.001

From the chi-square findings, the null hypothesis that *there is no significant influence of gender on cartoon characters preference* was rejected since  $P < 0.05$ . It was true therefore, that gender did influence the cartoon characters the children chose to identify with. According to (Kirsh, 2005) previously done research studies have linked gender portrayals in children programming as important in the socialization process of children who are likely to manifest tendencies to imitate same gender characters than opposite gender characters.

**2.2 Moderating Effects of Gender on Cartoon Viewership Patterns and Children Social Behavior**

*H<sub>0</sub>: There is no significant influence of gender on cartoon viewership time patterns*

From the research, it was important to find out if there were any differences in television cartoons viewership patterns emanating from the child's gender. Did gender influence the time that a child watched television cartoons during weekdays, weekends and holidays? A chi-square test of association was used to determine if there was any significant difference.

**Chi-Square Tests for Cartoon Viewership and Child Gender**

Cartoon Viewership		Value	Df	Asymp. Sig. (2-sided)
Weekdays	Pearson Chi-Square	5.039 <sup>a</sup>	3	.169
Weekends	Pearson Chi-Square	2.922 <sup>a</sup>	3	.404
Holidays	Pearson Chi-Square	1.217 <sup>a</sup>	3	.749

From the chi-square findings, the null hypothesis that *there is no significant influence of gender on cartoon viewership patterns* was adopted since  $P > 0.05$ . The child's gender therefore didn't influence the time they spent watching cartoon programs. This research study was able to establish that watching television cartoons was a favorite pass time for majority of the children regardless their gender; according to (Roberts & Foehr, 2008) the time children dedicate to watch television exceeds other media they can access which is in line with the study research findings that regardless they were in school or at home for holidays children spent most of their time watching television cartoons.

**2.3 Moderating Effects of Age on Cartoon Viewership Patterns and Children Social Behavior**

*H<sub>0</sub>: There is no significant influence of age on cartoon viewership time patterns*

The research sought to find out if a child's age did influence the time they spent watching television cartoons, the study engaged children between 7 and 10 years and as such it was imperative to find out if this did influence the time spent on television cartoons by running a chi-square test of association.

**Chi-Square Test of Age and Time Spent Watching Cartoons**

Cartoon Time		Value	df	Asymp. Sig. (2-sided)
Weekdays	Pearson Chi-Square	10.689 <sup>a</sup>	3	.014
Weekends	Pearson Chi-Square	6.587 <sup>a</sup>	3	.086
Holidays	Pearson Chi-Square	2.085 <sup>a</sup>	3	.555

From the chi-square findings for child's age group and time spent watching cartoons on weekdays, the null hypothesis that *there's no significant influence of child's age on time spent viewing cartoons* was rejected since  $P < 0.05$ . A child's age therefore influenced the time spent watching cartoons during weekdays. On the weekends and school holidays however, the child's age didn't influence the time a child watched television cartoons since  $P > 0.05$  the null hypothesis *there is no significant influence of child's age on time spent viewing cartoons* was adopted. It is expected that older children have

more school assignments they expect to work on after school; according to (Torrecillas-Lacave, 2013) parents are mostly restrictive to school going children with homework during weekdays on television viewership which could explain the difference in age and time spent watching television cartoons during weekdays.

### Chi-Square Tests of Age and Preference to Watch Television Cartoons or Play Outdoors

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.600 <sup>a</sup>	2	.037
Likelihood Ratio	6.917	2	.031
Linear-by-Linear Association	3.173	1	.075
N of Valid Cases	350		

From the research findings, it emerged that age did to some extent influence preference to either watch television cartoons or play outdoors as  $P < 0.05$ . Majority of 7 and 8 year olds preferred to play outdoors while most 9 and 10 year olds indicated that they preferred to watch television cartoons. These findings reveal emerging physical inactivity tendencies as the children grow older.

### 3.0 Conclusions

From the study findings, gender and age of the child does influence their choice of cartoon content, cartoon characters and cartoon viewership tendencies. Though gender doesn't influence choice of comedic themed cartoons with both boys and girls highly preferring such cartoons, it does however influence choice of violent themed cartoons where boys are mainly inclined to watch such especially where the lead character exhibits super powers. Further the findings link increased likelihood of the boys to learn verbal and physical aggression by watching violent laced cartoon content. The research also established that gender did influence the cartoon characters that the children chose to identify with; girls gravitated towards female lead characters as did the boys to male lead characters. Age of the children mainly influenced their cartoon viewership habits with the older children spending less time watching television cartoons on weekdays. Age also did influence children physical activity levels with older children preferring to watch television cartoons other than play outdoors.

### 4.0 Recommendations

Parents, guardians and care givers need to monitor the content children watch especially that which is violent or abusive as it potentially has negative influence on them.

The time children watch television cartoons needs to be regulated and children need to be encouraged to engage more in physical activities such as outdoor playing.

### 5.0 Suggestions for Further Research

The link between socio-economic status and children television viewing patterns needs to be further researched

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# Adaptation and Evaluation of Ware Potato Storage in Horo and Jardega Jarte Districts of Horo-Guduru Wollega Zone of Ethiopia

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DOI: 10.29322/IJSRP.8.8.2018.p8011

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8011>

**Abstract-** Agricultural products become important for various purposes. To sustain an adequate supply on the market, handling method, storage and transporting technologies of agricultural produce are imperative. Especially for perishable commodity, great attention should be given. Horticultural product must be transferred from the field to the table in a state that is acceptable to end users. In Oromia as whole, substantial amount of horticultures are believed to go waste before it reaches for users due to lack of proper handling and appropriate storage. Until damage occurred, mostly effect of mishandling and storage is not realized. However, poor handling and storage can easily result in total loss of agricultural produce. Holetta ware potato storage was developed to prolong shelf life of potato in two Districts of Horo-Gudure Wollega Zone. In order to adapt and evaluate this ware potato storage, the study was conducted at Horo and Jardega Jarte districts in Gitilo Dale and Sombo Watu sites. From the result obtained, for Gitilo Dale site ware potato storage prolonged potato tuber for four and half months with 0.85% damage, 1.35% shrinkage and 8.32% sprouted. Average maximum and minimum storage temperatures are 21 and 10 °C respectively whereas maximum and minimum of relative humidity of storage are 70 and 34% consecutively. Whereas for Sombo Watu site within four and half months, the storage is characterized with 3.32% damage, 8.42% shrunk and 15.65% get sprouted. Average maximum and minimum storage temperatures are 26 and 17 °C respectively whereas maximum and minimum of relative humidity of storage are 63 and 20% consecutively. As per result observed from evaluation of storage, the storage is mainly recommended for Gitilo Dale site condition irrespective of potato variety.

**Index Terms-** Damage, Humidity, Potato, Shriveling, Sprout, Storage & Temperature

## I. INTRODUCTION

Potato (*Solanum Tuberosum L.*) is the fourth most important food crop in the world [1, 2] and grown in more than 125 countries and consumed almost daily by more than billion people. Several millions of people living in developing countries depend on potatoes for their survival. Ethiopia has highest potato

producing potential than any country in Africa with 70% of 13.5 million hectares of arable land suitable to potato cultivation and production as well [3]. However, the potato is widely regarded as a secondary non-cereal crop in part because it has never reached the potential in supporting food security.

In Oromia, root crops covered more than 86 thousand hectares of land and yielded more than 5 million quintals of produce per year. Potatoes, onion and sweet potatoes constituted 62.56%, 13.94%, and 12.57% of the regional area under root crops, respectively. Particularly in East Wollega Zone, potatoes and sweet potatoes covered 77.98% and 9.89% of the area under root crops and 60.91% and 16.83% of the production, respectively [4].

Potato is one of the most productive food crops in terms of yields of edible energy and good quality protein per unit area and per unit of time fitting into intensive cropping systems [5]. Potato is one of precious gift and also very common in the dishes of most Ethiopians. This importance necessitated the growth and production of potato throughout the year often via the use of irrigation. Potato provides high nutrition and an adaptive to Ethiopia climate [6].

Contribution of potato tubers to the diet and income generation in the country is insignificant due to several factors. The reasons are low production and productivity, lack of adequate pest control, lack improve varieties, market, lack of attention to product quality and prevention of physical damage, as well as the lack of storage and packing facilities [3,7]. To reach the end users, there should be appropriate post-harvest handling mechanism. Methods and technologies of handling are imperative for various agricultural products.

Great attention should be given for ware storage especially for perishable commodities in order to transfer from the field to the table in a state of acceptable to users. Most of them begin deteriorate as soon as they are harvested, and most are particularly prone to handling damage at all times till consumed. Since they are susceptible to any action, proper handling and appropriate storage structure is paramount important to preserve their self-life.

In general speaking, handling damage is greatly underestimated, because usually mishandling do not appears until

sometime damage occurred. Mechanical or physical damage of the products can be occurred through all stage of the chain from harvest to consumption with inclusiveness of handling and transportation from rural to urban markets. Poor handling and storage can easily result in a total loss.

Lack of proper storage systems are among the main factors contributing to the low yield of potato in the region, which is the case at the country level also [8]. Furthermore, market price of the product and marketing systems are also problematic [9]. Due to lack of an appropriate storage and handling equipment's, substantial amount of horticultural product is believed to go waste before it reaches for consumption or is sold at a thrown away price. According to Mulatu, 2005 [10] unavailability of proper potato seed storage forces the farmer to sell immediately during harvest with low price, whereas availability of proper storage facilities allow farmers to sell their potato tuber as a seed during planting or in the later season with higher price compared to the immediate sell.

Farmers stored potato either for ware or seed using various traditional mechanisms. These traditional storage facilities do not allow the farmer to store potato not more than three and half months without deterioration [9]. However farmer requires good storage either to use tubers of their own harvest as a seed source to postpone sales to get better market price and for household consumption in the later season. Low market demand for potato tuber production cost was among the main factor. According to Fuglie, 2007 [11] farmers in the Jeldu and Degem districts were already distinguished the seed and ware potato and they might look only for seed potato market, whereas according to Ayalew and Hirpa, 2014 [9] study farmers immediately sell the tuber as a ware due to fear of market unavailability for seed potato.

Postharvest losses can also be minimized by storing them at low temperature and high relative humidity environment [12]. The storage employs the cooling power of evaporation. Evaporative cooling occurs when dry warm air blown across a wet surface. Heat in the air is utilized to evaporate the water resulting in air temperature drop and a corresponding increase in relative humidity [13, 14]. According to Rusten 1985 [15], Evaporative cooling is generally more efficient where air temperature are high; relative humidity very low, water available and air movement is adequately available.

An evaporative cooling chamber is simple technology, easy to construct and low cost of its construction since it can be made from locally available materials. Low temperature storage system can effectively extend shelf life of fruit and vegetables in minimizing major postharvest losses by arresting metabolic breakdown and fungal deterioration. An evaporative cooling system has an efficiency of 50% significant effect on room temperature of non-air conditioned as well as shaded rooms [16]. It enables by letting availability of fruits and vegetables possible in most parts of the year effectively without additional inputs in to production. In addition to this, disposal problem faces in many town and city that consequent pollution will be reduced.

The purpose of this investigation was therefore; to adapt and evaluate effective storage that helped to prolong shell life of potato tuber and reduces loss occurs due to mishandling and storage problem and enable sustainable supplying to local market got ensured.

## II. MATERIAL AND METHOD

### SITE SELECTION

Potential potato producing districts were identified and selected according to recommendation established by Horo Guduru Zone Natural Resource and Agricultural Development office based on merit and accessibility to road. From Horo district, *Gitilo Dale* site was selected for conducting research. *Gitilo Dale* is located at altitude of 2770m above sea level, latitude 9°32'N, longitude 37°04' and characterized with wind speed of 0.02 to 0.04 m/s. From Jardega Jarte district, *Sombo Watu* was selected. *Sombo Watu* site is characterized with altitude of 2410m above sea level, latitude 9°57'N, longitude 37°05'E and has wind speed range of 0.01 to 0.02m/s.

### MATERIAL

Important materials for construction of an appropriate evaporative cooling storage were identified and selected. Accordingly different sizes of wooden plank, straw, thatch, timber, mesh wire, mud and nails with different sizes were prepared and employed for construction of required size and shape of storage structure. Five storages were constructed and each ware potato storage has a capacity to store five quintals of potato tube. However Gudane, Jalane and Menagesha potato variety were available at *Gitilo Dale* site but Gudena variety was selected and used as treatment since it is predominately cultivated. Jalane potato variety was employed or used in *Sombo Watu*.

So far two meter width and three meter length ware potato storage were constructed for three & two farmers in Horro & Jardega Jarte districts respectively. The constructed potato storage structures were faced in windy direction of *Gitilo Dale* and *Sombo Watu* sites so as to enhance removal of warmed air due to respiration of potato tubers. The storages were constructed in sites where air is mostly blown for more than four months starting from September. The storage employs an evaporative cooling system which is an efficient & economical means for reducing the temperature and maintains required relative humidity in storage.

### CONSTRUCTION OF STORAGE

Floor is basic component of potato storage structure and should be strong enough to support or carry the required load. Storage load mainly imposed from entire constructed body and loaded potato tubers. The floor carried the bed or maximum height of the piles of potatoes laid on six crates which has 1.2m length and 0.6m width where potato tubers get over laid. Each crate has a capacity to store 80 kg of potato tubers. The constructed wall stands up to 1.5m above floor level to support bulk potatoes under normal condition. The wall in a bulk potato store, together with a layer of insulation, must resist all lateral forces. On these walls with preference to windy direction, ventilation window was suited for air entrance and exit for cooling system.

Four ventilation windows which have 35 by 40cm dimension were prepared in our workshop and constructed. Among these, two of them allow cool air in flow from environment in to the storage and the remaining two of them exit hot air from storage to the environment. The roof spans were 3 meter by 1.7meter and

to provide a minimum overhang of 0.5m on inlet and out let elevations. The roof must prevent rain penetration and must not allow light to reach the potatoes. The actual opening part of the door requires no special structural attention. However, if it is intended to fully utilize the entire store volume, it is necessary to provide vertical timber boards across the door opening. Main treatments are amount of damage, sprouted, shrinkage, temperature, humidity and area of storage. Potato tubers were stored over floor that is exposed to sun light.

### EVALUATION OF STORAGE

Four quintals of potato tubers were stored in all storages. Prior to harvesting potato tubers, potato stalks were removed in order to make better curing period. Before storing the potato, prerequisite data's particularly weight of potato, volume of potato, storage and ambient condition were collected & documented starting on loading day. Potato tubers were directly harvested from the farm and screening was made soon and separation of undamaged from damaged done earlier to storing them.

Since storage employs evaporative cooling heat trapped from warmer pad to lower, stored produces shelf life would be prolonged to better without significant decomposition & deterioration. Rate of evaporation is mainly affected with temperature, relative humidity, air movement and surface area of containers. In order to achieve best storage time or prolong shelf life, proper storage management should be practiced.

Proper storage practices include temperature control, relative humidity control and air circulation. Both storage air inlet & outlet ventilation windows were opened during night time at 13:00 to 00:00 and closed at day time 00:00 to 12:00 at local time. Storage losses are mainly caused by the processes like respiration, sprouting and evaporation of water from the tubers. Therefore parameters like damage, wilting & sprouting which determine storage performance were closely observed & data were being collected within five days interval from both sites.

### III. RESULT AND DISCUSSION

Three storages were constructed in *Gitilo Dale* site of Horo district where as two of them were prepared in *Sombo Watu* site of Jardega Jarte district. Each ware potato storage has a capacity to store five quintals of potato tube. All storages were made to have good feature than any other and their inner surface became smooth so that physical injure of potato that was accountable for decomposition get removed. Before storing the potato, pre-requisite data's particularly on storage and surrounding condition were collected and recorded.

Since all data were collected at the same time with similar air condition, average based ambient condition was taken for all storages. Important datas' were begun to be collected proceeding storing date. Proper data was taken as follow, four quintals of potato tube were kept in each storage for case of *Gitilo Dale* site at the same day and important data's were registered. Whereas for case of *Sombo Watu*, five days later the remaining two storages were loaded and data collections were began.

In overall, proper storage practices include temperature, relative humidity, air circulation and maintenance of space between containers for adequate ventilation, and avoiding incompatible product mixes. Storage losses are mainly caused by

the processes like respiration, sprouting, evaporation of water from the tubers, spread of diseases, changes in the chemical composition and physical properties of the tuber and damage by extreme temperatures. Temperature and relative humidity of surrounding environment and storage were collected at day and night of storage and for control within five days interval since both are important parameters for determining shelf life of stored commodities. The storage life of a product varies with species, variety and pre harvest conditions particularly quality and maturity.

As a whole, ambient temperature and humidity, temperature and humidity of storage, mass of damage, sprouted and shrinkage were among those important treatment collected to determine number of a day potato can be stored without inconsiderable losses occurred.

Gudane variety was collected using modern potato digger at *Gitilo Dale* site and stored starting from October 08, 2018 in three storages. Whereas at *Sombo Watu* site *Jalane* variety was digged and stored later than five days. In both sites, data were started to be collected on the storage began. Data were collected and interaction of these parameters was anticipated separately as follow for both districts.

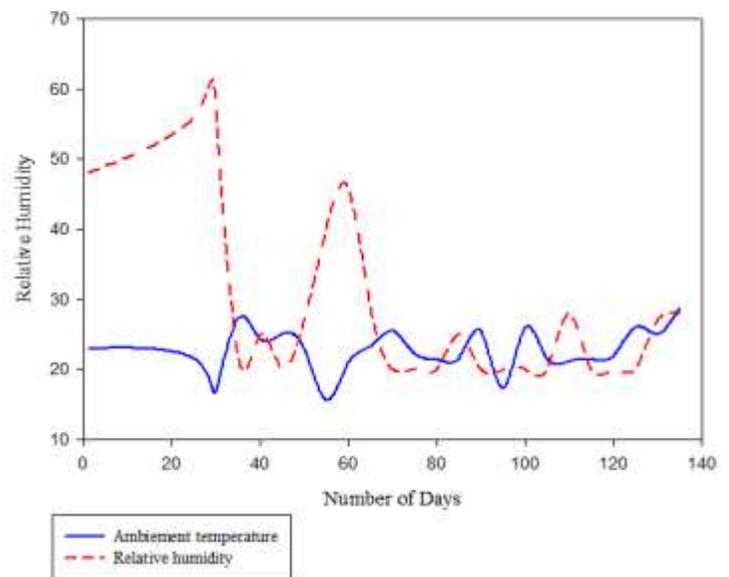


Figure 1 Ambient temperature and humidity variation during day time in case *Gitilo Dale* site

According to Basedya & Samuel, 2013 [17] under ambient temperatures from 25 to 35 °C, respiration rate is higher and storage life become short. Deterioration of stored produce during storage mostly depends on temperature. Throughout the period between harvest and consumption, temperature control is one of the most important factors in maintaining product quality.

Respiration and metabolic rates are directly related to room or air temperatures within a given range. The higher the rate of respiration, the faster the produce deteriorates. However average based maximum and minimum ambient temperature variation of *Gitilo Dale* at mid-day is 27.3 °C and 15.6 °C respectively which is still less than recommendation.

Relative humidity, air movement and surface area are other important parameters to be considered during handling product stored since they have much contribution to determine shelf life of product stored. Speed of air at *Gitilo Dale* is low and it's intensive movement is mostly occur between September to February. Here maximum and minimum relative humidity of potato stored during mid-day is 60% and 20%.

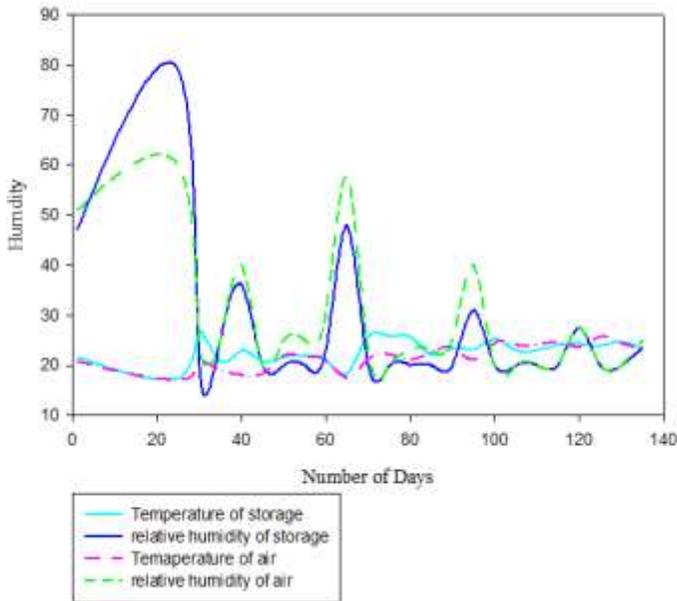


Figure 2 Night time ambient temperature and humidity as well as temperature and humidity as well as temperature and humidity at *Gitילו Dale Site*

According to Odesola & Onyebuchi, 2009 [18] at high relative humidity, agricultural products maintain their weight, wilting and softening are reduced and rate of water evaporation is low and therefore cooling is low. Maintaining high humidity around harvested produce reduces water loss, which would result in decreased returns through poor quality which mean wilting, shrivelling and loss of saleable weight [17].

High humidity should be used with low temperature storage because high humidity and temperate in combination favours the growth of fungi and bacteria. In order to prolong shelf life, relative humidity and temperature should be maintained properly. According to heat transfer application temperature goes from higher to lower concentration until it reaches equilibrium condition. During day time since the storage is tight and no way for light and wind to enter, what products respired concentrated in storage. When ventilation windows which is directed to wind motion get opened during the night, cold wind wiped out the warms from the storage and storage get cooled.

Here maximum & minimum relative humidity of storage environment is 70 % & 34% whereas maximum & minimum temperature of the storage is during night is 21 & 10 °c respectively. Air movement here is better and dried air blown outside of the ware storage which carried off warmed air from inside of the storage.

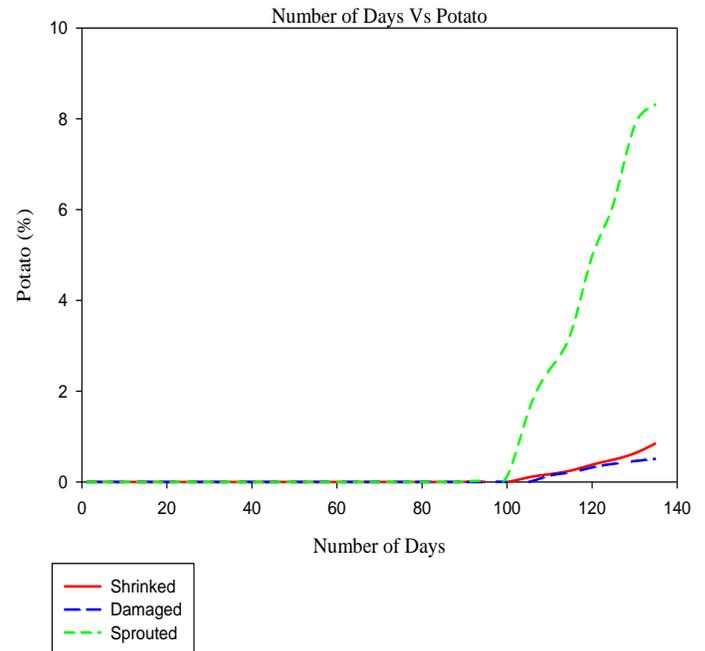


Figure 3 Amount potato damage, shrunked and sprouted during storage period at *Gitילו Dale*

Rate of evaporation is mainly dependent on movement of air and surface area over which tubers stored. As water evaporates from a surface it tends to raise the humidity of the air that is closest to the water surface. If humid air remains in place, the rate of evaporation will start to slow down as humidity rises. On the other hand, if the humid air and the water surface constantly been moved away and replaced with drier air, the rate of evaporation will either remain constant or increase. The greater the surface area from which water can evaporate, the greater the rate of evaporation [18].

As the period of storage increased, rate of decomposition, shriveling and sprout increased too. However at hundred thirty five days: 8.32 %, 1.36 % & 0.85% became sprouted, shrunked & damaged respectively. Here all sprouted tubers were directly used for on field plantation for the next season where as some shrunked part were used for dish. Decomposition of the tubers may be caused mainly because of injury happened during transportation from field in to storage and respiration processes.

The storage is very tight and opaque for light to minimize degree of damage and welting and storage ventilation window should be opened as per programmed. But in reality due to mismanagement and dalliance, the windows were not opened on time and not closed before the time as per scheduled. Because of this mishandling considerable amount of potato tubers were decomposed, welted and sprouted before it researched expected time planned.

Here potato tubers were normally stored over local bed inside the house which exposed to solar radiation. At high relative humidity and temperature, respiration rate becomes high and the faster the produce deteriorates. The more water gets removed; greater weight losses and shrinkage become higher than usual.

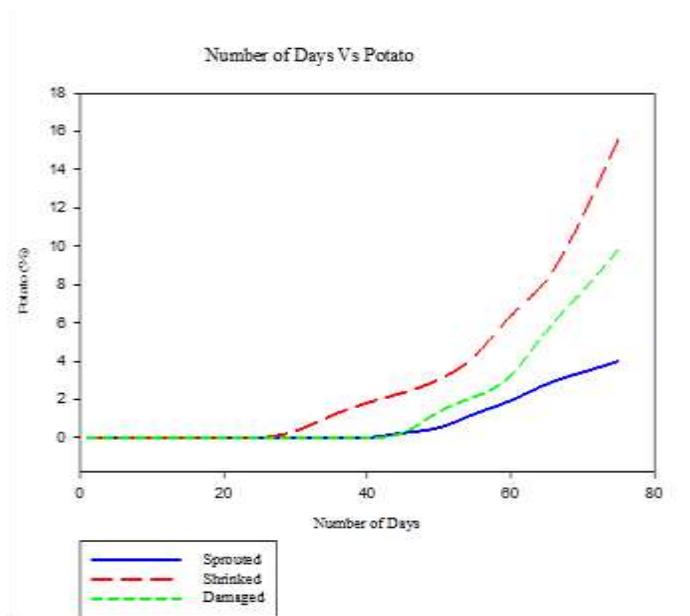


Figure 4 Amount of potato get damaged, shrunk and sprouted employing traditional mechanism

Since potato tuber respire, water gets losses quickly. Unless water vapor should be blown up with dry air coming outside through vent, wilting, shriveling & weight loss will be increased. Here there is no vent and means to remove humid air to get cooled environment and pad. Sample of 25kg potato tubers were used as control at seventy five days 54.65% wilted, 14.19% damaged and 30% sprouted.

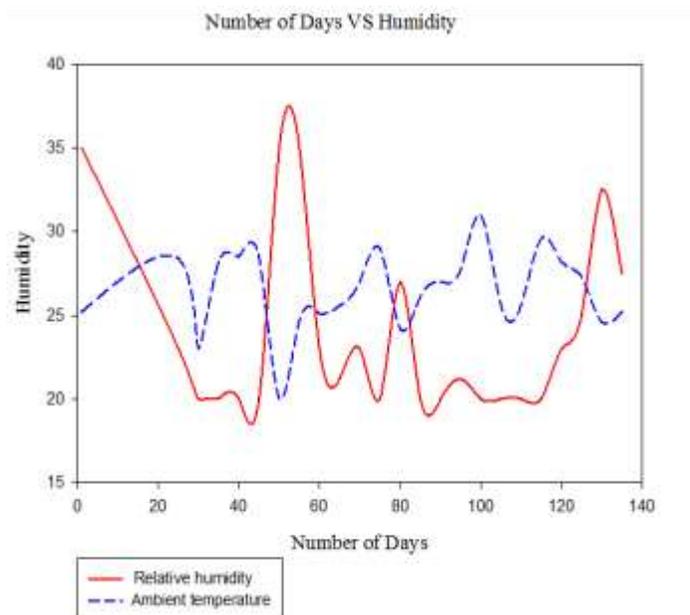


Figure 5 Ambient temperatures and Humidity variation during time in case Sombo Watu site

Under ambient temperatures from 25 to 35°C according to Basediya, 2013 respiration rate is higher and storage life is short. However in case of Sombo Watu site of Jardega Jarte average based maximum and minimum ambient temperature variation at

mid-day were 31°C & 23°C respectively which is more or less in the specified range.

Since they have much contribution to determine shelf life of product stored, relative humidity, air movement and surface area are important parameters to be considered during handling product stored. Here maximum and minimum relative humidity of potato stored during mid-day is 36% and 20%. Here temperature is becoming higher as compare to Horo district site and relative humidity is become lower as compare to Horo district. Both parameters are directly and indirectly influencing storage performance in handling practices.

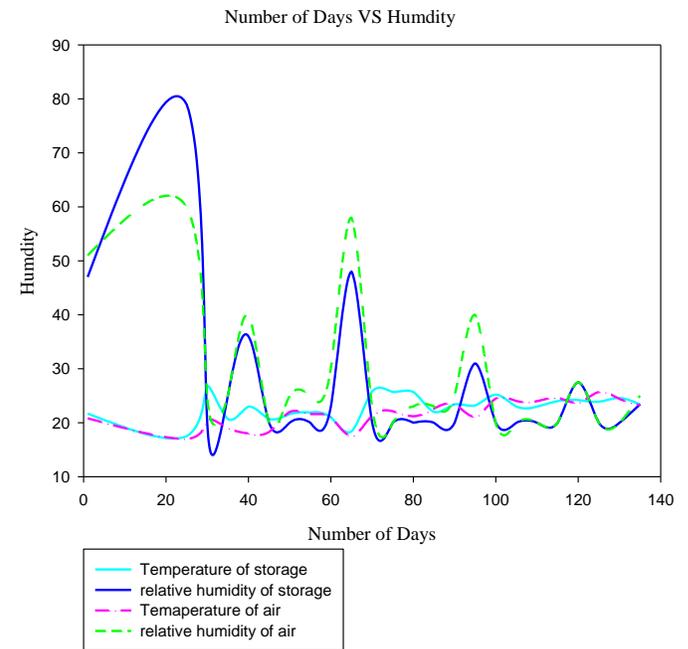


Figure 6 Night time ambient temperature and humidity as well as temperature and humidity as well as temperature and humidity at Sombo Watu

According to Odesola & Onyebuchi, 2009 [18] when the relative humidity is high, the rate of water evaporation is low and therefore cooling is also low. But relative humidity of the storage during night time is still higher than ambient when computed on average, maximum & minimum became 62% and 20% respectively.

However humidity & high temperate in combination favors the growth of fungi and bacteria. At night time higher temperature with warmed air presented in the storage but cold and dried air is blown in environment outside the storage. Since at every day at 1:00 local time, ventilation window get opened for recirculation of air the chamber. Cold dried drive out warmed air due to creation of bouncy force because ingredient of density difference air. Temperature of storage is higher than temperature of air in environment this implies that water vapor get respired during the day time get accumulated and become removed at night time. This causes temperature difference which bases cool environment for potato tubers.

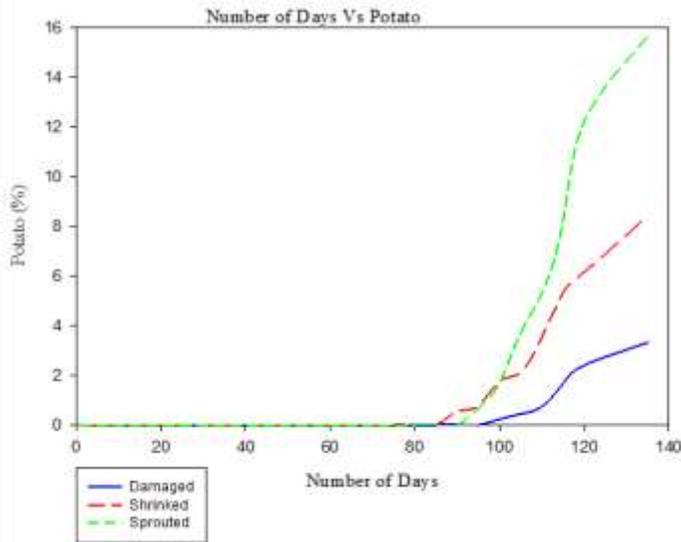


Figure 7 Amount potato damage, shrivelled & sprouted during storage period at Sombo Watu

Since ambient temperature and relative humidity of Sombo Watu is higher than Horo district, rate deterioration is increasing from time to time. As the period of storage increased, rate of decomposition, shriveling and sprout increased faster than that of Horo district. Since altitude is lower, air becomes warmer & wind speed is lesser. However at hundred thirty five days about 15.65%, 8.42% & 3.32% became sprouted, shrivelled & damaged respectively.

Damage or decomposition mainly connected with injure caused during transporting from field in to storage and respiration processes. All damage and some sever shrinkage tubers are not useful. The remaining tubers can be used as food and seed. The sprouted potato totally used as seed for both off season and on season. Most of the time for off season case; it generates high income for farmers than on season.

#### IV. CONCLUSION AND RECOMMENDATION

From the experimental result obtained, we observed that various parameters are engaged to determine quality of storage of potato tubers. In addition to the maturity level and variety, damage, shrivelling and sprouting have great importance in order to decide shelf life of stored potato and their valuable. Thus, damages and sprout can be minimized by taking care during transportation from field to the storage and harvesting time. Harvesting period and activity also affects the storing time and the stalk of the potato should be removed twelve days before storage to strengthen skin of potato under the soil.

With proper storage practices, this ware storage has prolonged shelf life of potato for five months with little losses at holeta site. While the remaining factor keeps constant, at Gitilo Dale site, this storage enabled to preserve potato tubers for about four and half months with little damages less than 1%. Since altitude, weather condition and wind speed of Holetta and Horo district is diverse, result obtained at both sites are somewhat different. Whereas at Sombo Watu site within the same months potato get stored with losses of 3.5%. Therefore, temperature, relativity

humidity and air speed are main influence factor for storing potato tubers.

Proper handling practices and managing time of operation are another important issue which affects storage produce life. Storage ventilation window operation time should be managed in order to have long storage time. Window should be opened at 13:00 and closed before 06:00 in order to block sunlight from entering the storage. If the light gets diffused in it speeds up sprouting faster and losses too. Main advantage of storage is prolonging shelf life of potato thereby sustainable availability of potato over the market and makes gain of additional money for farmers.

In general the structure of the storage required important care during construction totally the sun light should be blocked as much as possible from entering into the storage and time of ventilation have to be seriously applied unless there might be great losses or cause total damage on potato tubers.

#### ACKNOWLEDGMENT

The authors would like to thank Post-harvest & Food Engineering and Energy Engineering department of Bako Agricultural Engineering Research Center for support manuscript, contribution for preparation of paper and valuable comments and suggestions on research work and technicians of wood workshop particularly Mr. Girma Abdisa and Mr. Fikadu Dhugasa for their emanate contribution for construction of ware potato storages at both districts. We also thank AGP-II unit of Oromia Agricultural Research Institute for their financial support and comments in reviewing the manuscript.

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# Liability in Tort for Defective Products: A Review.

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DOI: 10.29322/IJSRP.8.8.2018.p8012

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8012>

**Abstract** Liability in tort for defective product is anchored on negligence. It is governed by legal principles found chiefly in the judgment of judges entrusted with the administration of justice and partly from law books of eminent scholars. This work examines the subject of defective product within the confines of law of tort, and argues that consumers should be protected at all times and independently of contractual relations otherwise producers themselves may become ‘killers’ in the near future.

**Keywords:** Care, Consumer, Defective, Duty, Product, Negligence, Liability.

## 1. Introduction

Liability[1] in tort for defective product is an exception to the strict legal order that none but a party to a contract can be found on its breach. In this, the case becomes one of *delict* and not of breach of contract. It must therefore be shown that there was a duty owed and breached which led to injury to the person whom the duty is owed. This is because a man cannot be charged with negligence if he has no obligation to exercise diligence.

Thus, rules and principles have been enunciated upon tort-based actions to ensure protection of a consumer. One obvious example is the tort of negligence[2], which applies to hold manufacturers and producers of defective products and services liable.[3] Originally, liability was restricted to the existence of a contractual relationship.[4] The general principle was that a person selling an article, which he did not know to be dangerous cannot be held liable to a person with whom he made no contract by reason of the fact that reasonable inquiries might have enabled him to discover that the article was in fact dangerous. Hence, a person who is not a party to a contract can neither sue for its breach nor enforce its performance even if it confers benefit on him.[5] Lord Hunter in *Cameron v. Young*[6] put the law thus: “a stranger to a lease cannot found upon a landlord’s failure to fulfill obligations undertaken by him under contract with the lessee”. Lord Macmillan reviewed liability cases under contract on the one hand and under negligence on the other hand and concluded as follows:-

It humbly appears to me that the diversity of view which is exhibited in such cases as *Gorge v. Skivington* on the one hand and *Blacker v. Lake & Elliot, Ltd.* on the other hand – to take two extreme instances – is ex-

plained by the fact that in the discussion of the topic which now engages your Lordships’ attention, two rival principles of the law find a meeting place where each has contended for supremacy. On the one hand, there is the well-established principle that no one other than a party to a contract can complain of a breach of that contract. On the other hand, there is the equally well-established doctrine that negligence apart from contract gives a right of action to the party injured by that negligence – and here I use the term negligence, of course, in its technical legal sense, implying a duty owed and neglected. The fact that there is a contractual relationship between the parties which may give rise to an action for breach of contract, does not exclude the co-existence of a right of action founded on negligence as between the same parties independently of the contract, though arising out of the relationship in fact brought about by the contract.[7]

Obviously therefore, liability exists both in contract and in tort via negligence arising from the same or different set of facts. The near impracticability to prove negligence in order to protect consumers in Nigeria necessitated this research. This study therefore aims to achieve the following specific objectives: (i) to determine the extent to which action founded on negligence can avail a consumer without contractual relation and (ii) to ascertain the extent to which duty of care exists in the context of Nigerian case laws. To investigate these, the following research questions are imperative, namely, does negligence *simpliciter* avail a consumer without contractual relation? and can the duty of care exist independently of any contract? The paper appraises common law authorities and juxtaposes same with Nigerian case laws on the subject. It questions the *ratio decidendi* in Justice K. O. Anyah’s case.

## 2. Definition of Terms

Certain terms emerge in the topic of discourse – consumer, product and defective product. Attempt is made to define them within the coverage of this paper.

(a) **Consumer:** The definition of a consumer is not a simple task. Variegated definitions abound. Some define it from

individualistic[8] point of view, others see it from organizational[9] angle yet another defines it from the point of contract – purchases.[10] Section 32 of the Consumer Protection Council Act defines consumer to mean an individual who purchases, uses, maintains or disposes of product or services. Monye in an all-embracing description, wrote that "... the term consumer is not confined to purchasers. It extends to contractual consumers; ultimate users as well as any person who comes into contact with a product or service in any way whatsoever".[11] For the purpose of this paper, the term consumer is restricted to ultimate users and any person who comes into contact with a product or service in any *legitimate*[12] way whatsoever. The qualification is necessary to exclude those who may come into contact with the product in an improper and illegitimate manner. Thus, in terms of goods and services, every (human) being[13] is a consumer. A consumer is a receiver of goods, services or both for use or consumption either *gratis* or otherwise. Hence, a giver or provider of such goods and services is under a duty of care and may be liable for injury arising from the defects in the goods and services so provided, provided the consumer sustains injury in the use of the product.

(b) **Product:** The Consumer Protection Act of 1987(UK) defines a product as "any goods or electricity and ... includes a product which is comprised in another product..."[14] In the same vein, section 45 defines goods as including "substances, growing crops and things comprised in land by virtue of being attached to it and any ship, air craft or vehicle". In general, 'product' is not limited to articles of food, drink *et cetera*. It includes articles such as underwear,[15] tombstone,[16] motorcars,[17] lifts,[18] hair-dye,[19] condom,[20] contraceptive pills,[21] perambulator[22] *etcetera*. The liability for defective product has also been extended to building; hence, building[23] may also be viewed as product. But, is a statement capable of being a product so as to entitle one to damages for injuries sustained as a result of a careless statement via defective statement, nay defective product- negligent statement?[24]

The issue of liability for negligent statement upon which injury or loss results was once unsettled. Of the two divides, one posited that no action could lie for a negligent statement even if it was intended to be acted upon and indeed was so acted upon by anyone to his loss.[25] This was predicated on the legal principle that the duty to be careful in making statements arises only out of either contract or fiduciary relationship. On the other hand, the progressive views restricted liability for such statements to professionals acting in their professional capacities.[26] Lord Denning himself stated:

Let me now be constructive and suggest the circumstances in which I say that a duty to use care in making a statement does exist apart from a contract in that behalf. First, what persons are under such duty? My answer is those persons, such as accountants, surveyors, valuers and analysts, whose profession and occupation it is to examine books, accounts, and other things, and to make reports on which other people – other than their clients – rely in the ordinary course of business. Their duty is not merely a duty to use care in their reports. They have also a duty to use care in their work, which results in their reports...[27]

The duty is not one at large. It is restrictive. It is a duty, which the professionals owe to their employers or clients and also "... to any third person to whom they themselves show the account or to whom their employer is going to show the accounts so as to induce him to ... or take some other action on them". Implicitly, the duty does not extend to strangers. Again, it is limited to a given transaction specifically required and disclosed to the concerned professional. Thus, the duty of care and the consequent liability do not extend to indeterminate persons, time and transaction.[28]

(c) **Defective Product:** Etymologically, the verb "defect" is synonymous with default, deficiency, destitution, lack, shortcoming, spot, taint, want, blemish, blotch, error, flaw, imperfection, mistake, failing, fault, foible.[29] In the same vein, the adjective 'defective' means deficient, inadequate, incomplete, insufficient, scant, short, faulty, imperfect, marred.[30] Generally, therefore, a 'defective product' is one that is deficient, faulty, inadequate or incomplete. Such product lacks something essential to make it adequate, sufficient, faultless and spotless. According to Monye, "a product which poses some hazards to life or property is certainly defective".[31] It is reasoned that this definition is not entirely correct. A product is defective when the hazard to life or property is not expected. If the hazard is expected, the product is merely dangerous and not necessarily defective. She further illustrated: "A poison, a chemical or an explosive is inherently dangerous; but if accompanied with an appropriate label and warning it may not be construed as defective".[32] This again is objectionable. Is every inherently dangerous article defective, and is such defect curable by mere appropriate labeling or warning? It is appropriate to observe that an inherently dangerous article is not necessarily defective whether there is warning or otherwise. For example, a properly timed time bomb is inherently dangerous though not defective. Conversely, an improperly timed time bomb is both inherently dangerous and defective. Hence, 'defective product' and 'dangerous product' are not strictly the same though related.

It is imperative to point out that a distinction exists between defect in contract and defect in tort. Monye says and rightly too that a safe but inferior product may be regarded as defective in contract but not so in tort.[33] This is true where the buyer specifically and expressly demanded from the seller a non-inferior product and the latter, knowingly or otherwise sales inferior product to the former. The learned author illustrated with a measure of authority thus:

For a product to be considered defective in tort, it must be in such a condition as is capable of causing injury to person or property. Using our earlier illustration, if a skin lotion contrary to its presentation fails to tone the skin, the claimant cannot succeed in the absence of a definite injury. This is because the duty owed to a consumer in tort is to guard against possible injuries.[34]

From the bench, the judgment of Lewis J is apt. The jurist opined:

I have to remember that the duty owed to the consumer, or the ultimate purchaser, by the manufacturer is not to ensure that his goods are perfect. All he has to do is to take reasonable care to see that no injury is done to the consumer or ultimate purchaser. In other words, his duty is to take reasonable care to see that there exists no defect that is likely to cause such injury.[35]

Although Lewis J. did from the quoted statement define neither defect nor product, it is clear that whatever is categorised, as 'defect' must be capable of causing injury and indeed must have occasioned injury to the plaintiff. Currently, the issue of product defect and consequent liability is regulated by statute[36] rather than the case law in most jurisdictions. This paper is delimited to the tort aspect of defective product liability.

### 3. Liabilities in Tort for Defective Products

As a general proposition of law, a party is liable for damage caused by defective product only when there is contractual relationship. The principle of privity of contract applies to

limit liability[37] to parties to the contract except in few cases of undisclosed principal, constructive trust among others.[38] The importance of contractual relation as a basis of liability was emphatically stated in *Dunlop Pneumatic Tyre Company Ltd v. Selfridge and Company Ltd*[39] thus:

My Lords, in the law of England certain principles are fundamental. One is that only a person who is a party to a contract can sue on it. Our law knows nothing of a *jus quaesitum tertio* arising by way of contract. Such a right may be conferred by way of property, as, for example, under a trust, but it cannot be conferred on a stranger to a contract as a right to enforce the contract in *personam*. A second principle is that if a person with whom a contract not under seal has been made is to be able to enforce it consideration must have been given by him to the promisor or to some other person at the promisor's request... A third proposition is that a principal not named in the contract may sue upon it if the promisee really contracted as his agent. But again, in order to entitle him so to sue, he must have given consideration either personally or through the promisee, acting as his agent in giving it.[40]

The House of Lords in *Scruttons Ltd v. Midland Silicones Ltd*[41] unanimously cited with firm approval the decision in *Dunlop's* case. This position is anti-consumerism. It is rare to see a case of contract between a manufacturer of a product and its consumer, i.e. contract of sale. The contractual relationship in most cases exists between the manufacturers and the wholesalers or retailers and not between the manufacturers and the ultimate users. Yet it may not be denied that the manufacturer had the ultimate consumer in contemplation from when the

idea of making the product was conceived, through the processing time until the end of production. It is therefore argued that even when there is a chance of intermediate examination of the product but without the possibility of tempering with same, the manufacturer should still be liable to the ultimate user in the event of injury unless the former can show that the product left its control in non-defective condition.

Notwithstanding the judicial decisions in *Dunlop's case* and other similar cases, judicial authorities exist where liability avails without contractual relation. These instances are discussed below.

**i. Fraud:** Where the injury results from fraudulent misstatement, liability avails in favour of a third party even in the absence of contract. In *Longridge v. Levy*[42] a man sold a gun which he knew was dangerous for the use of the purchaser's son. The gun exploded in the hand of the purchaser's son. The court held that the purchaser had a right of action in tort against the gun maker based on fraud of concealment on the part of the seller of the gun. This was subsequently held not to be of wider application.[43]

The liability here is anchored on the fact that the article was dangerous to the knowledge of the manufacturer. The knowledge of the danger creates an obligation on the manufacturer or any such person to warn the third party and its concealment is in the nature of fraud.

**ii. Where the article is dangerous per se:** In respect of this, a special or peculiar duty is imposed on those who send forth or install such articles to take precautions as necessary as other parties may come within their proximity.[44] In *Dominion Natural Gas Co., Ltd v. Collins and Perkins*,[45] the appellant company installed gas apparatus, which supplied natural gas on the premises of a railway company. The company installed a regulator to control the pressure but their men negligently made an escape – valve discharge into the building instead of the open air. The railway workmen – the plaintiffs were injured by an explosion in the premises. The defendants were held liable. In the absence of contractual relation, the court per Lord Dunedin who read the majority judgment held:

There may be, however, in the case of anyone performing an operation, or setting up and installing a machine, a relationship of duty. What that duty is will vary according to the subject matter of the things involved. It has, however, again and again been held that in the case of articles dangerous in themselves, such as loaded firearms, poisons, explosives, and other things *ejusdem generis*, there is a peculiar duty to take precaution imposed upon those who send forth or install such articles when it is necessarily the case that other parties will come within their proximity.[46]

The distinction of articles dangerous *per se*[47] and articles dangerous *sub modo*[48] has been a subject of sustained criticism. Heuston and Buckley wrote:

The distinction is certainly difficult to support in principle. There is nothing, which is at all times and in all circumstances dangerous;

there is an element of danger in every object.[49]

Similarly, in *Read v. J. Lyons & Co.*[50] the Attorney General Sir Hartley Shawcross argued:

The true question is not whether a thing is dangerous in itself but whether, by reason of some extraneous circumstances, it may become dangerous. There is really no category of dangerous things, which require more and some which require less care.

It is conceded that there is an element of danger in everything. However, it is contended that certain objects are inherently dangerous. A loaded gun at all times and in any hand is inherently and patently dangerous – pull the trigger and the consequence is grave harm to person if the nozzle is pointed to a person, but not so for a toy gun. The common ground is that a degree of care arises proportionately to the level of danger associated with the article and special care ought to be exercised in respect of articles dangerous *per se* than articles dangerous *sub modo*.

### **Iii Negligence and Neighbourhood Principle**

The defendant has the duty to exercise ordinary care in compounding an article in order to maintain the safety of those he knew or ought to know the article may be purchased for. The duty is not limited to the immediate purchaser but also extends to the ultimate consumer. In *Francis v. Cockrell*,[51] the plaintiff was injured by the fall of a race course stand while he sat on a seat he had booked and paid for. The defendant was the proprietor of the stand and acted as a receiver of the money. The contractor negligently erected the stand though the defendant was not aware of the defect. The court followed the decision of Lord Chief Baron in *George v. Skivington* where the Law Lord put the law succinctly thus:

He said there was a duty in the vendor to use ordinary care in compounding the article sold, and that this extended to the person for whose use he knew it was purchased and this duty having been violated, and he having failed to use reasonable care, was liable in an action at the suit of the third person.[52]

It is important to state that the defendant is presumed and reasonably to know or foresee the ultimate consumer of his article. Ignorance does not avail. Lord Lush J. in *White v. Steadman*[53] opined:

That a person who has the means of knowledge and only does not know that the animal or chattel which he supplies is dangerous because he does not take ordinary care to avail himself of his opportunity of knowledge is in precisely the same position as the person who knows.

The defendant should know or ought to know or contemplate the defect and foresee the consequent danger and

therefore, independently of contract, take reasonable care to prevent injury to the purchaser and or ultimate user. The actual or constructive knowledge of the defect in the article raises the duty of care upon the maker of the article. In the American case of *Macpherson v. Buick Motor Co.*[54] the plaintiff bought a car from a retailer. The car was manufactured by the defendant. The defect in the construction of the car caused injury to the plaintiff. The court held that the plaintiff was entitled to recover damages from the manufacturer. Cardozo J. opined:

There is no claim that the defendant knew of the defect and willfully concealed it... The charge is one, not of fraud, but of negligence. The question to be determined is whether the defendant owed a duty of care and vigilance to anyone but the immediate purchaser... The principle of *Thomas v. Winchester* 6 N.Y 397 is not limited to poisons, explosives, and things of like nature, to things, which in their normal operation are implements of destruction. If the nature of a thing is such that it is reasonably certain to place life and limb in peril when negligently made, it is then a thing of danger. Its nature gives warning of the consequences to be expected. If to the element of danger there is added knowledge that the thing will be used by person other than the purchaser and used without new tests then, irrespective of contract, the manufacturer of this thing of danger is under a duty to make it carefully.

Similarly Breth MR. in *Heaven v. Pender*[55] held:-

The proposition which these recognised cases suggest and which is, therefore, to be deduced from them, is that whenever one person is by circumstances placed in such a position with regard to another that every one of ordinary sense who did think would at once recognise that if he did not use ordinary care and skill in his own conduct with regard to those circumstances he would cause danger of injury to the person or property of the other a duty arises to use ordinary care and skill to avoid such danger.

The court employed a scenario where goods were to be supplied to be likely used by some other person who had no contractual relation with the supplier. The Judge then put the law in its considered perspective thus:-

Whenever one person supplies goods, or machinery or the like, for the purpose of their being used by another person under such circumstances that everyone of ordinary sense would, if he thought, recognize at once that unless he used ordinary care and skill with regard to the condition of the thing supplied or the mode of supplying it, there will be danger of injury to the person or property of him for whose use the thing is supplied, and who is to use it, a duty arises to use ordinary care and skill as to

the condition or manner of supplying such thing. And for a neglect of such ordinary care or skill whereby injury happens a legal liability arises to be enforced by an action for negligence. This includes the case of goods, etc....[56]

Even when the manufacturer of the article has shown reasonable care and diligence he may still be held liable if the article had left its company in a defective condition. In *Grant v. Australia Knitting Mill*,[57] the defendant was an underpant manufacturer. The plaintiff complained of dermatitis arising from the use of the underpant manufactured by the defendant, as a result of the latter's use of excess sulphitis. The defendant led evidence to the effect that he had manufactured 4,737,600 pairs of underpants without complaints. The plaintiff succeeded because the underpant was proved and held to be defective when it left the defendant's company.

Similarly, in the Nigerian case of *Edward Okwejinor v G. Gbakeji & anr*[58], the plaintiff/appellant pleaded that on the 13<sup>th</sup> day of February, 1991, he took out a bottle of Fanta Orange drink from a crate of mineral he purchased from the first defendant/respondent earlier same day. Meanwhile the first defendant/respondent purchased from the manufacturer, the 2<sup>nd</sup> defendant/respondent. While drinking the Fanta orange, the plaintiff/appellant allegedly felt some sediments and rubbish down his throat and stopped half way to take closer look at the content of the bottle. He then discovered that the bottle contained a dead cockroach. He developed stomach pain and was consequently hospitalized. During trial, an unopened Fanta orange containing a fly in the same crate of mineral was tendered and admitted (exhibit G). The trial court held that the contaminated Fanta orange which the plaintiff bought and consumed caused him stomach pain, vomiting and stooling and led to his admission in hospital. The Supreme Court set aside the decision of the Court of Appeal and affirmed the decision of the trial court on the point that 'plaintiff is a person closely and directly affected by the act of the 2<sup>nd</sup> defendant and he owes the consumers including the plaintiff the duty of care or that the drinks manufactured by them should not do damage to the consumers'.[59] This decision is highly commendable as it upholds the liability of the 2<sup>nd</sup> defendant/respondent without contractual relationship with the plaintiff/appellant.

On the contrary, the case of *Bates v. Batey & Co Ltd*[60] stands out. In that case, the plaintiff bought a bottle of ginger beer from a retailer who bought from the manufacturer. The bottle was defective though unknown to the manufacturer who could have discovered it by the exercise of reasonable care. The court per Horridge J. held that the manufacturer was not liable because he did not know of the defect.[61] Lord Buckmaster in *Donoghue v. Stevenson* viewed cases that granted damages for injury sustained by the plaintiff without contract as legally vexatious and prayed that those cases "should be buried so securely that their perturbed spirits shall no longer vex the law".[62] In answer to this in clear terms and rightly so, Lord Macmillan in the same case adumbrated: "In a true case of negligence, knowledge of the existence of the defect causing damage is not an essential element at all". Hence, ignorance of the defect is not a defence.

In the case of *Longmeid v. Holliday*[63] a defective lamp was sold to a man whose wife was injured by its explo-

sion. Although the vendor of the lamp against whom the action was brought was not the manufacturer[64], the judgment of the court covered manufacturers. The court put the law thus:-

It would be going much for to say, that so much care is required in the ordinary intercourse of life between one individual and another, that if a machine not in its nature dangerous, but which might become so by a latent defect entirely unknown, although discoverable by the exercise of ordinary care, should be lent or given by one person even by the person who manufactured it, to another, the former should be answerable to the latter for a subsequent damage accruing by the use of it.[65]

It is submitted that the case of *Bates v. Batey & Co Ltd* and the likes are against public interest, public health and safety[66]. They are capable of promoting the circulation of defective products to the public and still render the ultimate consumers helpless in the event of injury. There is no reason the ancient position in relation to negligent act should not be extended to defective product. In the 15<sup>th</sup> century case of the *Thorns*[67] the court held: "though a man doth a lawful thing yet if any damage do hereby befall another he shall answer for it, if he could have avoided it".

This is the correct principle, which is reasonable and just. To hold otherwise is to accord legal sanctity to injurious avoidable negligent conduct. Hence, the opinion of Lord Esher in *Emmeus v. Pottle*[68] is apt. The jurist opined:-

Any proposition the result of which would be to show that the common law of England is wholly unreasonable and unjust cannot be part of the common law of England.

Indeed to hold otherwise is to encourage product chaos, which is dangerous to the unborn, unhealthy to the living and ungodly, may be, to the dead. In *Donoghue v. Stevenson*,[69] the appellant on August 26, 1928 drank a bottle of ginger beer manufactured by the respondent. A friend of the appellant bought the bottle of the ginger beer at paisley; the said friend poured some of the ginger beer out into a tumbler, which the appellant drank. Again the friend proceeded to pour the remainder of the contents of the bottle into the tumbler when a snail, which was in a state of decomposition, floated out of the bottle. The appellant further averred that the results of the nauseating sight of the snail and the impurities in the ginger beer caused her shock and *severe* gastroenteritis. The House of Lords in a majority judgment[70] reviewed pre-existing relevant and related authorities on the issue and held:-

My Lords, if Your Lordships accept the view that this pleading discloses a relevant cause of action you will be affirming the proposition that by Scots and English Law alike a manufacturer of products, which he sells in such a form as to show that he intends them to reach the ultimate consumer in the form in which they left him with no reasonable possibility of intermediate examination, and with the knowledge that the absence of reasonable care

in the preparation or putting up of the products will result in an injury to the consumer's life or property, owes a duty to the consumer to take that reasonable care.[71]

The court enunciated the principle of duty of care to one's neighbour and defined neighbour in relation to the proximity of action of one man in relation to another and not necessarily physical closeness. Lord Atkin in the lead judgment explained:-

The rule that you are to love your neighbour becomes in law, you must not injure your neighbour; and the lawyer's question, who is my neighbour receives a restricted reply. You must take reasonable care to avoid acts or omission, which you can reasonably foresee would be likely to injure your neighbour. The answer seems to be – persons who are so closely and directly affected by my act that I ought reasonably to have them in contemplation as being so affected when I am directing my mind to the acts or omissions which are called in question.[72]

By this, the duty to take care and the liability for breach, independently of contract was re-affirmed with judicial seal of finality. This landmark decision accorded the concept of consumer protection a pride of place in the society.

However, in the Nigerian case of *Justice K. O. Anyah v. Imo Concord Hotels Ltd & 2 ors.*, [73] negligence was judicially sanctioned as an impractical theory of consumer protection. The facts of the case are that on the 19<sup>th</sup> day of December, 1986, the appellant, Justice K. O. Anyah came to Owerri, Imo State of Nigeria to attend a book launching ceremony. He drove his 505 Peugeot Saloon Car with registration No IM 6583 AF into the premises of the 1<sup>st</sup> Respondent, Imo Concord Hotels Ltd and booked accommodation for one night. At the gate of the hotel, the 2<sup>nd</sup> and 3<sup>rd</sup> respondents who were the hotel security men on duty on that day registered the number of the appellant's car and issued him with a plastic disc No 102. Thereafter, the security men lifted the bar across the gate and the appellant drove his said car into the hotel and parked it in a parking space therein. He then locked the car, pocketed the keys and checked into the room allocated to him where he slept for the night.

The following morning, the appellant checked out of the hotel, went to pick his car where he parked it but discovered that the car had been stolen. He immediately reported same to the hotel management and the latter ordered investigation yet the car was not recovered. Consequently, the appellant filed an action in court claiming a total of ₦150,000.00 (One Hundred and Fifty Thousand Naira) for the value of the stolen car, expenses incurred and general damages on the ground that the respondents were negligent in allowing his car to be stolen in the hotel on 20<sup>th</sup> December, 1986. The trial court held that the Respondents owed duty of care to the appellant, a decision the Court of Appeal reversed. At the Supreme Court, the apex court noted the meaning and relevance of 'duty of care' and 'neighbour' in an action for negligence. The court affirmed that the principle of negligence is that a person owes a duty of care to his neighbour who would be directly affected by his act or omission. The court adumbrated thus:-

There is a legal duty owed to take reasonable care to avoid acts or omissions, which can be reasonably foreseen to likely injure a neighbour. "Neighbours" in this regard are persons who are so closely and directly affected by one's act that one ought reasonably to have them in contemplation as being so affected when one is directing his mind to the acts or omissions which are called in question.[74]

Thereafter the Supreme Court per Kalgo JSC in the leading judgment reasoned and concluded to wit: "I have carefully studied the submissions of both counsel on this issue and after considering the facts of this case and read the case cited by the respondents' counsel, I am satisfied that the appellant is not such 'neighbour' that the respondents must or ought reasonably to have him in contemplation when directing their minds to their acts or omissions".[75]

On the facts of the case, the court opined:

The parking of a car or other valuable possessions does not necessarily give protection to the properties so parked from being interfered with by third parties. The proprietor of such hotels and/or the provider of such facility may not necessarily be liable for any loss that may occur as a result of the use of the space so provided. The fact that there are security men employed by the hotel assisted by policemen does not, *ipso facto*, create any legal relationship between the hotelier and the lodger requiring the former to ensure the security of the lodger's car parked in the hotel. After all, the hotel itself has its own properties to protect and unless there is an existing legal duty for it to protect the properties of others who come into the hotel, it has no duty of care owed to them and the presence of security men and policemen in its premises alone cannot be taken to be security to protect the properties of visitors. But where, for example, a visitor who came through the hotel gate was given a plastic or metal disc and he parked his car in the hotel park, locked it up, gave the key to the hotel security men and drew their attention to where he parked the car[76], there may arise a duty of care on the part of the security men to ensure the safety of the car. In the instant case, the appellant merely parked his car in the hotel park after he was allowed in and given the hotel disc.[77]

Implicitly, the court reasoned that the defendants/respondents owed a duty of care and vigilance to no one but those who parked their cars in the hotel premises and surrendered their keys to the hotel security men and drew their attention to where the cars were parked. This writer is of the humble view that the respondents owed legal duty of care to their neighbours, and their neighbours include all the customers to the hotel, whether the cars' keys were surrendered to the

securitymen or otherwise, and whether their attention was drawn to the place the cars were parked or not. In this case, the relationship between the appellant and the respondents created a clear legal duty of care on the part of the respondents for the safety of the car of the appellant. The appellant was a neighbour to the respondent, and the latter owed legal duty of care to the former, the breach of which entitled the appellant to reliefs sought. Hence, this writer reasons that the decision of the trial court is preferable in the circumstance of the case.

#### 4. Defenses to Liability on Defective Product

The case of negligence arising from defective products is not yet a strict liability wrong. The defendant is legally entitled to certain defences. These range from inherent risks to statutory defences among others. These are examined below.

a. Where a risk is inherent in a product and well known: When a risk of a product is well known and widely publicised, there can be no defect in the product if the risk occurs. In *Richard v. LRC Products Ltd*, [78] a condom was held not to be defective even though the woman became pregnant after its use. This was because there is always the risk of pregnancy even with the proper use of it. Again, in *XYZ v. Sihering Health Case Ltd* [79] it was held that a contraceptive pill was not defective for causing cardiovascular problems because it was a known possible side effect. However, it has been held that contamination of blood used for transfusion renders the blood defective as the public expected not to be given contaminated blood. [80] It therefore follows that where a given risk is associated with a particular product, the occurrence of that risk does not render the product defective and consequently, the manufacturer cannot be held liable for any injury. However, there must be a warning to all and sundry.

- b. Statutory Defences include;
- i. Defects attributable to legal requirements. [81]
  - ii. Defendant was not the supplier of the product. [82]
  - iii. The defect was not in existence at the relevant time. [83]
- c. Other possible defences are:
- i. Frolic or user's negligence;
  - ii. The act of a third party. It is necessary to observe that products may really pass from manufacturer into other hands from which they may be exposed to vicissitudes which may render them defective or noxious and for which the manufacturer may not be held responsible.
  - iii. Defendant's exercise of duty of care.

This onus is on the defendant to assert and prove any of the defences available to him.

#### 5. Conclusion

It is clear from the reviewed cases that liability in tort has not just gone one step beyond, it has gone more than fifty. It is obvious that *Winterbottom v. Wright* [84] is no more a good law in that regard. In that case, upon negligence in the construc-

tion of a carriage, it broke down and a stranger to the manufacture and sale sought to recover damages for injury sustained allegedly due to the negligence in the work. It was held that there was no cause of action either in tort or contract. The court categorically ruled: "The only safe rule is to confine the right to recover to those who enter into the contract; if we go one step beyond that; there is no reason why we should not go fifty".

The point of emphasis is that the categories of carelessness, which can assume the legal quality of negligence in law of tort are never closed, much as social and economic life of man remains infinite in variety and in degree. In *Chapman v. Pickersgill* [85], Pratt CJ opined: "I wish never to hear this objection again. This action is for tort: torts are infinitely various; not limited or confined, for there is nothing in nature but may be an instrument of mischief." The cardinal principle of liability for negligence, in the words of Lord Atkin: "is that the party complained of should owe to the party complaining a duty to take care, and that the party complaining should be able to prove that he has suffered damage in consequence of a breach of that duty". [86] Each case depends on its own peculiar facts and circumstances.

#### References

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- [1] Liability means subjection to a legal obligation. It may be civil or criminal. The former arises either from breach of contract or duty of care owed to the injured party. F. N. Monye, 'Liability for Defective Products', *The Nigerian Juridical Review*, Vol.6, 1994-1997, pp. 137-157.
  - [2] In *Chevron Nigeria Limited & anr v. Kehinde Omoregha & 5ors* (2015) 16 N.W.L.R. (pt.1485) 336 @ p. 350 paras. A- D, negligence was defined as 'negligence in law ranges from inadvertence that is hardly more than accidental to sinful disregard of the safety of others. It denotes the failure to exercise the standard of care that a reasonable prudent person would normally have exercised in a similar situation. That is to say, any conduct falling below the legal standard established to protect others against reasonable risk of harm, as against conduct that is intentionally, wantonly, or wilfully disregarding of other's rights'. *G.K.F. Inc. Ltd v. NITEL* (2009) 39 NSCQR 426, F.N., Monye 'Liability For Defective Products', *Loc. Cit.*, p.142, note 1.
  - [3] David Oughton and John Lowry, *Textbook on Consumer Law*, Great Britain: Blackstone Press Ltd, 1997, p.134
  - [4] *Otto Hamann v Senganjo & Anr* (1962) ALL N.L.R. 1070, *John Holt Ltd v Leonard Ezeafulukwe* (1990) 2 N.W.L.R. (pt. 133) 520 C.A., *D&E Estates Ltd v. Church Commissioners for England* (1989) A.C 177; *Murphy v. Brentwood District Council* (1991) 1 A.C 398. Lord Denning in *Candler v. Crane Christmas & Co.* (1951) 1 All ER 426 at p. 431 described it as

- 'cardinal error', and adumbrated the consequences thus, '... if one of the parties to a contract was negligent in carrying it out, no third person who was injured by that negligence could sue for damages on account of it'.
- [5] *Beswick v. Beswick* (1968) A.C 68 (1908) A.C 176, 1908 S. C (H.L) 7; *Cavalier v. Pope* (1906) A. C. 428.
- [6] Quoted in *M'alister (or Donoghue) (Pauper) v. Stevenson* (1932) A.C 562 at pp.621 – 622.
- [7] Kanyip, B. Bakwaph, Consumer Protection in Nigeria Law, Theory and Policy, (Abuja: Rekon Books Ltd., 2004), p.26; Aaaker, P.A. and Day, G. S., Consumerism, 2<sup>nd</sup> ed., ( New York: Free Press, 1974), p. XVII, cited from Monye, F. N., Law of Consumer Protection, (Ibadan: Spectrum Books Ltd., 2003), p. 16.
- [8] Schiffman, L.G. and Kanut, L.L. Consumer Behaviour, Prentice – Hall, Inc., Engle Wood Cliffs, 1978, cited from Monye, F. N. *Op. Cit.* p. 16.
- [9] Section 32, Consumer Protection Council, Act, 1992.
- [10] Monye, F. N. *Op. cit.* p. 19.
- [11] Italics mine for emphasis.
- [12] This includes both natural and corporate bodies capable of use or consumption of goods and services. There is no good reason a corporate body cannot sue for damage to it arising from defective product since it can sue to enforce its fundamental rights. See Mr. Charles Okechukwu & ANR v. EFCC & ors (2015) 18 N.W.L.R. (pt. 1490) 1 @ p.24, Onyekwuluje v. Benue State Govt. (2005) 8 N.W.L.R (pt. 928) 614
- [13] Section 1 (2) Consumer Protection Act, 1987.
- [14] *Grant v. Australian Knitting Mills* (1936) A. C. 85.
- [15] *Brown v. Cotterill* (1934) 51 T.L.R. 21.
- [16] *Herchial v. Stewart & Awdern* (1940) 1 K.B. 155.
- [17] *Haseldine v. Daw* (1941) 2 K.B. 343; (1941) 3 All E.R. 156.
- [18] *Watson v. Buckley* (1940) 1 All E.R. 174.
- [19] *Richards v. LRC Products Ltd.* (2000) 59 BMLR 185.
- [20] *XYZ v. Sihering Health Care Ltd* (2002) EWHC 1420.
- [21] *Abouzaid v. Mother Care (UK) Ltd* (21 December, 2000, C.A).
- [22] *Rimmer v. Liverpool City Council* (1984) Q. B. 1, 16.
- [23] *Candler v. Grane, Christmas & Co(A Firm)* (1951) 2 K.B. 164; *Hedley Byrns & Co Ltd v. Heller &Partners Ltd* (1964) A. C. 465.
- [24] *Low v. Bouverie* (1891)3 Ch. 82; *Le Lieevre v. Gould* (1893) 1 QB 491. However, the following cases were to the contrary: *Slim v. Croucher* (1860) 1 De G.F.&J 518; *Cann v. Willson* (1888) 39 Ch. D 39.
- [25] *Candler v. Crane Christmas (supra)*; *Derry v. Peek* (1889), 14 App. Cas. 339; *Fish v. Kelly* (1864) 17 C. B. N. S. 194
- [26] *Candler v. Crane Christmas & Co supra* at p.433. The law Lord did not mention legal practitioners in his list. He opined that "The Lawyer is never called on to express his personal belief in the truth of his client's case" unlike an accountant. It is observed that a lawyer is never called to express his personal belief in the truth of his client's case but a legal opinion of the position of his client case. See also *Everett v. Griffiths* (1920) 3K.B. But see *Nocton v. Lord Ashburton* (1914) A. C. 932.
- [27] *Ultra mares Corpn v. Touche* (28) (174 N. e. 144) cited in *Candler v. Crane Christmas & Co supra* at p.435.
- [28] *English Thesaurus, Geddes & Crosset*, 1997, p. 56
- [29] *Ibid.*
- [30] Monye, F. N. *op. cit.* p. 122.
- [31] *Ibid.*
- [32] *Ibid.* p. 128
- [33] *Ibid.*
- [34] *Daniels v. White & Sons* (1938) 1 All ER 258 cited in Monye, F.N., *Op. Cit.* p. 128; See also *Boardman v. Guinness (Nig.) Ltd* (1980) NCLR 109.
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- [76] Underline mine for emphasis
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# PLL Based Firing Circuit for Three Phase Controlled Rectifier in Aircraft Landing Light

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DOI: 10.29322/IJSRP.8.7.2018.p8013

<http://dx.doi.org/10.29322/IJSRP.8.7.2018.p8013>

**Abstract-** Aircraft electrical components operate on many different voltages both AC and DC. Many aircraft power systems use 115 volts (V) AC at 400 hertz (Hz) or 28 volts DC. The most lighting services on aircrafts are powered by 28 V DC. They vary from 600 W for landing lights to few watts for minor internal illumination usages. The input voltage for the system is 115 V AC whereas the 600watts landing light uses only 28 V DC. It so needs to rectify the three-phase input AC voltage to DC voltage for the voltage requirement of the landing light. The theme of this paper is to design phase-locked-loop (PLL) based firing controller circuit for controlling the firing angle required. The PLL based firing controller circuit is linear firing angle controller. In PLL based firing angle controller circuit, the error of the ramp-comparator circuit has been minimized by means of an error blocking circuit added to block the discharging error of the ramp-comparator circuit. As ramp-comparator circuit and PLL circuit are involved in the controller circuit, it has the advantage of equal error per channel, and the error may be reduced by changing the free running frequency of PLL. The results of firing circuit are tested by PROTEUS software in this paper.

**Keywords:** alternating current, direct current, circuits, phase-locked-loop, landing light

## I. INTRODUCTION

Aircrafts are equipped with a variety of lights that are used for navigation, safety and to improve visibility during flight or when taxiing on the ground [4]. Lighting systems on aircrafts' are exterior lighting, interior lighting and emergency lighting. Exterior lighting system consists of landing lights, taxi lights, logo lights, wing illumination lights, service lights, position lights, anti-collision lights and strobe lights. The landing light is light for night landing. And it is located on wing leading edge or landing gear. The voltage rating that landing light use is 28 V DC or 115 V AC. Its power rating is 600 W. Past and present technologies include ordinary incandescent lamps, halogen lamps, various forms of arc lamps and discharge lamps and LED lamps. The airplanes have both transformer-rectifiers to turn the 400 Hz AC voltage into DC voltage for the 28 volts buses, and a static inverter to create the AC 400 Hz in case the aircraft power decreases up to the battery power. The aircraft battery offers a short-term power storage capability [1]. Most of aircrafts' electrical systems use a three-phase, 400 Hz, AC bus supplied by engine driven generators. However, most aircrafts' lighting systems use only 28 V DC. Due to aircraft generating power is 115 V, 400 Hz AC and the required voltage level for the landing light is 28 V DC, the input AC voltage must be converted into required DC output voltage.

In converting voltages from AC voltage to DC voltage, there are many electronic switching devices used for rectification mode. The most used switching devices are diodes, thyristors (SCRs), gateturn-off thyristors, power Darlington transistors, power MOSFETs, and insulated-gate bipolar transistors (IGBTs) [2]. Power semiconductor devices are the most important functional elements in all power conversion applications. In this paper, thyristor which is also known as silicon-controlled rectifier (SCR) is used as the switching device for controlled rectifier.

There are various methods for controlling the SCR by providing the pulses to the gate for the purpose of rectification AC to DC. In accordance with Tai-Ming Timmius Lee [3], the phase-locked-loop based firing circuit has the advantages over phase shifter based firing circuit and ramp comparator based firing circuit due to the following facts. The accuracy of the phase-locked-loop based firing circuit is very high if compare with the other circuits. Although the circuit complexity of phase-locked-loop based firing circuit is more complex, the error for each channel is extremely less than the others. And also the linearity of the phase-locked-loop based firing circuit is the best among these firing circuits. In this dissertation, there is detailed description and functioning of each block of phase-locked-loop-based firing angle controller circuit. The phase-locked-loop-based firing circuit is better for firing controlled thyristors at a constant, equidistant spacing. The maximum error that may be introduced in the equidistant spacing of the consecutive pulses can be shown to be  $360^\circ/N$  where N is a frequency multiplying factor.

## II. METHODOLOGY

### A. Three-phase Six-pulse Bridge Controlled Rectifier

Generators on most aircrafts produce 115 V, 400 Hz. Power generated from the generators is directly used without modification or is routed through transformers, rectifiers and inverters to change voltage or type of current. Most lighting system on aircrafts use 28 volts DC. For the voltage requirement of landing light which is 28 volts DC, the input AC voltage; 115 V, 400 Hz, needs to rectify. The steps for rectifying 115 V, 400 Hz AC to 28 volts DC are shown one by one in block diagrams of Fig.1.

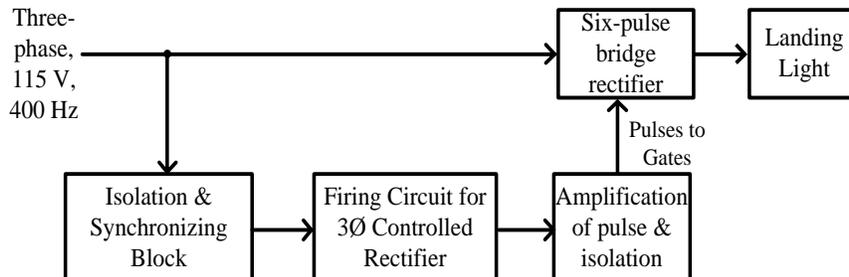


Figure 1. Three-phase Controlled Rectifier for Landing Light

Due to the difference in voltage levels of power circuit and firing controller circuit, the firing circuit must be isolated from the power circuit which has the high voltage system input of 115 V. And also for the purpose of producing synchronized firing angle for the rectifier used on high voltage system input, the low voltage input for the firing circuit must also be synchronized with the high voltage input of power circuit. And then the output voltage from the firing circuit is not high enough to trigger SCR used in bridge rectifier so that the amplification of this voltage is needed and so does isolation between power circuit and firing circuit. With the help of step-down transformer, the input AC supply voltage is stepped down from 115 V to 8 V which will be used for the gate-pulse signal firing circuit.

### B. Firing Circuit for Three-phase Controlled Rectifier Using Phase-Locked-Loop Technique

The block diagram of a three-phase phase-locked-loop based firing controller circuit is illustrated in Fig.2. The input voltage for the firing circuit is low level voltage which is the secondary low voltage of the step-down transformer. After passing the zero-crossing detector circuit, the input sine-wave signal is inversely converted into the square-wave signal and then is fed to the ramp-generator circuit as the input signal. The output signal of the ramp-generator will be compared with the DC reference voltage which can be set constantly the voltage value for the firing angle. The two output signals from the two ramp-comparators are fed to the AND gates for the purpose of error blocking. The error blocking circuit is built to block the discharging error of the capacitor in the ramp-generator. The S-R flip-flop is used to set 180° phase shift of the two input signals of it.

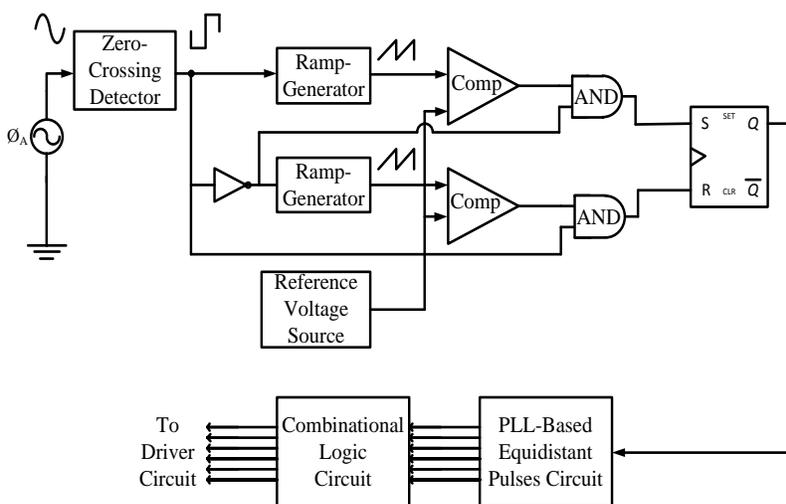


Figure 2. A Block Diagram of Three-phase Phase-Locked-Loop-Based Firing Controller

And then the phase-locked-loop circuit is driven by the output signal of the S-R flip-flop. The range of most of the existing firing circuits may not cover from 0° to 180°. The firing circuit can be adjusted from 0° to 175° so that the error of the firing circuit is 5°. By adjusting free running frequency to shift the phase angle of the PLL output, the firing circuit can be adjusted from 2.5° to 177.5° so

that the error of the firing circuit is  $2.5^\circ$ . Therefore the error of the linear firing circuit may be reduced by half by changing the free running frequency of the PLL chip. Actually, the PLL-based firing circuit may be adjusted from  $0^\circ$  to  $180^\circ$  with less than a  $1^\circ$  error. This error is caused mainly by the modulated frequency of the pulse driver and the turn-on time delay of the thyristor. All the error terms of the input stages can be corrected by changing the free running frequency of the PLL chip to shift the phase of the output frequency. The overall circuit diagram is shown in detail in Fig.3.

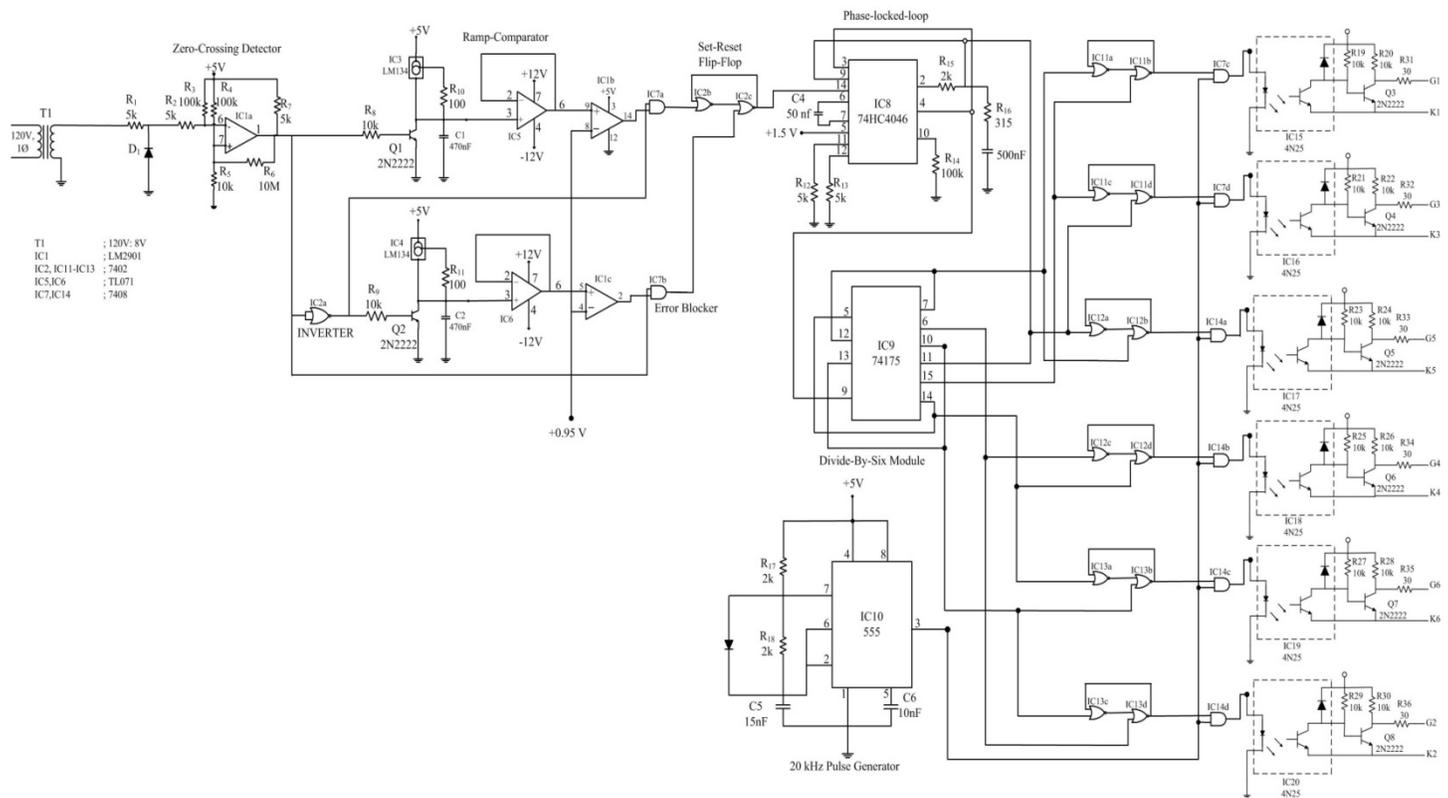


Figure 3. Three-phase Phase-locked-loop Based Firing Circuit

### III. DESIGN CONSIDERATION AND SIMULATION RESULTS

#### A. Zero-Crossing Detector

It is designed for the use level detection, low-level sensing and memory applications in consumer and automotive and industrial electronic application. In this project, it generates output when the input, which is the output sin-wave voltage signal of the step-down transformer, crosses a reference point; in this case zero volts or ground. LM 2901 is used for realizing Zero-Crossing Detector.

The values of each component for the zero-crossing detector are selected according to the following equations:

$$R_1 + R_2 < 10k\Omega \quad \text{Eq (1)}$$

$$R_1 + R_2 \approx R_5 \quad \text{Eq (2)}$$

$$R_5 \leq R_4/10 \quad \text{Eq (3)}$$

$$R_3 = R_4 \quad \text{Eq (4)}$$

$$R_6 \gg R_4, R_6 \gg R_5 \quad \text{Eq (5)}$$

$$R_7 \approx R_2 \quad \text{Eq (6)}$$

By choosing the value of resistor  $R_5$  about  $10 k\Omega$ , the values of resistors,  $R_1$  and  $R_2$ , will become  $5 k\Omega$ . And according to the Equations 3 and 4, the values of resistors  $R_3$  and  $R_4$  are calculated and the result is  $100 k\Omega$ . Due to Equation 5, the value of resistor  $R_6$  is selected as  $10 M\Omega$ . And the value of the resistor  $R_7$  is chosen as  $5 k\Omega$  according to Equation 6. The comparators in LM 2901 IC chip are designed to operate from a single power supply over a wide range of voltages. In the paper, 5 V single power supply is used for the zero-crossing detector. The simulation results for the zero-crossing detector circuits with the input ac signal and output inverse square-wave are shown in Fig.4.

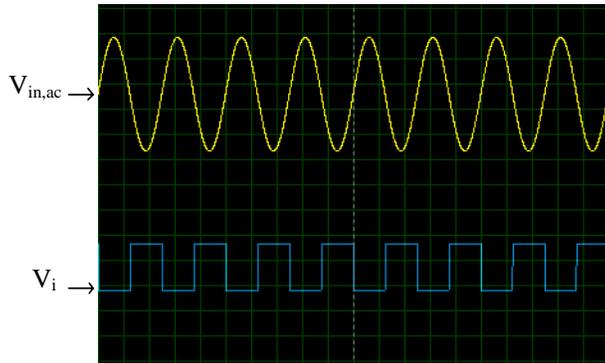


Figure 4 Input and Output Voltage Signals of Zero-Crossing Detector

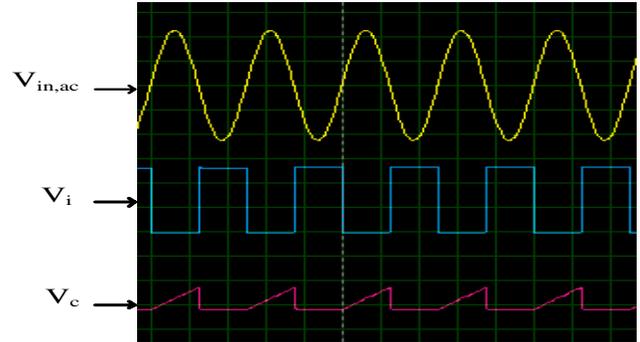


Figure 5 Output Voltage Waveforms of Zero-Crossing Detector and Ramp-Generator

### B. Ramp-Comparator Circuit

A ramp-comparator circuit is composed of two elements, a ramp-generator and a comparator. For the ramp-comparator circuit, the output voltage signal of the zero-crossing detector is used as the input signal of the ramp-comparator. In ramp-generator circuit, LM 134 is used as the three-terminal adjustable current source and 2N2222 transistor is used as the switching transistor. And the values of each component of the ramp-generator are calculated as the following equation;

$$V_c = \int_0^t \frac{I_s}{C} dt \quad \text{Eq (7)}$$

By assuming the voltage  $V_c$  for the maximum value about 1.5 volts and the capacitor  $C$  is about 470 nF whereas the time  $t$  is the upper case value of about 1.25 ms for the 400 Hz frequency, the result of current  $I_s$  is calculated as 0.564 mA. And according to the reference [7], the value of  $R_{set}$  is calculated as 120  $\Omega$  but it is chosen about 100  $\Omega$  in this paper. And the simulation results for the ramp-generator and also zero-crossing detector circuit are shown in Fig 5.

TL 071 IC chip is used for realizing buffer amplifier behind the ramp-generator circuit, which has wide common mode (up to  $V_{CC+}$ ) and differential voltage range, low input bias and offset current and high slew rate : 16V/ $\mu$ s. As the buffer amplifier, it has a unity gain and very high input impedance. And it is also essentially an impedance transformer. The simulation results of ramp-generator and unity gain buffer amplifier are shown in Fig 6.

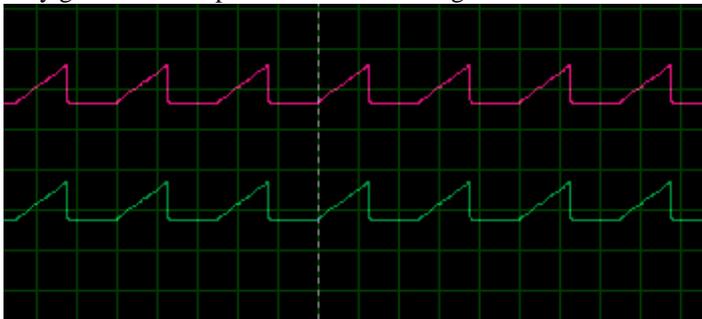


Figure 6 Output Voltage Waveforms of Ramp-Generator and Buffer Amplifier

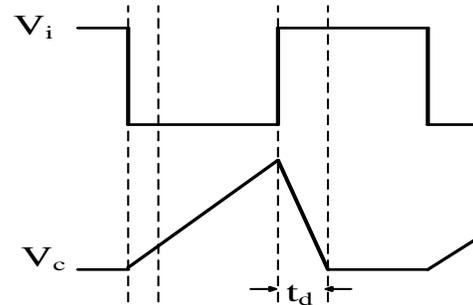


Figure 7 The Pulse Response of the Ramp-Generator

### C. Error Blocking Circuit

One major problem is caused by discharging the capacitor of the ramp generator. In Fig 7,  $t_d$  is the error term caused by the discharging error of the ramp-generator. As a result,  $V_o$  in Fig 7 contains error. One thing which can be done to avoid the discharging error is to add an additional discharging circuit to the output of the ramp-generator.

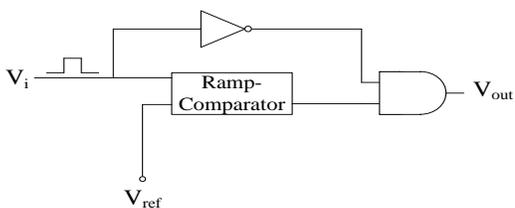


Fig 8 Error Blocking Circuit

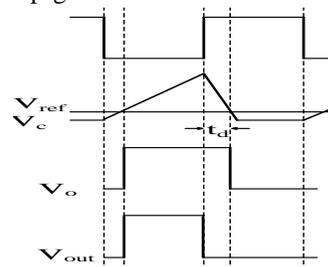


Figure 9 Pulses Response of the Error Blocking Circuit

This addition can be minimized  $t_d$ . However, it is impossible to reduce  $t_d$  to zero. The technique called error blocking can be used to block the discharging error is shown in Fig 8. When the input signal of the ramp generator is low, the linear ramp waveform is generated. An inverter and an AND gate are added to the circuit. If the input signal,  $V_i$ , goes low, the output of the inverter will go high. If  $V_c$  is greater than  $V_{ref}$  in ramp-generator circuit,  $V_{out}$  will go high. No matter whether the ramp-comparator output is high or low if  $V_i$  goes high,  $V_{out}$  will go low. The simulation results for the ramp-comparator circuit and error-blocking are as shown in Fig 10. To convert the variable width pulses obtain from comparator outputs to get  $180^\circ$  width pulse, the S-R Flip Flop is used. The simulation results for the positive edge triggered S-R Flip-Flops are shown in Fig 11.



Figure 10 Output Voltages Waveforms of Error Blocking Circuit

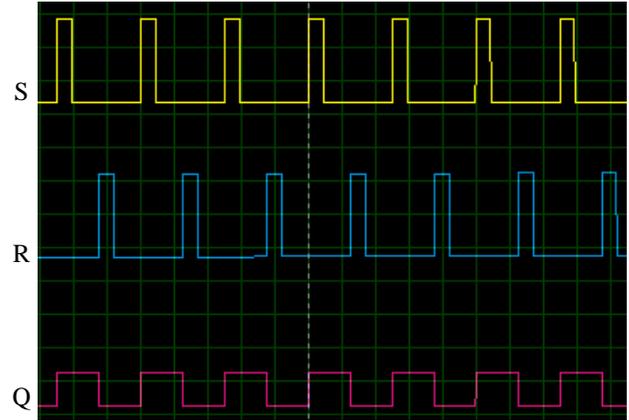


Figure 11 Output Voltage Waveforms of Positive Edge Triggered S-R Flip-Flop

**D. Phase-locked-loop**

A phase-locked-loop is commonly used in motor control, frequency synthesizers and radio receivers. In designing a thyristorized three-phase AC to DC converter, a phase-locked-loop technique is usually employed to generate equidistant spacing of six consecutive pulses for triggering six thyristors. The basic principle of the equidistant pulses scheme is simplified into a scheme as shown in Fig 12. In Fig 11, when the phase detector receives the input frequency,  $f_i$ , the phase detector outputs a phase difference signal,  $f_d$ , by comparing the signals of  $f_i$  and  $f_c$ . After the low pass filter receives the output signals from the phase detector, the low pass filter integrates the phase difference signal and outputs a DC signal. This DC signal can control the output frequency of the voltage controlled oscillator, VCO. Then the output signal of the VCO is divided by six and the resulting signal is the  $f_c$ . The output logic signals of the divide-by-six module can be used to drive the driver circuit. In other words, the circuit in Fig 12 works like a frequency multiplier. A divide-by-six module can be implemented by using three flip-flops.

In this paper, 74HC4046 IC chip is used for the phase-locked-loop circuit, and TTL 74175 IC chip is used for divide-by-six module. The simulation result for phase-locked-loop circuit using 74HC4046 IC chip is shown in Fig 13.

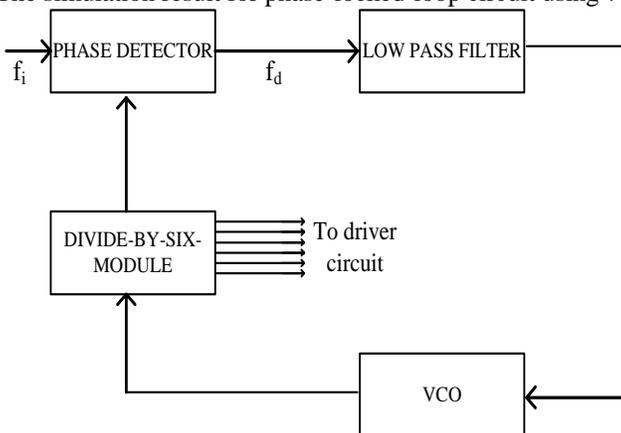


Figure 12 A Block Diagram of Equidistant Pulses Scheme

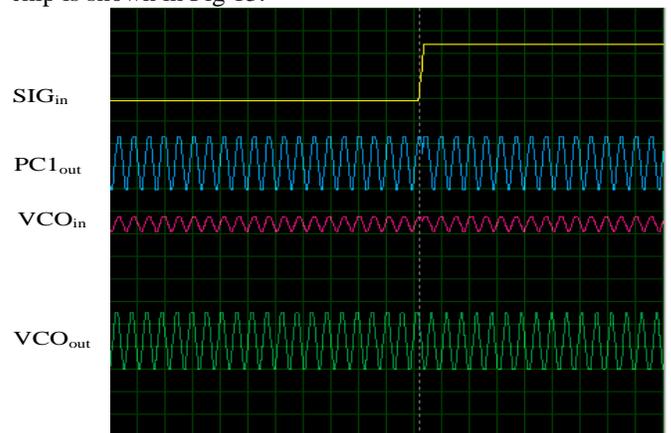


Figure 13 Outputs Waveforms of Phase-Locked-Loop 74HC4046 Chip

**E. High Frequency Waves**

Pulse gating of thyristor is not suitable for RL loads, and this difficulty can be overcome by using continuous gating. However, continuous gating may lead to increase thyristor losses and distortion of output pulse. So, a pulse train generated by modulating the pulse gate at high frequency is used to trigger thyristor. This high frequency wave is known as carrier wave and is generated by 555 timer. AND operation is performed between the S-R flip-flop outputs and carrier waves so that pulses required for triggering the

thyristor called firing pulses or gate pulses are obtained. The simulation results of AND gate for the positive polarity and negative polarities are shown in Fig 14.

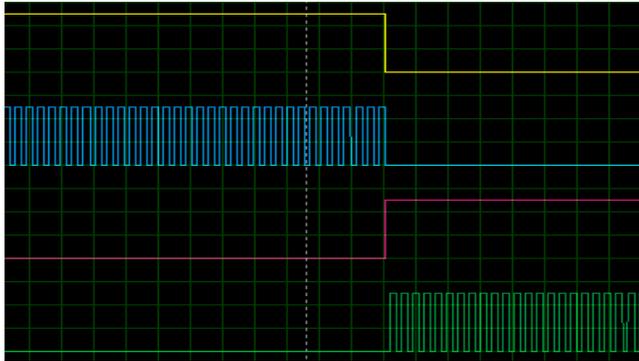


Figure 14 Simulation Results for AND Gates

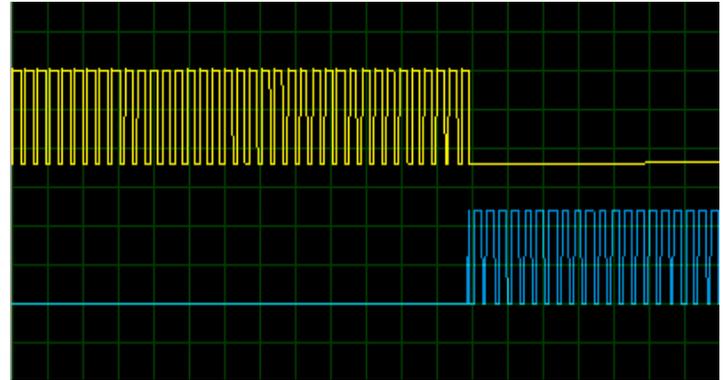


Figure 15 Final Pulses for Gate Terminals of Thyristors

#### F. Amplification of Pulses and Isolation

Outputs from the AND gates cannot be connected directly to between gates and cathodes of thyristors because the outputs will not be able to supply the necessary current required by the gate circuit of thyristor. Apart from this, isolation between the control circuit and power circuit is also required. Therefore, with the help of phototransistor-based optocoupler circuit, these two objectives of strengthening the pulse and providing the isolation are met. For the gate circuit voltage requirement of thyristors, the gate-pulse voltages for the thyristors are amplified by supplying about 12 V to the transistor of phototransistor-based optocoupler circuit. In this paper, the 4N25 phototransistor-based optocoupler is used. Final pulses after isolation and amplification using phototransistor-based optocoupler circuit are shown in Fig 15.

#### IV. CONCLUSION

In the ramp generator circuit, overdriving will result in a low saturation voltage of collector to emitter in the transistor. It helps to reduce the error of the ramp generator circuit. The error blocking circuit helps to block the discharging error of the ramp generator. The phase-locked-loop-based firing controller has two ramp generators. Therefore, the procedures of calibration are less complex. The free running frequency of the PLL chip can be adjusted to reduce the error of the phase-locked-loop-based firing controller. All the error terms of the input stages can be corrected by changing the free running frequency of the PLL chip to shift the phase of the output frequency. According to the final gate pulse signals of the proposed firing circuit are high enough to drive the gate voltage of thyristor on the six-pulse bridge controlled rectifier, the proposed firing circuit is good enough to use in the rectification of input 115 V AC system to the required 25 V DC voltage for the 600 W landing lights.

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# Students' Perception of the Implementation of Entrepreneurship Education in Secondary Schools for Economic Development

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DOI: 10.29322/IJSRP.8.8.2018.p8014  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8014>

**ABSTRACT:** The study investigated students' perception of the extent of the implementation of entrepreneurship education for economic development. The survey design was adopted for the study. The population of the study comprised 9,714 SS2 students in Calabar Education Zone. Simple random technique was used to select 936 students which made up the sample of this study. The major instrument was a questionnaire with a reliability index ranging from 0.71-0.81 achieved using Cronbach alpha method. Two hypotheses were formulated and data gathered were analyzed with population t-test. The results of the analysis were found to be significantly high for curriculum content and low for utilization of instructional facilities. Recommendations included among others that instructional facilities should be properly utilized for effective implementation of entrepreneurship education, for the purpose of economic development.

**Keywords:** Students' perception, implementation and entrepreneurship education

## INTRODUCTION

Education remains the process through which human potentials are developed. The aim of education in whatever form is to mould an individual to a better person, who will be relevant to his environment and make positive contributions to his society. But most secondary school graduates find themselves roaming the streets not knowing what to do to help themselves, because they lack skills which should help them excel in life. As a result of this idleness they constitute nuisance to the society. As often said "an idle mind is the devil's workshop" the

joblessness of the youth today stems from their non-acquisition of entrepreneurial skills. As such the youths are mostly involved in anti-social activities like thuggery, armed robbery, militancy, ethnic and political clashes which could be traced to the fact that they are not equipped with skills that enable them to fit into the world of economic and productive enterprise upon graduation.

Entrepreneurship education is that education which assists students to develop positive attitude, innovation and skills for self-reliance, rather than depend on the government for employment. Entrepreneurship education will enable schools to produce graduates with self-confidence and capacities for independent thought to discover new information leading to economic development (Emetaron, 2008). Agu (2006) opined that entrepreneurship education is the type of education designed to change the orientation and attitude of the recipient, and in the process equip him with the skills and knowledge to enable him start and manage a business enterprise. This type of education aims at developing the requisite entrepreneurial skills, attitudes, competences and dispositions that will predispose the individual to be a driving force in managing a business. It is a skill based education. Similarly, Umunadi (2011) viewed entrepreneurship education as the basic education that prepares people for owning and managing their own businesses, vocational and technical in nature deeply rooted in practical work, it is the acquisition of skills in local crafts and proper technological training for self-reliance. This implies that Entrepreneurship Education prepares one to be adequately equipped to acquire skills which could be used to manage his own business.

Some objectives of entrepreneurship education according to Paul, (2005) is organized to achieve the following objectives: to create employment, to reduce high level of poverty, to create

smooth transition from traditional to a modern industrial economy, to provide the young graduates with enough training and support that will enable them to establish an occupation in small and medium sized businesses, to inculcate the spirit of perseverance in the youths and adults which will enable them to persist in any business venture they embark on. Entrepreneurship Education reduces the high level of rural-urban migration, to offer functional education for the people that will enable them to be self-employed and self-reliant, to provide the youth adequate training that will enable them to be more creative and innovative in identifying noble business opportunities.

The new senior secondary curriculum has five compulsory subjects; English Language, General Mathematics, Civic Education, Computer Studies/ICT, one trade subject selected from the newly introduced 35 trade subjects (Federal Government of Nigeria, 2008). Duruamaku-Dim (2013) enumerated the 35 entrepreneurship subjects to include: Auto body repair and spray painting, Auto electrical work, Auto mechanical work, Auto parts merchandising, Air conditioning refrigerator, Welding and Fabrication, Engineering Craft Practice, Electrical installation and maintenance work, Radio, TV and Electrical work, Block laying, Brick laying and concrete work, Painting and decorating, Plumbing and Pipe fitting, Machine wood working, Carpentry and joinery, Furniture Making, Upholstery, Catering and craft practice, others include Garment making, Textile trade, Dyeing and bleaching, Printing craft practice, Cosmetology, Leather goods manufacturing and repair, Keyboarding, Shorthand, Data processing, Store keeping, Book keeping, GSM maintenance, Photography, Tourism, Mining, Animal husbandry, Fisheries, Marketing, and Salesmanship. He noted that at the senior secondary school level no formal lecture is encouraged; students are exposed to the knowledge and skills dimensions of

entrepreneurship education through the use of entrepreneurship driven technology. He emphasized that two issues are important when considering secondary school curriculum and entrepreneurship studies. These are the curriculum content and learning.

The curriculum is a planned learning experience made available to help students achieve the learning outcomes to the best of their abilities. It is expected that with the introduction of the 35 entrepreneurship subjects in the Senior Secondary Education Curriculum (SSEC) any student who passes through the above curriculum must have developed the necessary confidence to be self-reliant. Chukwurah (2011) defined the curriculum as a learning experience given to the learner under the guidance of the teacher. The teacher is central to the process of education, but most teachers lack the skills to impart the needed knowledge for students to acquire the skills (Dimson, 2011). To effectively implement the curriculum of entrepreneurship education the teacher must be competent.

Instructional facilities constitute important resources to the realization of the goals and objectives of the school. It is the presence of these facilities that enhances the students' learning by allowing them gain the needed practical experience. Umar and Ma'aji (2010) observed that Technical and Vocational Education (TVE) has been forced to perform below standard due to non-availability, inadequacy or total neglect of the required facilities in the workshop for effective acquisition of skills. They noted that to realize the objectives of the educational system the teachers' efforts may be meaningless without the instructional facilities being available. They discovered that the curriculum can only be implemented where facilities in the workshop are adequate and relevant.

According to Udonwa (2010) who studied the utilization of physical and material resources for secondary education programme in Oyo State with adequate resources and allocation, projections and use. Sixty (60) secondary schools were selected from 10 Local Government Areas of the State. He analyzed the data collected using the z-test analysis of variance and t-test statistical techniques. The findings revealed that the level of utilization of physical and material resources was low and that the provision of instructional facilities was inadequate despite geometric increase in students' ratio. He further devised that there is dire need to improve the allocation and utilization of resource materials in schools to check students' performance. Educational outcomes in schools are closely linked to utilization and adequacy of teaching/learning resources in different ways. He further mentioned that, poor utilization and under-utilization of facilities bring forth low educational performance.

In a study carried out by Ofoha (2011), on assessment on how the curriculum was implemented in Nigerian secondary schools with a view to determining the appropriateness of Nigerian secondary education curriculum found that the curriculum was appropriate in terms of goals and content but found weak in its method of implementation. He also found teaching method used in implementing the curriculum as mainly theoretical. Home Economics, Agricultural Science, Introductory Technology, Music, Fine Arts, Food and Nutrition, Technical Drawing and other core and vocational and technical subjects that were mostly taught while Arts and Crafts, clothing and textiles did not receive much attention. He also found that students' entrepreneurial capabilities were significantly low as there was no significant production of marketable goods and services to show for their practical knowledge.

Availability of appropriate facilities according to them enhances students' learning by allowing them to be involved in demonstrations, and practice which will build their skills. The facilities apart from being available should be adequate, so that the students do not struggle to use them. In line with the foregoing, Uzoagulu (1993) discovered that students were compelled to carry out practice exercise in group due to lack of adequate tools and equipment. The school workshops, laboratories or studios are meant to offer equipment chances for practical training of students in the acquisition of skills in different trade areas. Students' potentials seem not to be properly channeled as most schools do not have the necessary instructional facilities to ensure the effective implementation of the curriculum.

Various authors have agreed that students learn best what they find understandable. And that students' perception about a subject influence their understanding and learning of that subject and continued study of the subject. This is indicative that a major reason underpinning students' participation in a learning task is their perception of the subject as fascinating, boring, simple, difficult, or important. There is evidence that students who find a subject interesting tend to choose it for further study. Perception in the light of this study is how the students judge the extent to which entrepreneurship education has been implemented in their schools.

Given the scenario above, this study focused on finding out the extent to which entrepreneurship education is implemented as perceived by students in secondary schools for economic development as this will enable stakeholders to know the extent of implementation and what should be done next.

### **Statement of the problem**

Every secondary school graduate is expected to have been prepared for higher education and at the same time acquire relevant trade or entrepreneurship skills needed for poverty eradication, employment and wealth generation. From observation and interaction with some of the students the researcher got to know that the aim for which the Basic Education Curriculum was introduced has been defeated and the objectives of the 35 trade or entrepreneurship subjects has not been achieved.

Most secondary school graduates are idle and some are involved in various vices due to unemployment. Several studies have shown that most individuals do not possess useful entrepreneurial skills which have led to heightened social problem in the society. As often said “an idle mind is the devil’s workshop” the joblessness of many youths today stems from their non-acquisition of entrepreneurial skills. This has further aggravated the negative behaviour of our youths in the society as most anti-social acts could be traced to the fact that the youths are not empowered to be self-reliant. The training acquired at the end of secondary education seems inadequate to make the school leavers competent and self-reliant.

The question is: What is student’s perception of the extent to which entrepreneurship education is implemented in terms of the curriculum contents and utilization of instructional facilities to impart skills in secondary schools for the implementation of entrepreneurship education in secondary schools for economic development. This is the crux of this study.

### **Research questions**

The following research questions guided this study:

1. To what extent is the curriculum content of entrepreneurship education implemented in secondary schools as perceived by students?

2. To what extent are instructional facilities utilized for the implementation of entrepreneurship education in secondary schools as perceived by students?

### **Statement of hypotheses**

The following hypotheses were tested statistically in this study:

1. The extent of implementation of entrepreneurship education curriculum in the secondary schools as perceived by students is not significantly low.
2. The extent to which instructional facilities are utilized for the implementation of entrepreneurship education in secondary schools as perceived by students is not significantly low.

### **Research methodology**

The research design adopted for this study was the survey design. This design was considered appropriate because it elicited information on students' perception on the implementation of entrepreneurship education in secondary school for economic development. The target population of the study consisted of all SS2 students in all public secondary schools in Calabar Education Zone. The zone has a total of 9,174 students in public secondary schools. The sample of the study was made up of 936 students selected from the population of the study representing about 10% of the target population and used for the study.

Two hypotheses were formulated and tested at 0.05 level of significance using population t-test as the statistical tool applied and the result of the analysis presented hypothesis by hypothesis. One instrument was used for data collection in this study. This was a questionnaire titled "Students' Perception of Implementation of Entrepreneurship Education Questionnaire (SPIEEQ)".

The response of the item for curriculum content was structured on a four point rating scale as follows:

Very High Implementation (VHI) = 4; Highly Implemented (HI) = 3;

Moderately Implemented (MI) = 2; Not Implemented = 1.

### Hypothesis one

The extent of implementation of entrepreneurship education curriculum in secondary school as perceived by students is not significantly low.

To test this hypothesis, population t-test analysis was applied to data and the results presented in Table 1.

TABLE 1

Population t-test analysis result showing of extent of students' perception to which curriculum content is implemented in entrepreneurship education

N=902

Variable	$\bar{X}$	$\mu$	S.D	t	p-value
Curriculum content	99.63	87.5	27.005	13.485	.000

Significant at .05 level, df=901

Results from Table 1 shows the mean score of secondary school as 99.63 and that of the population mean as 87.5 while calculated t is 13.485 at .05 level of significance with a p-value of 0.000. The difference is significant as the p-value of 0.000 is lower than the value of .05 level of significance hence the null hypothesis is rejected. Therefore, the extent of implementation of

entrepreneurship education curriculum content in secondary school is not significantly low but high.

**Hypothesis two**

The extent to which instructional facilities are utilized for the implementation of entrepreneurship education for economic development is significantly low. To test this hypothesis, population t-test analysis was applied and the results presented in Table 2.

TABLE 2

Population t-test analysis, showing results for the extent to which facilities are utilized for the implementation of entrepreneurship education as perceived by students

(N=902)

Variable	$\bar{X}$	$\mu$	S.D	t	p-value
Utilization of facilities	24.35	25.0	13.71	-1.432	0.152

Significant at .05 level, df=901

Table 2 shows the mean score of utilization of facilities for the implementation of entrepreneurship education in secondary schools as 24.35 and a population mean of 25.0, while the calculated *t* is -1.432 at .05 level of significance with a p-value of 0.152. The computed *t*-value of -1.432 is statistically not significant because  $X=24.35$ ,  $S.D=13.71$ ,  $+ (901) = -1.432$ ,  $p > .001$  at .05 level of significance, hence, the null hypothesis was retained. It is therefore concluded that the extent to which facilities are utilized for the implementation of entrepreneurship education in secondary school is significantly low.

**Discussion of findings**

The findings of this hypothesis revealed that the students' perception of the extent to which curriculum content is implemented in entrepreneurship education in secondary schools is not significantly low but high. All thanks to the Federal Government for this initiative in our school system, which is giant stride towards achieving a strong and self-reliant nation with great and dynamic economy and full of opportunities for her citizens. The introduction of the new secondary school curriculum in secondary schools in Nigeria is a fresh initiative which according to NERDC in 2011 aimed at ensuring that graduates from secondary schools are trained in entrepreneurship skills and possess relevant skills that will equip them for challenges of labour market and be employers of labour.

Again, the findings of this study was found contrary to the report of Ofoha (2011) whose assessment on how the curriculum was implemented in Nigerian secondary schools with a view to determining the appropriateness of Nigerian secondary education curriculum found that the curriculum was appropriate in terms of goals and content but found weak in its method of implementation. He also found teaching method used in implementing the curriculum as mainly theoretical. Home Economics, Agricultural Science, Introductory Technology, Music, Fine Arts, Food and Nutrition, Technical Drawing and other core and vocational and technical subjects that were mostly taught while Arts and Crafts, clothing and textiles etc, did not receive much attention. He also found that students entrepreneurial capabilities was significantly low as there were no significant production of marketable goods and services to show for their practical knowledge.

Results from hypothesis two revealed that, the extent to which facilities are utilized for the implementation of entrepreneurship education in secondary schools is significantly low. This

result implies that even when the facilities were found to be available and adequate according to the findings of this study, the utilization of these facilities were significantly very low. This finding was in agreement with Okunola in Udonwa (2010) who studied the utilization of physical and material resources for secondary education programme in Oyo State with adequate resources and allocation, projections and use. Sixty (60) secondary schools were selected from 10 Local Government Areas of the State. He analyzed the data collected using the z-test analysis of variance and t-test statistical techniques. The findings revealed that the level of utilization of physical and material resources was low and that the provision of instructional facilities was inadequate despite geometric increase in students' ratio. He further devised that there is dire need to improve the allocation and utilization of resource materials in schools to check students' performance. This was supported by Ogunsola (2004) who added that educational outcomes in schools are closely linked to utilization and adequacy of teaching/learning resources in different ways. He further mentioned that, poor utilization and under-utilization of facilities bring forth low educational performance.

Again, findings from this study, also concurs with the findings of Udonwa (2010) who reported that 98% of the teachers do not improvise nor utilize instructional facilities during teaching. He concluded that non-improvisation and non-utilization of instructional facilities by teachers has reduced teaching effectiveness. It was also observed that inadequate provision of instructional facilities has contributed to poor performances of students. The aim of the instructional facilities is to provide services and facilities that support and enrich the school curriculum as well as enhance the performance of instructional goals of a school.

More so, the findings of this study is in consonance with the findings of Nwosu (2010) in a study on utilization of information and communication technology (ICT) as a tool and strategies for improving teacher's professional development for effective service delivery, where it was found that teachers can to a very low extent utilize ICT resources for their professional development to enhance service delivery in schools. It also revealed that slow access to ICT equipment, low internet connectivity, lack of sufficient computers and high cost of laptop, lack of qualified personnel, interrupted power supply and others constitute a hindrance to ICT usage.

### **Conclusion**

Based on the findings of the study, it was concluded that students' perception of the extent of implementation of entrepreneurship education as perceived by students was significantly high for curriculum content but low for utilization of instructional materials. Again, based on the findings, it was concluded that the introduction of trade subjects into the Senior Secondary Education Curriculum (SSEC) which was aimed at meeting emerging educational needs and economic development, as well as ensure that entrepreneurship and technical subjects were not properly embedded in the curriculum in our educational system which is a challenge to the implementation of entrepreneurship education.

It was concluded based on the findings of this study that, facilities must be properly utilized by the beneficiaries. This is because effective implementation of entrepreneurship education curriculum cannot be realized without effective provision and utilization of instructional facilities in teaching various trade or entrepreneurship subjects. It is therefore paramount and basic to properly utilize instructional materials while teaching in schools.

It is evident from the study that secondary school students in Calabar Education Zone have not had enough practical in entrepreneurship skills to allow economic development. The schools are expected to rise to the challenge of equipping the students with the necessary entrepreneurial knowledge, skills, values and attitude for them to live as competent citizens of the society and contribute meaningfully to nation building.

### **Recommendations**

In view of the various findings and conclusions of the study, the following recommendations are hereby forwarded for the consideration of the Federal Ministry of Education, curriculum developers, school administrators, teachers, private sectors and future researchers.

1. Curriculum planners should gauge the level of success of current implementation of entrepreneurship education and plan towards an implementation that will instill basic skills in the youths. Entrepreneurship education should be integrated into schools right from the primary education level to stir up the interests of job creation in the mind of the learners at the formative stage of their lives.
2. Government should not only make facilities available and adequate to teachers and students, but should also ensure that these facilities are properly utilized for effective implementation of entrepreneurship education.

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# Change in Anterior Chamber Depth and Intraocular Pressure after Phacoemulsification Surgery of Senile Cataract

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DOI: 10.29322/IJSRP.8.8.2018.p8015

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8015>

## Abstract

**Purpose:** To evaluate anterior chamber depth (ACD) and Intraocular pressure (IOP) alternation after phacoemulsification.

**Patients and Methods** : A quasi-experimental study with one group pre and post design were analysed. We analysed 41 eye who underwent cataract phacoemulsification surgery at Medan Baru Eye Hospital. The ACD and IOP were assessed before and after surgery on 1<sup>st</sup>, 3<sup>rd</sup> 14<sup>th</sup> of 41 eyes post phacoemulsification. ACD was measured with IOL Master 500 Karl Zeiss® was measured with Non-Contact Tonometry Shin-Nippon®.

**Results** : A total of 41 eyes, with characterized by age >60 year (78,3%), female (52,2%), left eyes(52,2%). The mean ACD had increased significantly at D0-D+1,D0-D+3, D0-D+14 and the mean IOP had decreased significantly at D0-D+3, D0-D+14, D+1-D+3, D+1-D+14 (p<0,05).

**Conclusion** : There was a significant increase in ACD and decrease in IOP after phacoemulsification.

**Keyword** : Anterior chamber depth, intraocular pressure, phacoemulsification, senile cataract.

## I. Introduction

Cataract is the opacity of the lens that can occur due to hyper hydration of the lens, denaturation of the lens protein or both. There are several causes of cataracts such as genetic, congenital disorder, metabolic syndrome, trauma, toxicity and senile cataract. Senile cataract is the most common type cataract, associated with the process of degeneration (age-related). Cataracts can occur because the lens cell are very susceptible to both mechanical disturbance and loss of the chemical arrangement of the lens. If there is any damage, the lens cell does not undergo a turnover and will be maintained for life<sup>1,2,3,4,5,6,7</sup>

Cataract is the leading cause of reduced vision in the world. Estimated number of blindness caused by cataracts in the world is around 17 million people and will predicted to increase to 40 million by 2020. Cataracts occur in 10% of Americans and this prevalence increases up to 50% for those who are aged between 65 and 74 years old. And up 70% in aged group over 75 years.<sup>1,2,3,5,8,9.</sup>

In Indonesia, cataract is the most common cause of blindness, as well as in the world. Currently half of the 45 million blindness is caused by cataracts. In Indonesia in 1991, the prevalence of blindness was 1.2% with estimated number blindness due to cataracts was 0.67%. In 1996 the number of blindness caused by cataract was increased to 1.47%, and in 2013 was increased to 1.8%. In 2005 it was reported that rural areas in Indonesia had the highest prevalence of cataracts in Southeast Asia<sup>2,5,10,11</sup>

## II. Method

This study was conducted by Quasi Eksperimental method with One Group Pre and Post test design was performed in Medan Baru Eye Hospital. Eligible patient with cataract senilis were collected in March 2018. The inclusion criteria in this study was  $\geq 40$  years old cataract patients who were willing to undergo senile cataract surgery, and willing to be checked regularly of ACD and IOP changes before and after phacoemulsification cataract surgery. The examination were conducted on days 1<sup>st</sup>, 3<sup>rd</sup> and 14<sup>th</sup>. The Exclusion criteria were patient with senile cataract with history of trauma oculi, corneal abnormalities, glaucoma, and eye infections.

The study was conducted in accord the ethical study of Declaration of Helsinki as approach by Medical Faculty University of Sumatera Utara ethic committee. Informed consent was approved from all patient. All subject were conducted ophthalmology examination include Snellen Chart, Examination of anterior segment with Appasamy @slitlamp, examination of intraocular pressure with Shin-Nippon non contact tonometry, examination of anterior chamber depth used IOL Master 500 Karl Zeiss®.

All data was analysed with SPSS software 19 to observed changes in ACD and IOP by used t-test and Wilcoxon test, to find the correlation between ACD and IOP before and after phacoemulsification surgery we used Pearson test and Spearman's test.

## III. Results

The subjects were 60 eyes but 14 eyes were excluded because the subjects did not complete follow-up after phacoemulsification surgery, so the total number of our study subjects were 46 eyes (n = 46).

Table 4.1. Characteristics patients of senile cataract based on age

AGE (YEARS)	FREQUENCY (n)	PERCENTAGE (%)
<b>41-50</b>	2	4.3
<b>50-60</b>	8	17.4
<b>&gt; 60</b>	36	78.3
<b>TOTAL</b>	46	100

Table 4.1. showed that most cataract subjects were in age group > 60 years as many as 36 people (78.3%). And the least found in the age group 41-50 years as many as 2 people.

Table 4.2. Characteristics patients of senile cataract based on sex

SEX	FREQUENCY (n)	PERCENTAGE (%)
<b>MALE</b>	22	47.8 %

<b>FEMALE</b>	24	52.2 n%
<b>TOTAL</b>	<b>46</b>	<b>100.0%</b>

Table 4.2. showed that the subjects of cataract mostly in women 24 people (52.2%), while in men as many as 22 people (47.8%).

Table 4.3. Characteristics patients of Senile cataract based on eye lateralization

<b>EYE</b>	<b>FREQUENCY (n)</b>	<b>PERCENTAGE (%)</b>
<b>Right</b>	22	47.8 %
<b>Left</b>	24	52.2 n%
<b>Total</b>	<b>46</b>	<b>100.0%</b>

Table 4.3. showed the most cataract mostly in left eyes 24 patients (52.2%), while in the right eye were 22 eyes (47.8%).

Table 4.4. Anterior chamber depth rate of resile cataracts

<b>Anterior Chamber Depth</b>	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b><math>\bar{x} \pm SD</math></b>
<b>D0</b>	46	2.59	4.04	3.25 ± 0.372
<b>D+1</b>	46	2.30	4.37	3.64 ± 0.484
<b>D+3</b>	46	3.03	4.38	3.69 ± 0.303
<b>D+14</b>	46	3.02	4.50	3.72 ± 0.343

Table 4.4. Showed that the mean anterior chamber depth before phacoemulsification surgery was 3.25 mm, the first day after phacoemulsification surgery was 3.64 mm, the 3<sup>rd</sup> day was 3.69 mm, and the 14<sup>th</sup> day was 3.72 mm.

Table 4.5. Intraocular pressure rate of cataracts senile cataracts

<b>Intraocular Pressure</b>	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b><math>\bar{x} \pm SD</math></b>
<b>D0</b>	46	11	20	16.00 ± 2.309
<b>D+1</b>	46	11	20	15.48 ± 2.483
<b>D+3</b>	46	10	18	13.78 ± 1.788
<b>D+14</b>	46	10	18	13.39 ± 1.680

Table 4.2. It showed that the rate of intraocular pressure before phacoemulsification surgery was 16.00 mmHg, the first day after phacoemulsification operation 15.48mmHg, 3<sup>rd</sup> day was 13.78 mmHg, and 14<sup>th</sup> day was 13.39 mmHg.

Table 4.6. Change anterior chamber depth after phacoemulsification surgery.

<b>Anterior Chamber Depth</b>	<b>N</b>	<b><math>\bar{x} \pm SD</math></b>	<b>Mean Differential</b>	<b>P</b>
<b>D0</b>	46	3.25 ± 0.372	0.387	0.0001*
<b>D+1</b>	46	3.64 ± 0.484		
<b>D0</b>	46	3.25 ± 0.372	0.433	0.0001*

<b>D+3</b>	46	3.69 ± 0.303		
<b>D0</b>	46	3.25 ± 0.372	0.464	0.0001*
<b>D+14</b>	46	3.72 ± 0.343		
<b>D+1</b>	46	3.64 ± 0.484	0.047	0.451
<b>D+3</b>	46	3.69 ± 0.303		
<b>D+1</b>	46	3.64 ± 0.484	0.078	0.330
<b>D+14</b>	46	3.72 ± 0.343		
<b>D+3</b>	46	3.69 ± 0.303	0.031	0.389
<b>D+14</b>	46	3.72 ± 0.343		

Note : Paired t-test

\* Significant ( $P < 0.05$ )

Table 4.6. The result of paired t-test showed  $p = 0.0001$  ( $p < 0.05$ ) on D0-D +1, D0-D + 3, D0-D + 14 thus according to statistical test found significant changes of anterior chamber depth prior to phacoemulsification surgery and on 1<sup>st</sup>, 3<sup>rd</sup>, 14<sup>th</sup> day 1, after phacoemulsification surgery.

Table 4.7. Change Intraocular pressure of senile cataract after phacoemulsification surgery

<b>Intra Ocular Pressure</b>	<b>N</b>	<b><math>\bar{x} \pm SD</math></b>	<b>Mean Differential</b>	<b>P</b>
<b>D 0<sup>a)</sup></b>	46	16.00 ± 2.309	0.522	0.192
<b>D+1</b>	46	15.48 ± 2.483		
<b>D 0<sup>a)</sup></b>	46	16.00 ± 2.309	2.21	0.0001*
<b>D+3</b>	46	13.78 ± 1.788		
<b>D 0<sup>b)</sup></b>	46	16 ± 2.309	2.609	0.0001*
<b>D+14</b>	46	13.39 ± 1.680		
<b>D+1<sup>a)</sup></b>	46	15.48 ± 2.483	1.696	0.0001*
<b>D+3</b>	46	13.78 ± 1.788		
<b>D+1<sup>b)</sup></b>	46	15.48 ± 2.483	2.087	0.0001*
<b>D+14</b>	46	13.39 ± 1.680		
<b>D+3<sup>b)</sup></b>	46	13.78 ± 1.788	0.391	0.027
<b>D+14</b>	46	13.39 ± 1.680		

Note : a) Paired t-test

b) Wilcoxon test

\* Significant ( $P < 0.05$ )

Table 4.7. The result of statistical test shows that  $p = 0.0001$  ( $p < 0.05$ ) on D0-D+3, D0-D+14, D+1-D+3, D+1-D+14, thus according to statistical test found significant change intraocular pressure.

Table 4.8. Correlation of anterior chamber depth with intra ocular pressure patients with senile cataract after phacoemulsification surgery.

<b>N</b>	<b>R</b>	<b>P</b>
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<b>ACD D0<sup>c)</sup></b>	46	0.086	0.256
<b>IOP D0</b>	46		
<b>ACD D+1<sup>c)</sup></b>	46	0.988	0.002*
<b>IOP D+1</b>	46		
<b>ACD D+3<sup>c)</sup></b>	46	0.586	0.083
<b>IOP D+3</b>	46		
<b>ACD D+14<sup>d)</sup></b>	46	0.649	0.069
<b>IOP D+14</b>	46		

Note : c) Pearson Correlation test

d) Spearman's Correlation test

\* Significant ( $P < 0.05$ )

Table 4.8. The result of statistical test showed  $p = 0.002$  ( $p < 0.05$ ) on ACD D + 1-IOP D + 1 thus according to statistical test not found Significant correlation of anterior chamber depth on 1<sup>st</sup> day after phacoemulsification surgery with intraocular pressure 1<sup>st</sup> day pressure after phacoemulsification surgery.

#### IV. Discussion

The most cataract subjects in our study were aged over 60 years old (78.3%), female (52.2%), male(47.8%), left eye(52,2%), and right eyes (47,8%). Table 4.4. showed the mean depth of the anterior chamber depth prior phacoemulsification surgery increased which was in accordance with Junejo MK et al's research in Pakistan in 2016 where there was increased in the anterior chamber depth after phacoemulsification surgery. In table 4.5. showed that the mean values of intraocular pressure before phacoemulsification surgery decreased, it was consistent with Dooley et al's study in Ireland where there was decreased in intraocular pressure after phacoemulsification surgery.

In table 4.6 we found significant changes in anterior chamber depth according to statistical test prior phacoemulsification and after phacoemulsification surgery. This was consistent with the research by Osman C et al in turkey and Wozniack MM in Poland in 2016, where they found increased depth in ACD and decreased IOP after phacoemulsification surgery with uncomplicated IOL implantation. In the Mustafa KJ study in Pakistan in 2016 there was a significant increase in anterior chamber depth after phacoemulsification, as well as a study by Cigdem A et al in Turkey where there was an increase in anterior chamber depth and widening of iridocorneal angle in non-glaucoma patients post phacoemulsification surgery .

According to statistical tests there was a significant changed of intra-ocular pressure from pre-phacoemulsification operation with post-phacoemulsification on 3<sup>rd</sup> day and 14<sup>th</sup> day after surgery. It was consistent with the study of Alina D in the Czech Republic in 2016 where cataract surgery could reduced intraocular pressure and increased the anterior chamber depth. Other studies said according to Mohammad et al in Iran, phacoemulsification could reduce high intra-ocular pressure. In a study of Liu XQ et al in China in 2012 there was a decreased in intraocular pressure in first week after phacoemulsification surgery. This is supported by the Qiu J et al study IOP decreased and ACD increased significantly in eyes without history of glaucoma.

Table 4.7. showed decreased intra-ocular pressure on 3<sup>rd</sup> day and 14<sup>th</sup> day after phacoemulsification surgery. In Table 4.8. The results of statistical tests showed a significant correlation between anterior chamber with intra-ocular pressure after the first day of phacoemulsification surgery.

#### V. Conclusion

There was a significant increase in anterior chamber depth and decreased intraocular pressure before and after phacoemulsification surgery.

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# Analysis of Factors Influencing Job Stress of Academics Staff with Special Reference to Sri Lanka Institute of Advanced Technological Education

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DOI: 10.29322/IJSRP.8.8.2018.p8016

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8016>

*Abstract- This is a phenomenological research study within the perspectives of job stress of academic staff for which deductive approach was used to collect views of respondents. This research was designed to study different perspective of employee job stress and accordingly an attempt was made to identify and evaluate the effect on the variable relating to the factors causing job stress of academic staff with special reference to Sri Lanka Institute of Advanced Technological Education. Two stage stratified sampling technique was employed to select the elementary units of the sampling frame, in which empirical evidences were obtained from the responds of Directors, Senior Lecturers, Lecturers and Assistant Lecturers in four selected (stratified randomly) Advanced Technological Institutes. At the stage of preparation of research model, the factors causing the job stress were identified with special reference to Sri Lanka Institute of Advanced Technological Education through literature reviews and structured questionnaire which was administered among Directors, Senior Lecturers, Lecturers and Assistant Lecturers who are the evaluators of the service of Advanced Technological Institutes. Lickert mean was used as the score and the standard deviation was used to check the level of significance of each factor causing employee job stress with special reference to academic staff of Advanced Technological Institutes. Mean of means was used to find the strength of each independent variable i.e. organizational stressors, individual stressors, personal stressors and environmental stressors. Research finding revealed that greater proportion of factors causing job stress of academic staff of Advanced Technological Institutes depends on organizational stressors and individual stressors. Study indicates that personal stressors and environmental stressors could cause employee job stress of academic staff of Advanced Technological Institutes at moderate level or lower level*

*Index Terms-* Sri Lanka Institute of Advanced Technological Education (SLIATE), Head of the Department (HOD), Simple Random Sampling (SRS), Standard Deviation (SD)

## 1. Introduction

In today competitive world, organizations cannot perform well unless the employees in such organizations are committed and work effectively. It is important to have faithful employees who do their job tasks independently. Employees nowadays have to work together in teams and have to prove that they are worth being part of these organizations. They also want to be part of a successful organization which provides a good income and good opportunities for growth and development.

The word “stress” is one of the most frequently used words today. We live in a world developing fast, requiring constant adaptation. Technology is changing, so are social habits, values, social structures and people. Everybody has to cope with those changes, not only individuals, but the organizations and government as well (Thompson, 2002) some people are aware of positive values of those changes, but very few think of the negative consequences that may ensue. According to some estimates, humankind loses 100 million workdays every year due to the aftermath of stress. What matters more, 50 to 75 per cent of today’s diseases are related to stress. The European Agency for Health and Safety at Work, states that stress within organization is the second most frequent trouble and affects as many as 28 per cent of employees (Coopers, 2006)

In developing countries employees face more stress and employers do not realize the impact of job stress on employee’s involvement and commitment. One study found that about 100 million workdays do not remain workdays because of stress and approximately 50% to 75% diseases are because of stress (Iqbal, 2012) (Kahn, 1990) defined stress as an outcome of designated work that cause harm for the individual. Job stress is considered to be detrimental factor for employees (Kahn, 1990)

National Institute of Occupational Safety and Health (1999) defined stress as injurious physical and emotional response that arises when workers' abilities and resources do not match the job demands and requirements. (M, 1984) Jamal also found that job stress is imbalance between job demands and employee's abilities to fulfill these demands. The employee's stress level increases with increase of imbalance between job demands and individual's ability to meet demands. (M, 1984) Jamal defined job stress as individual's response to his work environment that threats employee's physically and emotionally. Stress is a mental strain that is caused by internal or external stimulus that creates hindrance for employees in performing their duties up to mark (Khuwaja, 2002)

## 2. Research Problem

This applied research on job stress of academics. There is various challenges face by academics. Based on the type of the work do and based on their carrier targets, the challenges or the stressors they face can be categorized in to several groups such as (1) Interpersonal relationship with students, academics, administrative and non-academic staff, (2) Teaching (development of course content, planning on suitable teaching methods and exam setting and assessment and (3) Carrier development (MBA, PHD) and national development. In addition to duties and career targets mentioned above and that are common to all the academic staff members, there are many voluntary administrative and other types of position(HOD) in the institute and many academics give part of their working time for such positions. These challenges may put the academics under pressure and stress.

Some factors highlighted in the HNDM program review report done by the HETC project, shows that lecturers are overloaded and demotivated on their work. It shows that an Assistant lecturer has to lecture for minimum 21 hours, Lecturer 19 hours and Senior Lecturer 17 hours a week. There are instances where, the Lecturer could be provided only 16 hours of lectures in his permanent Institution, to meet the norm set by the SLIATE the Lecturer is compelled to go to another ATI, spending extra time and money by his/her own to meet the requirement. There are cases where the lecturer/s willingly accepts this requirement and voluntarily does/do the job with no complaints. This service of teachers should not be under-estimated at any cost. On the other hand, as the lecturers are compelled to stick to the norm set by the SLIATE, to meet this norm all Assistant Lecturers/lecturers and senior Lecturers have to do a minimum of 05 subjects a week. This could lead to serious quality erosion in the teaching learning process because the teachers job does not confine to teaching alone, but marking assignments, student counseling and academic counseling to state a few, which go hand in hand with teaching. These activities consume a considerable number of hours of a teacher. However, the existing situation has demoralized and de-motivated the lecturers and has made the teaching a routine matter than making it a creative exercise. Amongst all these shortcomings the career prospects for lecturers as a whole seem to be minimal in the system.

It was revealed (through unconfirmed sources) at the discussions that there had been around 50% turnover among lecturers in the past few years in the system. Lectures of the SLIATE working hour per week is unbearable when compare with other higher educational institutes (senior lecturer 19 hours, Lecturer 21 hours and assistant lecturer 23 hours). Rule of working 8 hours per day, unbearable evaluation and monitoring system which reduce autonomy of lectures and increase stress levels and high labour turnover of academic staff which very badly affect its performance (syndicate minutes )

## 3. Objectives of the Study

The objectives of the research can be indicated as follows.

1. To identify factors affecting to employee job stress.
2. To examine how these factors have been influenced job stress of academics in the Sri Lanka Institute of Advanced Technological Education.
3. To critically analyze factors that influence Job stress of academics in the Sri Lanka Institute of Advanced Technological Education.
4. To give possible recommendations upon research analysis enabling policy makers to utilize them in future

#### 4. Literature Review

Stress is a word derived from Latin word “Stingers” meaning to draw tight Stress (Doyle, 2003) and in the second half of the twentieth century scholars examined the consequences of stress in clinical and social psychology (Darr, 2008) and that is more than two decades the researchers consider job stress as one of the biggest concerns for organizations at individual and organizational level. (ILO, 1992)

Some people are aware of positive values of those changes, but very few think of the negative consequences that may ensue. According to some estimates, humankind loses 100 million workdays every year due to the aftermath of stress. What matters more, 50 to 75 per cent of today’s diseases are related to stress. The European Agency for Health and Safety at Work, states that stress within organization is the second most frequent trouble and affects as many as 28 per cent of employees (Coopers, 2006)

(Iqbal, 2012), (Kahn, 1990) defined stress as an outcome of designated work that cause harm for the individual. Job stress is considered to be detrimental factor for employees (Kahn, 1990)

A number of definitions on stress are found some of them are; Job stress has been defined in different ways. (Selye H. , 1956) Was the researcher who first time gave the idea of stress in life sciences. According to him stress is pressure and force that resist employees to perform at their maximum.

. Stress is a mental strain that is caused by internal or external stimulus that creates hindrance for employees in performing their duties up to mark (Khuwaja, 2002)

Rollinson (Rollinson, 2005) defines workplace stress as conditions which inhibit employees to perform normally in workplace. The conditions are termed as stressors – the potential sources that cause stress (Rollinson, 2005).

Stress is an adoptive response to an external situation that results in physical, psychological and/or behavioral deviations for organization participants (F, 2008)

Occupational stress was defined as an adoptive response to an external situation that results in physical and/or behavioral deviation for organizational participants (F, 2008)

Medical researcher, Hans Selyer (Selye H. , 1956) first usual the term “Stress” to describe the body’s biological response mechanisms. He defined stress as “the nonspecific response of the body to any demand”. It must be understood that in order for the stress to occur, the response should be nonspecific (J.S, 1994)

Hans’s selye one of the founding fathers of stress of research. He view in 1956 was than “stress is not necessarily something bad- It all depends on how you take it. The stress of exhilarating, creative successful work is beneficial, while that of failure, humiliation or infection is detrimental”. Selye believed that the biochemical effect of stress would be experienced irrespective of whether the situation was positive or negative. (J.S, 1994)

Occupational Stress is not an objective phenomenon. It is predominately subjective in nature and involves the employee’s active interpretation of his or objective circumstances. Potential stressors are not inherently server or negative; allow for the same stressor to be experienced by some as challenge and by other as hindrance. An assessment of each facet of the stress process includes dealing with the demands, coping ability. Personality type, emotions and related behaviors, physical health, psychological well – being and social functioning (Gillespie, 2001)

Stress is the continual appraisal by the person that his or her relationship with Personalities defines as a relatively stable set of characteristics that influence and individuals behavior. (Moorhead G G. R., 2001)

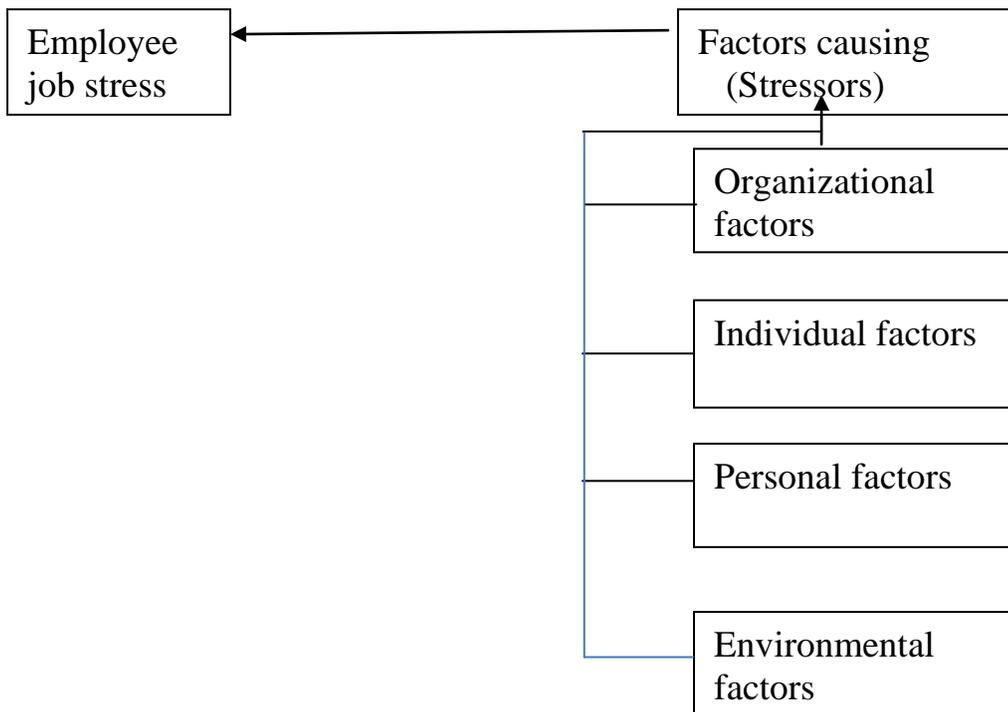
A personality trait may affect how a person will perceive and react to a situation or an event as a stressor. For example, an individual with low self-esteem. Individuals high in self-esteem typically have more confidence in their ability to meet job demands than do those with low self-esteem. Employees with high internal locus of control may take more effective action, more quickly, in coping

with a sudden emergency (stressor) than might employees with high external locus of control. Individuals high in internal locus of control are likely to believe that they can moderate the stressful situation. (Hillriegel D, 2004)

Seyle (Selye H. , 1956) pioneered the distinction between stressor and stress responses. Moreover, seyle emphasized that both positive and negative event can trigger an identical stress response that can be beneficial or harmful.

## 5. Conceptual Framework

Independent variable and dependent variables are used by the researcher in order to develop conceptual framework. This conceptual framework is logically developed, designed and explained. According to the primary objective of this study, to identify the factors causing job stress of academic staff with special reference to Sri Lanka Institute of Advanced Technological Education, job s is selected as independent variable and organizational stressors, individual stressors, personal stressors and environmental stressors as dependent variable.



### 5.1 Hypothesis

Based on the above mentioned conceptual framework, below mentioned hypothesis developed by the researchers to achieve research objectives.

H0: Organizational factors more influential towards employee job stress than other three factors namely, individual, personal and environmental.

H1: Individual factors are more influential towards employee job stress than other three factors namely, organizational, personal and environmental.

H3: Personal factors are more influential towards employee job stress than other three factors namely, organizational, individual and environmental.

H4: Environmental factors are more influential towards employee job stress than other three factors namely, organizational, individual and personal.

## 6. Research Methodology

A questionnaire as the research tool was used to collect data as it is the best and powerful tool for acquiring data. Four stressors which were more relevant for cause in job stress of academic staff of SLIATE were selected and tested them using following number of questions.

**Table 1:** Composition of the Questionnaire

Stressors	No of Questions
Organizational	20
Individual	5
Personal	4
Environmental	3

In order to administer the questionnaire in connection with the present research, two populations were chosen. The population of the present study consisted of Directors, senior Lecturers, Lecturers and Assistant Lecturers. Sample frame consist with 3 No's of Directors, 15 No's of senior Lecturers and Lecturers and 34 No's of Assistant Lecturers from the 12 No's of ATI's and 6 No's of Sections in Sri Lanka. Assuming that stress factors are available more in newly established Sections than established traditional ATI's, three ATI's and two Sections were selected out of 12 No's of ATI's and 6 No's of Sections by using Stratified random sampling method as the sample of the present research. Accordingly ATI of Dehiwala, Kandy, Kurunegala and Section of Anuradhapura and Batticaloa were selected.

Random number table was used to select the sample .Due to the level of homogeneity, only 16% was chosen from the directors and 40% was from the Senior Lecturers and Lecturers and 32% was chosen from the Assistant lecturers . Data was collected by passing 02 stages. At first 10 questionnaires' were collected out of total of 100 and checked the reliability of the questionnaire. For testing the internal consistency of the questionnaire the Cronbatch's coefficient alpha was used. The results of Cronbatch's alpha test are shown in the table 1. All the alpha values are well above the rule of thumb of .7 for a reliable scale, which suggests that the internal reliability of each instrument and sub instrument is satisfactory.

**Table 2:** Cronbatch's Alpha Coefficients

Sample	Length of the sampling frame	Reliability for the whole	Reliability for the Organizational Stressors	Reliability for the Individual Stressors	Reliability for the Personal stressors	Reliability for the Environmental Stressors
Stage one	10	0.823	0.632	0.743	0.892	0.893
Stage two	63	0.821	0.641	0.734	0.850	0.827

Cronbatch's alpha if item deleted coefficients proved that there was no opportunity to further improve the reliability of the measure since Cronbatch's alpha if item deleted coefficients of the items were less than the Cronbatch's alpha coefficients of the measure.

## 7. Analysis and discussion

### 7.1 Method of data analysis

Lickert mean ( $\bar{x}$ ) and standard deviation (SD) was calculated for each factor (Standard deviation is the measure of variance) as per statistical criterion, larger the stranded deviation value higher the variance (dispersion) therefore relevant factor becomes insignificant (not important). On the other hand smaller the standard deviation value, larger the influence, therefore factor becomes significant (important) and also the given factor is treated as 'variable' which affect to change the dependent variable (y variable). Accordingly all indicators (factors) have been tabulated in a row-column order. Specimen is given below. ) (Wickramasinghe, 2012)

**Table 3:** Method of Data Analysis

Factor	Mean	SD	Status	Variable effect
Leader	1.8	0.012	Significant	Variable which effect highly positive
Group	0.0	10.00	Insignificant	Not a variable
MIS	1.0	0.1234	Significant	Variable in effect

## 7.2 Method of data interpretation

Given factor (indicator) can be influenced either "+" or "-" if mean is -9 it is interpreted as the influence of the factor is negative (-). In the other word stress of academic staff has not been caused by level of recognition. Standard Deviation indicates whether x is significant or insignificant. If in any case  $SD > 1$  it is interpreted as "not a variable in influent" otherwise factor (indicator) becomes non influential variable. (Wickramasinghe, 2012)

**Table 4:** Criteria of Interpretation

Mean score	SD Value	Interpretation	Decision
Closer to zero	Zero	Not significant at all	Not a variable effect
Closer to zero	Low	Insignificant	Not a variable
Closer to zero	High	Significant	Variable in effect at lower level
Closer to one	Zero	Highly significant	Variable in effect
Closer to one	Low	Significant	Variable in effect <b>Encouraging</b> factor
Closer to one	High	Insignificant	Variable in effect <b>Essential</b> factor
Closer to two	Zero	Highly significant	Variable in effect of high level of <b>Encouraging</b> factor

Closer to two	Low	Significant	Variable in effect <b>Essential</b> factor
Closer to two	High	Insignificant	Variable in effect

The table given in the above indicates the method of criteria which was used to choose the decision. The relevant mean value and corresponding SD value where the given factor is a variable in effect or otherwise. Views of Directors and Academic Staff were obtained by means of questionnaire. (Questionnaire is shown in the Annexure 3) and those views were measured. Accordingly variability of each factor was identified.

### 7.3 Data Analysis

#### 7.3.1 Analysis: The Degree to Which Organizational Stressors Have Caused Job Stress of Academic Staff

**Table 5:** Level of variable effect and the level of significance of each indicator in connection with organizational stressors

Indicator	Mean value	Standard deviation value	Interpretation
Degree to which organizational structure has caused job stress	1.22	1.165	Variable high effect. Highly influential and highly significant
Degree to which organizational design has caused job stress	0.76	1.078	Variable effect at moderate level. Moderately influential and significant
Degree to which lapses on administrative policies and Practices have caused job stress	1.48	0.504	Variable in high effect, Highly influential and extremely significant.
Degree to which lapses on organizational procedures have caused job stress	1.29	0.676	Variable in high effect, Highly influential and extremely significant.
Degree to which lapses on availability of organizational standards have caused job stress	1.32	0.647	Variable in high effect, Highly influential and extremely significant.
Degree to which job changes have caused job	0.25	0.957	Variable effect at lower level. Lower influential and significant at lower level

stress			
Degree to which that development and changers have caused job stress	0.14	1.226	Variable effect at lower level. Lower influential and significant at lower level
Degree to which that job role have caused job stress	-0.1	1.54	Variable in effect negatively. Negative lower influential and significant
Degree to which that organizational working conditions have caused job stress	1.31	0.536	Variable in high effect, Highly influential and significant.
Degree to which that reliability of upward information have caused job stress	0.9	0.789	Variable effect moderate level. Moderately influential and highly significant
Degree to which that reliability of downward information have caused job stress	1	0.768	Variable in high effect, Highly influential and significant.
Degree to which that conceptual ability have caused job stress	1.12	1.016	Variable effect at high level. Highly influential and highly significant.
Degree to which that of technical ability have caused job stress	1.09	0.74	Variable effect at high level. Highly influential and highly significant.
Degree to which that HRM ability have caused job stress	1.16	1.148	Variable effect at high level. Highly influential and highly significant.
Degree to which that the level of responsibility have caused job stress	0.62	1.014	Variable effect at moderate level. moderately influential and significant
Degree to which that the level of recognition have caused job stress	0.78	1.015	Variable effect at moderate level. moderately influential and significant

Degree to which that the group level dynamics have caused job stress	-0.03	0.868	Variable effect negatively. Negative lower influential and significant.
Degree to which that group related culture have caused job stress	0.29	0.894	Variable effect at lower level. Lower influential and significant at lower level.
Degrees to which that group structure conditions have caused job stress.	0.55	0.953	Variable effect at moderate level. moderately influential and significant.
Degree to which that group conflict have caused job stress	0.66	1.113	Variable effect at moderate level. moderately influential and significant

With reference to the above table number 4.33, it was found that effect of the factors of organizational structure, lapses on administrative policies, lapses on organizational procedures, lapses on organizational standards , organizational working condition, reliability of downward information, conceptual ability of managers, technical ability of managers and HRM ability of managers were high. Accordingly it was found that the factors were highly influential. There SD values are closer to zero. Therefore, the factors are significant. Variable effect of organizational design, reliability of upward information, level of responsibility, level of recognition, group structure and group conflict were at a moderate level. Accordingly it was found that factor was moderately influential. Variable effect of job changes, development and changers and group culture were at very lower level. Accordingly they were reported at a very low influential level. But they were significant. Effect of job role and group level dynamics are negative at a very low level. It shows extremely low influence and also factor is insignificant. However there was no effect of. Also the factor was not a variable effect. It shows no influence at all but significant.

### 7.3.2 Analysis: The Degree to Which Individual Stressors Have Caused Job Stress of Academic Staff

**Table 6:** Level of variable effect and the level of significance of each indicator in connection with individual stressors

Indicator	Mean value	Standard deviation value	Level of significance
Degree to which personality has caused job stress	1.01	0.992	Variable effect at high level. Highly influential and highly significant
Degree to which attitudes and values has caused job stress.	1.3	0.776	Variable effect at high level. Highly influential and highly significant.

Degree to which perception has caused job stress	0.64	1.269	Variable effect at moderate level. moderately influential and significant
Degree to which job experience have caused job stress	0.52	1.352	Variable effect at moderate level. moderately influential and significant
Degree to which skills and abilities have caused job stress	1.29	0.857	Variable effect at high level. Highly influential and highly significant.

With reference to the above table number 4.34, it was found that effect of the factors of personality, attitudes and values, and skills and abilities were high. Accordingly it was found that the factors were highly influential. There SD values are closer to zero. Therefore, the factors are significant. Variable effect of perception and job experience were at a moderate level. Accordingly it was found that factor was moderately influential.

### 7.3.3 Analysis: The Degree to Which Personal Stressors Have Caused Job Stress of Academic Staff

**Table 6:** Level of variable effect and the level of significance of each indicator in connection with environmental stress

Indicator	Mean value	Standard deviation value	Variable effect
Degree to which family has caused job stress	0.16	1.357	Variable effect at lower level. Lower influential and significant at lower level
Degree to which financial condition has caused job stress	0.76	1.276	Variable effect at moderate level. moderately influential and significant
Degree to which residential and community have caused job stress	0.48	1.17	Variable effect at lower level. Lower influential and significant at lower level
Degree to which sex and civil states have caused job stress	-0.1	1.155	Variable effect negatively. Negative lower influential and significant

With reference to the above table number 4.35, it was found that effect of the factor of financial condition was moderate level. Accordingly it was found that factor was moderately influential. Variable effect of family and residential and community condition were at very lower level. Accordingly they were reported at a very low influential level. But they were significant. It was found that there was no variable effect in relation to the factor of sex and civil states. Therefore, it was not an influential factor but that factor was significant.

### 7.3.4 Analysis: The Degree to Which Environmental Stressors Have Caused Job Stress of Academic Staff

**Table 7:** Level of variable effect and the level of significance of each indicator in connection with environmental stressors

Indicator	Mean value	Standard deviation value	Level of significance
Degree to which political changes has caused job stress	-0.06	1.08	Variable effect negatively. Negative lower influential and significant
Degree to which Technical changers has caused job stress	0.13	1.16	Variable effect at lower level. Lower influential and significant at lower level
Degree to which economic changers have caused job stress	0.46	1.19	Variable effect at lower level. Lower influential and significant at lower level

With reference to the above table number 4.36, it was found that variable effect of technical changers and economical changers were at very lower level. Accordingly they were reported at a very low influential level. But they were significant. It was found that there was no variable effect in relation to the factor of political changers. Therefore, it was not an influential factor but that factor was significant.

## 8. Conclusion, Limitations & Recommendations

### 8.1 Conclusion

Research evidence revealed that effect of organizational stressors and individual stressors toward the job stress of academic staff are high and effect of personal stressors and environmental stressors are relatively moderate. In addition to that research evidence revealed that the effect of indicators of organizational structure, lapses on administrative policies, lapses on organizational procedures, lapses on organizational standards, organizational working condition, reliability of downward information, conceptual ability of managers, technical ability of managers and HRM ability of managers are highly affected and influential factors for causing job stress of academic staff. Out of these factors administrative policies and practices are high and more influential towards the job stress of academic staff.

### 8.2 Limitations

Theory was confined to employee job stress in the organization, in which only four factors namely organizational factors individual factors, personal factors and environmental factors were only considered in accordance with the theory by Fred Luthans (F, 2008) Research was designed to study implications relating to job stress of academic staff in the SLIATE

Further views were obtained from Directors, Senior Lecturers, Lecturers and Assistant Lecturers so as to critically evaluate their views about job stress of academic staff so that recommendations will be directly related to the academic staff of the SLIATE but perhaps finding would be indirectly related and benefited to the similar other organizations in Sri Lanka or elsewhere.

### 8.3 Recommendations

Following recommendations can be made to create stress free organizational environment for academic staff of SLIATE

1. Relevant authorities should review the existing structure and then determining what type of environment the SLIATE face now and in the future and then design the organizational structure accordingly.
2. In order to minimize or eradicate lapses on administrative policies, a proper implementation system on administrative policies should be introduced and continued.
3. To eradicate lapses in organizational procedures proper set of organizational procedures should be introduced and process by reviewing present set of organizational procedures
4. Establishing standards and adhering to them in higher educational institutes can reduced the level of stress of academic staff

Following recommendations can be made to create stress free organizational environment.

1. Administration should take necessary action to help officers to deal with stressful situations such as avoid the stressor, alter the stressor, adopt the stressor and accept the stressor.
2. Administration should train all employees
3. Administration should look forward to an uplifting of ethical standard in business over the next

Following recommendations are made by the researcher to avoid the personal stressors.

1. Conduct programmes to reduce stress and conflict through work-family initiatives
2. Should conduct family workshops and consultations related to marriage, single parent, working parents.
3. Conduct stress management workshop, relaxation seminars, and other kind of support.
4. Improve opportunities in which family members can join with SLIATE environment.  
Ex: Annual Get –together, Annual Trips

Following recommendation can be made to create stress free environment for academic staff.

1. Should practice equitable performance appraisal and reward system.
2. Expand opportunities to officers to involve with current changing environment.
3. Should actively promote the training and development of members.

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# Preparation of Chitin Nano Whiskers from Mushrooms

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DOI: 10.29322/IJSRP.8.8.2018.p8017

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8017>

**Abstract:** Mushroom has been valued throughout the world as a source of both food and medicine for thousands of years. The objective of this study has focused on the edible mushrooms (*Pleurotus ostreatus* and *Agaricus bisporus*) preparation of chitin nanowhiskers from mushrooms. Chitin nanowhiskers were prepared from both the mushrooms by acid hydrolysis method after the removal of contaminating proteins and other minerals. The concentration of acid for hydrolysis was standardized for the two mushrooms. Button mushroom has yielded maximum chitin (14.3%) when 9N HCl was used and the oyster mushroom showed maximum chitin yield (44.45%) when 12N HCl was used for hydrolysis. Thickness, length and surface characteristics of the chitin were assessed through SEM. Size of the nanowhiskers of the mushrooms ranged from 50-200nm in length and ~11nm of thickness.

**Key words:** Mushrooms, acid hydrolysis, chitin nanowhiskers, SEM

## 1. INTRODUCTION

Chitin is a natural, renewable, biodegradable and most abundant natural polymer after cellulose [1]. Chitin occurs mainly in the exoskeleton of arthropods, the internal flexible backbone of cephalopods, worms, webs of spiders, cell walls of fungi and yeasts [2]-[4]. Chitin is considered to be a major biomass resource [5], with an annual production of more than 1011 tons in nature [6]. Chitin is non-toxic, odorless, and biocompatible with living tissues [2], presenting antibacterial, moisture retaining and healing characteristics [7]. Chitin can be utilized in water purification [8], as additives in cosmetics [9]-[10], as antibacterial agent [11]-[12], as a pharmaceutical adjuvant [11]-[13], in the production of paper, textile finishes, production of photographic products, cements, heavy metal chelating agents, membranes, hollow fibers, and for the removal of unwanted materials [14]-[16]. In addition to all these chitin has extensive biomedical applications such as tissue engineering scaffolds, wound dressings, separation membranes, antibacterial coatings, stent coatings, and sensors [13],[15]-[18], since it is harmless to the human body [19]. Dietary fibers of chitin are useful for improving functional foods.

In nature chitin exists as nanowhiskers in the exoskeletons of arthropods, embedded in matrices of proteins and minerals. The nanowhiskers have a uniform width of 10–20 nm and a long fiber length. The mushrooms are macrofungi with a fleshy and spore-bearing fruiting body. They contain chitin in their cell walls acting as a structural component. Though much research has been

done on chitin from arthropods and their applications in the various field, chitin from mushroom is less explored. Therefore, our study has been focused on chitin from the mushroom.

## 2. MATERIALS AND METHODS

All chemicals used in this study were of AR grade and purchased from Himedia Laboratories (Mumbai, India). Two edible species of mushrooms, *Agaricus bisporus* (White button mushroom) and *Pleurotus ostreatus* (Indian oyster mushroom) were purchased from the local market and used for the study.

### 2.1. Preparation of chitin nanowhiskers

Chitin nanowhiskers were prepared by subjecting the chopped fresh mushroom to acid hydrolysis [20]. Oyster and button mushrooms were suspended in a 5 % aqueous KOH solution (w/v) and boiled for 6 h under stirring in order to remove contaminating proteins. The dispersion was rinsed with distilled water and filtered. The resulting paste was kept at room temperature overnight under agitation. Subsequently, the boiling, washing and filtering steps were repeated. The chitin fibers obtained were bleached with 17% solution of NaOCl<sub>2</sub> in 0.3M Sodium acetate buffer of pH 4.0 heated at 80°C for 2h with stirring. This procedure was repeated three times with rinsing. The resulting dispersion was centrifuged for 15 min at 1500rpm. Chitin was hydrolyzed with HCl by boiling for 90 min with stirring and the product was washed thoroughly with distilled water, followed by centrifugation (for 15 min at 5000rpm) and decanting the supernatant. This process was repeated three times.

The suspensions of chitin nanowhiskers were transferred to a dialysis bag and dialyzed for 2 h in running tap water and, then, kept overnight in distilled water. The product was further subjected to a supplementary dialysis for 12 h, changing the distilled water every 2 h; the dialysis was performed until a pH 6 was reached. The dispersion of nanowhiskers was accomplished further by three successive 2 min ultrasonic treatments. The dispersions were, subsequently, filtered to remove residual chitin nanocrystal aggregates. This is followed by the addition of appropriate volumes of 0.1M HCl solution until a pH of about 2.5 was reached. The particles were concentrated by dialysis against poly-(ethylene glycol). The solid fraction of this aqueous suspension was separated and kept at 6°C in a refrigerator until used after adding chloroform to avoid development of microorganisms.

#### 1.1. Characterization of chitin nanowhiskers

##### Fourier-Transform Infrared Spectroscopy Analysis

Infrared spectra of KBr and chitin mixtures were obtained over the frequency range of 400 to 4,000 cm<sup>-1</sup> at a resolution of 4 cm<sup>-1</sup> using FTIR Spectrometer, Shimadzu, IR affinity 1S. The sample was thoroughly mixed with KBr, and the dried mixture was then pressed to result in a homogeneous sample disk.

In order to prepare the pellet 1.5mg of the sample was mixed with 350mg of KBr. Ground mixture well and 100mg of the powder was spread uniformly in the die and pressed to make the pellet. The baseline was recorded and the pellet was mounted on the pellet on the die holder of the spectrophotometer with the help of tweezers. The spectrum was recorded from 400 to 4,000 cm<sup>-1</sup>. The background (baseline) reading was subtracted and the resulting values were compared with a spectrum of standard chitin.

##### SEM

Length and surface characteristics of the chitin nanowhiskers were determined through SEM. This is carried out at the Centre for Nano Science and Engineering (CNSE), IISc, Bangalore with an SEM, ZEISS, Germany, model ULTRA55. Keep sample on gold coating plate coated at 120seconds, on electron beam, of diameter 100nm, the signal used for coating secondary electron.

### 3. RESULTS

#### 4. COMPARISON OF CHITIN YIELD BETWEEN TWO MUSHROOMS.

The yield of chitin from button mushroom varied between 0.25% to 14.3% and the highest yield of 14.3% was recorded at a concentration of 9N HCl. The oyster mushroom has yielded 30.1% to 44.45 % chitin under different concentrations of HCl, with the highest percentage under 12N HCl. The button mushroom has recorded an average of 32.22% more chitin content than button mushroom (Table 1).

#### FTIR

Results of the FTIR spectroscopic analysis of chitin are presented in Figure 1 to Figure 3. Infrared absorption spectrum of the sample is concordant with the spectrum of the chitin standard.

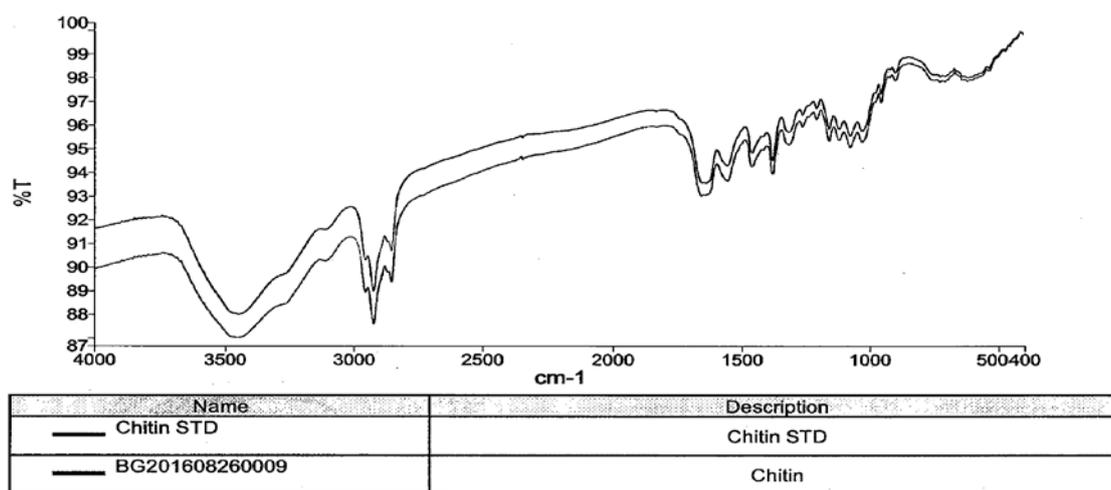


Figure 1: FTIR spectrum of chitin from button mushroom and standard chitin sample

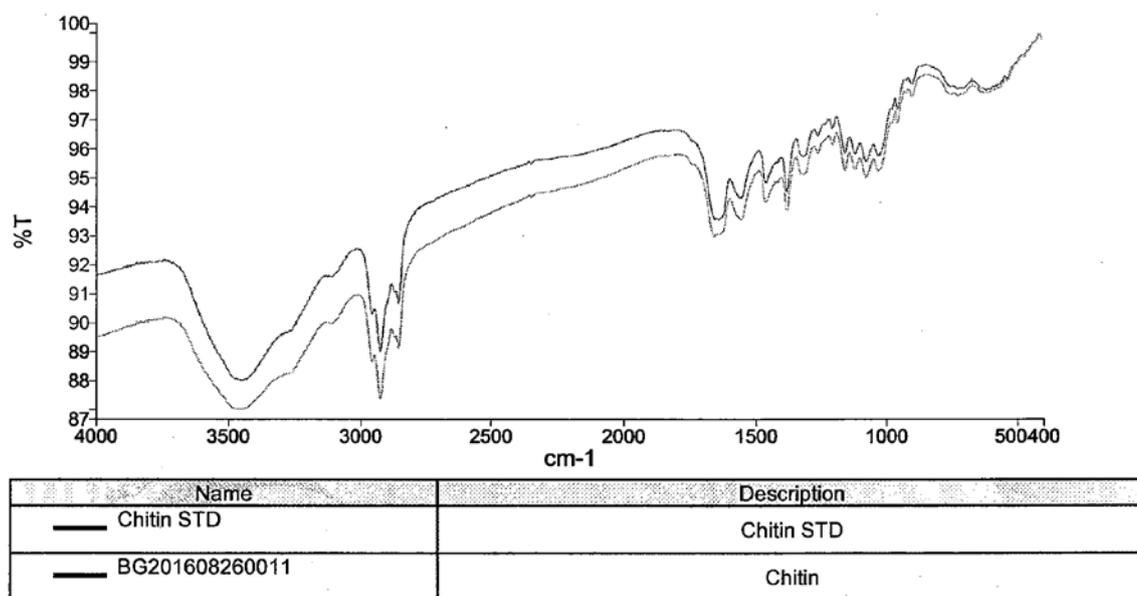
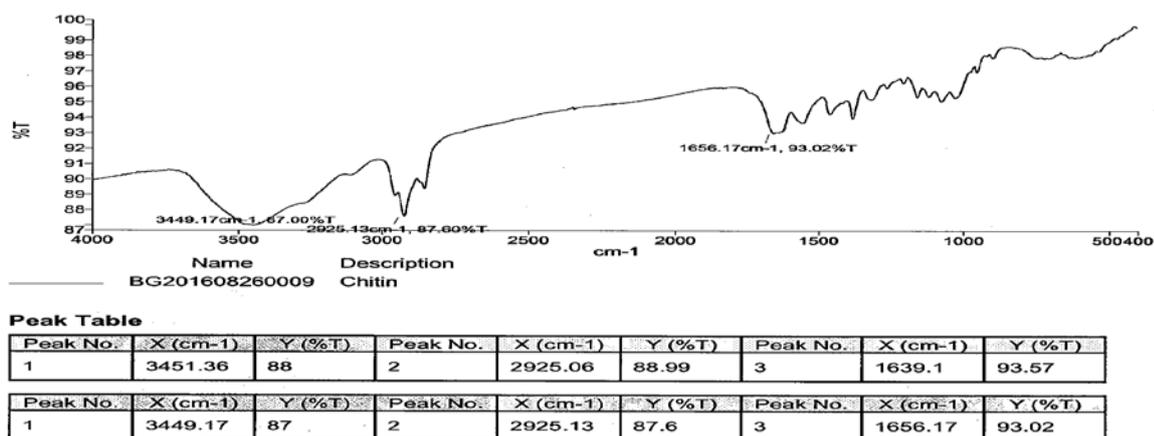
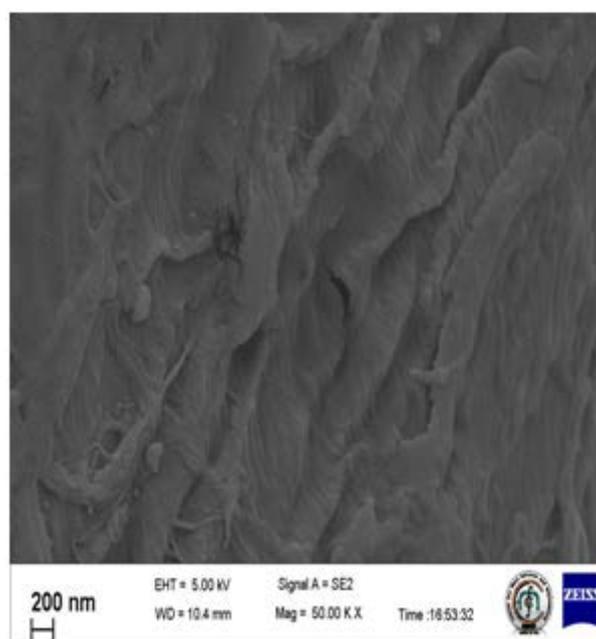


Figure 2: FTIR spectrum of chitin from oyster mushroom and standard chitin sample

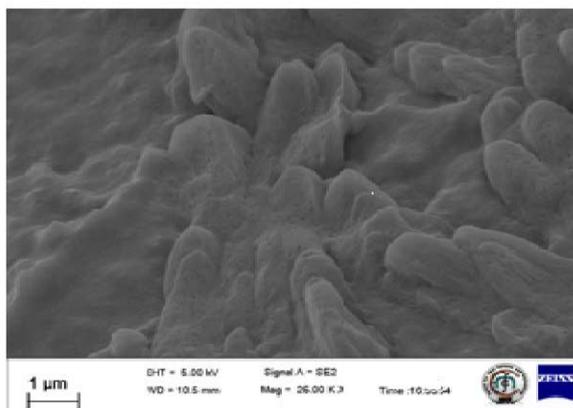


**Figure 3:** FTIR spectrum of Standard chitin sample

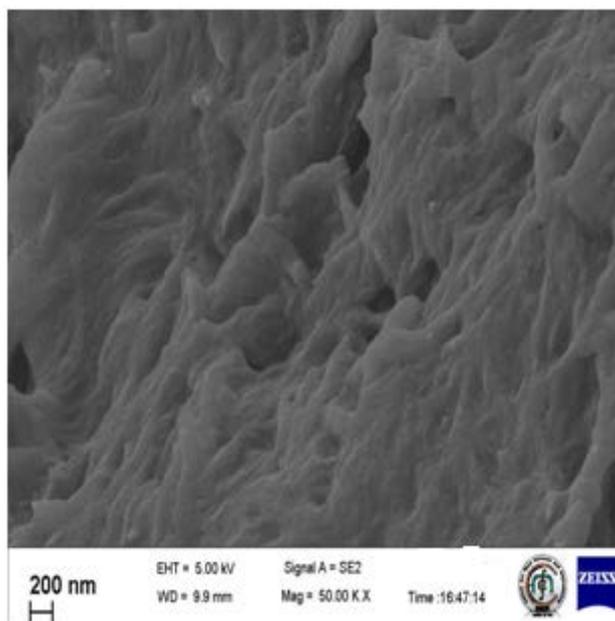
Acid hydrolysis of oyster mushroom has yielded 1.5 % of chitin nanowhiskers from the net weight of fresh mushrooms while button mushroom yielded 2.2 %. At the end of sonication treatment, the sample had a consistency of a colloid. SEM images of the partially dried colloidal sample containing isolated chitin nanowhiskers from the mushrooms are illustrated in Figure 4 to Figure 7. The sample showed bundles of chitin nanowhiskers with length ranging from 50-200nm and width of ~11nm (Table 1). The size range of nanowhiskers isolated is similar to that of fibers isolated from crab shells [21].



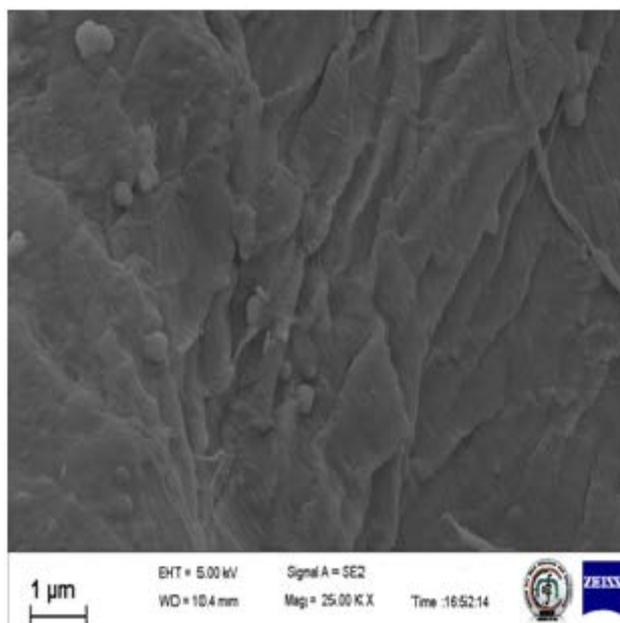
**Figure 4:** SEM images of chitin nanowhiskers from oyster mushroom at 200nm



**Figure 5:** SEM images of chitin nanowhiskers from oyster mushroom at 1 μm



**Figure 6:** SEM images of chitin nanowhiskers from button mushroom at 200nm



**Figure 7:** SEM images of chitin nanowhiskers from button mushroom at 1 μm.

**Table 1:** Comparative estimation of nanochitin in *Button* and *Oyster mushrooms*

Different Conc. of HCl	Absorbance at 555nm		Quantity present(mg/2g)		Percentage yield of chitin	
	Button mushroom	Oyster mushroom	Button mushroom	Oyster mushroom	Button mushroom	Oyster mushroom
3N	0.023	0.602	23	602	1.15	30.1
5N	0.005	0.656	5	656	0.25	32.8
7N	0.069	0.834	69	834	3.45	41.7
9N	0.286	0.672	286	672	14.3	33.6
12N	0.048	0.889	48	889	2.4	44.45
Average % yield					4.31	36.53

**Table 2:** Source and size of chitin nanowhiskers from mushrooms

Sl. No	Mushrooms	Extraction method	Length(nm)	Width(nm)
1	<i>Oyster mushroom</i>	Hydrochloric acid hydrolysis	50-200 to few microns	9-10.5 and ~11
2	<i>Button mushroom</i>	Hydrochloric acid hydrolysis	50-200 to few microns	8-11

## 5. DISCUSSION

Chitin is predominantly present as a fibrillar crystalline material. Based on infrared spectroscopy and X-ray diffraction data, native chitin is known to occur in one of the three crystalline forms  $\alpha$ -chitin,  $\beta$ -chitin, and  $\gamma$ -chitin, respectively, depending on its origin [22]. The molecules in  $\alpha$ -chitin are arranged in an antiparallel fashion, with strong intermolecular hydrogen bonding. The  $\alpha$ -chitin is the most abundant form existing in the shells of crabs, lobsters, krill and shrimps, insect cuticle, and the cell walls of fungal and yeast [3] having a crystallinity higher than 80% [23]. In  $\beta$ -chitin, present in squid pens and tube worms [24], [25] where the chains are arranged in a parallel fashion. The  $\gamma$ -chitin is the form of chitin in which the molecules are arranged in both parallel and anti-parallel manner. The  $\alpha$ -chitin is more stable when compared to the  $\beta$ -chitin and  $\gamma$ -chitin and hence more readily available in the market [26]-[27]. The chitin whiskers have a very strong potential for the development of nanomaterials because of their nano-sized structure, very high surface-to-volume ratio, high dispersibility in water and high viscosity, and excellent physical properties (otherwise called whisker i.e. highly crystalline chitin nanofibril) is composed of about 20 linear chains of N-acetylglucosamine, based upon the rod diameter and crystalline network dimensions[28]. Chitin content of oyster mushroom is 32.22% higher than that in button mushroom. Quality and characteristics of the chitin extracted from both mushrooms are at par with standard commercial chitin.

## CONCLUSION

The current study has standardized the acid hydrolysis method for the isolation of chitin nanowhiskers from fresh edible mushrooms. Use of 9N and 12N HCl has been identified as ideal for extraction of nanowhiskers from the button and oyster mushrooms respectively. The average chitin content of oyster mushroom (*P. ostreatus*) is 32.22% higher than that of the button mushroom (*A. bisporus*).

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# Cardiovascular Conditions on the Rise: A Pilot study

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DOI: 10.29322/IJSRP.8.8.2018.p8018

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8018>

## Abstract-

This paper is a pilot study seeking to ascertain the incidence of cardiovascular diseases and its therapeutic successes both in Jamaica and in Barbados. **Method:** EBSCO host data base was used to gain needed literature evidence regarding successful therapeutics for cardiovascular diseases. The review was facilitated by the analysis of relevant literature and the distribution of questionnaires to a cohort of medical technology students in Jamaica. For the pilot study regarding the awareness of collage age students about cardiovascular diseases, a stratum of 28 first year Medical Technology students was conveniently chosen. The evaluation of the statistical data was analysed using SPSS version 25. **Results:** Of the total consenting first year medical technology student population (N=28), 20 were female and the latter being male. Thirteen respondents were from ages 16-20 whereas 15 were from 20-24. Twenty-five persons indicated their awareness of cardiovascular diseases while 3 were unaware. Of the respondents, 89.3% were aware of hypertension and cardiac arrest, 76% aware of atherosclerosis and the awareness of other conditions were between 40-45%. Literature review reveals a steady increase in cardiovascular disease and increase successful therapeutics. **Conclusion:** First year Medical Technology students were chosen as they were anticipated to be awareness of cardiovascular disease, however it was evident that the group that was chosen for this pilot represented a group of persons who were not aware of the range of illnesses that are associated with cardiovascular diseases. General awareness needs to be improved, as increasingly more deaths are being reported from illnesses thus associated, with little knowledge to arrest the onset of the illness early. The study also highlighted successful therapeutics and technologies in both Jamaica and Barbados, identifying the negative effects of each.

**Index Terms-** cardiovascular, therapeutics, technologies, awareness

## I. INTRODUCTION

This research focuses on successful therapeutics and technologies for cardiovascular conditions on the rise. It highlighted and compared such therapeutics as well as technologies within Jamaica and Barbados. The negative effects of these therapeutics and technologies were also perused and discussed.

The Ministry of Health postulated that cardiovascular diseases occur as a result of ailments of the blood vessels and heart [1]. It publicised common cardiovascular conditions such

as inborn heart disease, failure of the heart, cerebrovascular disease and hypertension [1]. When examined on a global scale, it was seen where cardiovascular diseases induced a spike within a country's mortality rate thus resulting in 17.5 million deaths during 2012 [1, 3, 5]. The World Health Organization predicted the death of 23.6 million persons by the year 2030 from cardiovascular diseases and although the existing paucity of resources was evident among the Caribbean, countries such as Jamaica and Barbados have made improvements where this is concerned [7]. Jamaica has done pacemaker evaluation for patients, echocardiogram, stress echocardiogram and Holter monitor test among other therapeutic options [4]. Barbados implemented a standard hypertension management project and natives have used natural products containing L-Arginine to combat cardiovascular illnesses [9,10,12]. Despite the facts that these therapeutics were helpful, the research showed the negative effects of some such as L-Arginine. The negative effects of technologies such as intravascular and Angiojet thrombectomy were also explored. A survey was done among the student population to assess one's knowledge of such issues. Knowledge of cardiovascular disease will indeed be helpful in preventing future intolerable increases as activities that are done early on in one's life affects the type of disease that they will experience later on in life (60 years). The World Health Organization (WHO) global estimates of mortality and burden of disease, around 17.3 million people died from cardiovascular diseases in 2008 representing 30% of all global deaths. Of these deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke [20].

## Study Context and Conceptual Framework

Cardiovascular conditions for years, has been a sore point to many individuals. The condition has been tested by many professionals with little or no successful interventions. This pilot study will bring to focus, the interventions that have been successful over the few years with the hope to decrease the negative stigma that has been associated with the disease.

## Problem statement

The increase of cardiovascular conditions has become of crucial alarm to the world since recently. The severity of its impact on Caribbean countries such as Barbados and Jamaica are due to their lack of medical resources and also because of the unhealthy lifestyle many of the natives have adapted.

## Rational and Justification

Jamaica and Barbados, though lacking in resources and information to manufacture possible cures, have been introduced to new affordable technologies and therapeutics which have been proven to reduce the prevalence of cardiovascular conditions. The findings of this research will be beneficial to several developing countries as they will be able to implement such to decrease a population's mortality rate.

### **Purpose of study**

This study's aim was to explore the potency of cardiovascular therapeutics and technologies in Jamaica and Barbados and also to investigate the negative effects of some of these therapeutics. The prevalence of cardiovascular diseases in today's society have become quite alarming, more so in the Caribbean countries, and as such, there is a need for interventions in the therapeutic and technological aspect as one seeks to combat these diseases. The World Health Organization describes cardiovascular disease as varying disorders of the blood vessels and heart and predicts the death of 23.6 million people in 2030 from such diseases [7]. Caribbean countries, Jamaica and Barbados have had new developments in cardiovascular therapeutics and technologies, with some being of a similar nature while others differ.

## **II. BACKGROUND**

As it relates to cardiovascular diseases in Jamaica, the country's Minister of Health, Dr. Christopher Tufton, posits that these diseases have caused 34.8 % of death within the nation over the past five years [2]. Screening for blood pressure is highly recommended for persons 20 and above and persons were encouraged to do such checks at every doctors visit and as such, blood pressure checks were implemented and initiated in healthcare facilities regardless of a person's illness. If it is recognized that a person has irregularities in blood pressure, further medical assistance is provided, and the appropriate drug administered [2]. The Automated External Defibrillator is used to restart the heart in conjunction with cardiac pulmonary resuscitation in the case of sudden cardiac arrest and has been promulgated to the population via the Jamaica Information Service [2]. The Heart Foundation of Jamaica has implemented several therapeutic options as well as technologies to provide efficient treatment for varying cardiovascular conditions. The foundation has extended its capacities and has now implemented a larger pharmacy that provides both over the counter and prescription drugs. There has also been pacemaker evaluation for patients, echocardiogram, stress echocardiogram and Holter monitor test [2, 4]. Considerations are currently being made for a Cardiac Rehabilitation programme [4]. This programme will use physical, medical as well as psychosocial methods to combat recurring cardiac conditions as well as prevent them. Herbs such as breadfruit leaves are used to treat high blood pressure among the locals [5]. *Rytidophyllum tomentosum* (Search Mi Heart) is also used to treat multiple heart conditions [6]. Exercise is currently being used as a form of therapeutic for cardiovascular disease patients and persons at risk [8]. These persons have been encouraged to participate in events such as the Reggae, 5K and 10K marathons as exercise improves cardiovascular health.

As it relates to prevalent cardiovascular conditions in Barbados, there was a record of Barbados on the verge of such epidemic in 2015 as more than a third of the population suffered from hypertension [9].

*"The Barbadian government in collaboration with the WHO Pan-American Health Organization and the US Centres for Disease Control and Prevention embarked on a project to further improve the treatment of hypertensive individuals through a few clinics on the island. The efficacy was evident as there was an*

*increase in the control rate of hypertensive individuals since the initiation of the project. These procedures assessed individuals' lifestyle as it targeted the risk factors. There was improvement in assess to medications and technologies, exercise, reduction of salt intake and also a decrease in tobacco and alcohol consumption."* [9,10]

*"The Barbadian government also invested in the initiative to decrease sudden cardiac arrest deaths through the introduction of Cardiopulmonary resuscitation training and the usage of an external defibrillator that is automated. Both public and private sector individuals were encouraged to seek training in regard to these techniques for the reduction of mortality and morbidity from sudden cardiac arrest deaths."* [11]

It was seen where Barbadian natives with cardiovascular conditions had begun to use alternative methods as a form of therapy.

*Natural products such as L-Arginine and Blood Pressure Wellness have become ubiquitous among the Barbadian market. These products were proven to help with regulation of cholesterol, the dissolving of blood clots and also helps with preventing heart attacks and strokes.* [12]

*Additionally, a paediatric cardiac surgical programme was established at the Queen Elizabeth Hospital in association with Northshore University Hospital in New York has since 1982. This programme has raised the standards of care for those in the QEJ and not only benefits Barbadians but also citizens in other Caribbean countries.* [13]

The Advanced Cardiovascular Institute has introduced new interventions to the world of cardiovascular diseases. [14]

*"These interventions have provided essential new tools for physicians that therapeutically alter consequences for publics anguishing from a vascular ailment"* [19].

These therapeutics are known as Intravascular Ultrasound and Angiojet Thrombectomy [14]. The intravascular intervention consists of an ultrasound system which includes an intravascular catheter with an ultrasound transducer array, a transmit beamformer, a receive beamformer, and an image generator [15]. *"Through fragmentation and suction by rheolytic procedures, the Angiojet thrombectomy catheter is able to remove thrombi"* [16]. Thrombi, also known as intracoronary thrombus is associated with Myocardial infarction.

The National Center for Biotechnology Information postulates that the Intravascular ultrasound has a higher efficacy than the AngioJet thrombectomy [17]. When studies were carried out the outcome observed supported the above statement, in that only 0.4% of convalescents who endured Intravascular guided ultrasound imbedding had major cardiac events one-year post procedure, compared to a 1.2% of patients who underwent Angiojet thrombectomy guided procedure and suffered adverse

cardiac events. The major cardiac events are myocardial infarction, or stent thrombosis.

WedMD posits,

*“that L.Arginine is an amino acid that is used to treat cardiovascular conditions such as: congestive heart failure (CHF), chest pain, high blood pressure, and coronary artery disease. However, there are a few side effects experienced by patients who receive this treatment either orally, through and injection/shot and via skin application. The side effects experienced are: “gut pains, bloating, diarrhoea, gout, abnormalities of the blood, allergies, airway inflammation, worsening of asthma, and hypotension” [18].*

There are other Cardiovascular technologies and interventions available in Jamaica and Barbados which have adverse side effects. These interventions and technologies however will be acknowledged later in the research, an example is The Holter Monitor Test.

### III. METHOD

This research was carried out by using critical information from the perusal of various journal articles and

websites as it relates to treatment options for prevalent cardiovascular conditions and negative effects of such found using the EBSCO host data base. Research data was obtained from organizations such as the World Health Organization and the Advanced Cardiovascular Institute and newspaper articles from The Jamaica Gleaner and Observer. Magazines such as the Barbados Advocate and Heartline Magazine were also used to facilitate the study. To complete the pilot study, a questionnaire was sent out among the population (28) of first year Medical Technology students at a prominent tertiary institution in central Jamaica, after receiving consent and tested their awareness on Cardiovascular conditions. The data was recorded and analysed using the Statistical Package for Social Scientists (SPSS) software version 25 and results were tabulated.

### Statistical Analysis

SPSS version 25 software analysed the data and tabular representation was done.

### IV. RESULTS



Figure 1: Relationship of gender to age

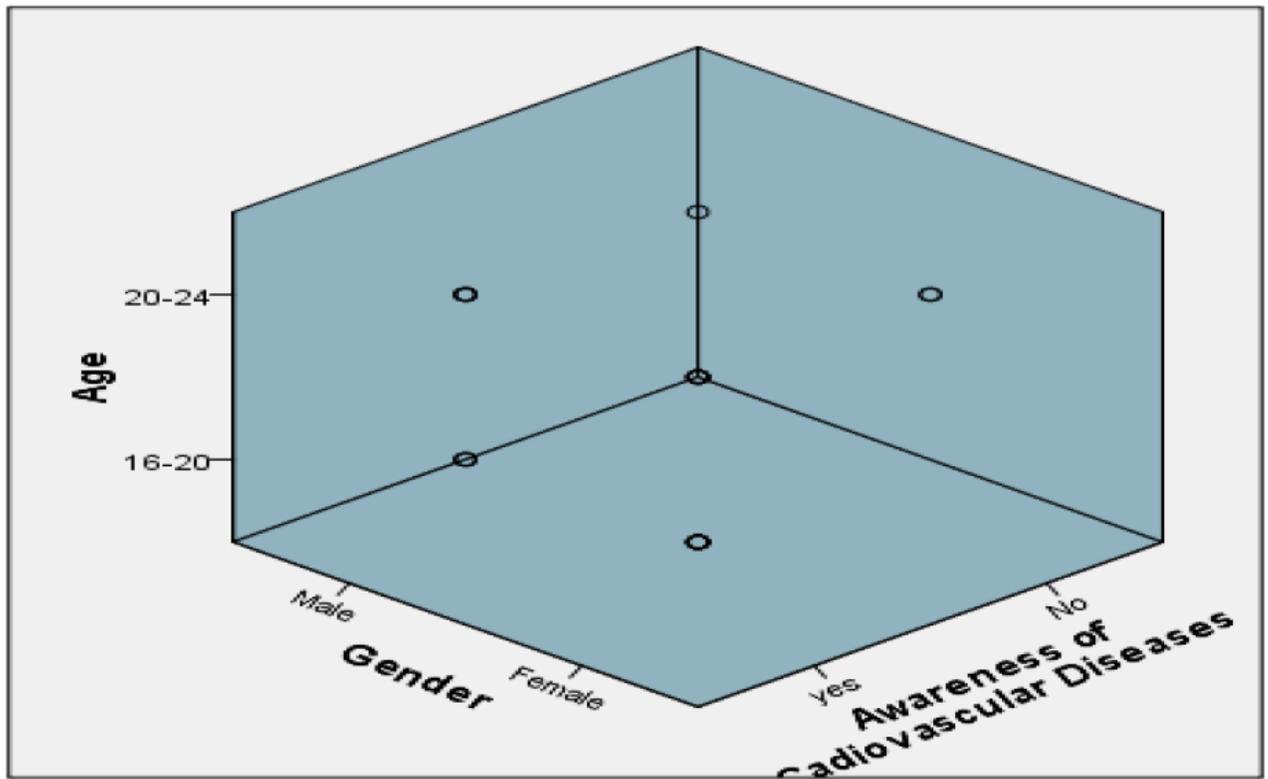


Figure 2: Relationship of gender and age to awareness of cardiovascular disease

**Awareness of Cardiovascular Diseases**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	3	10.7	10.7	10.7
	Yes	25	89.3	89.3	100.0
	Total	28	100.0	100.0	

Table 1: Numerical expression of the awareness of cardiovascular disease

**The Heart Conditions You Know**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ischaemic Heart Disease	4	14.3	100.0	100.0
Missing	System	24	85.7		
Total		28	100.0		

Table 2: percentage of participants in the pilot who were aware of Ishaemic Heart disease

**The Heart Conditions You Know**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Pericarditis	8	28.6	100.0	100.0
Missing	System	20	71.4		
Total		28	100.0		

Table 3: Percentage of participants in the pilot who were aware of Pericarditis

**The Heart Condition You Know**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Endothelial Dysfunction	1	3.6	100.0	100.0
Missing	System	27	96.4		
Total		28	100.0		

Table 4: Percentage of participants in the pilot who were aware of endothelial dysfunction

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The Heart Conditions You know

Atherosclerosis

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		Total	
Gender	Male	5	5
	Female	14	14
Total		19	19

---

Table 5: Number of person's male/females who are aware of Atherosclerosis

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The Heart Conditions You Know

Hypertension

---

		Total	
Gender	Male	7	7
	Female	18	18
Total		25	25

---

Table 6: Number of person's male/females who are aware of Hypertension

## The Heart Conditions You know

### Rheumatic Fever

		Total
Gender	Male	4
	Female	6
Total		10

**Table 7: Number of person’s male/females who are aware of Rheumatic Fever**

#### V. DISCUSSION:

The data obtained from the questionnaire shows that there were 28 participants involved within the study, with 8 being male and 20 being female (figure 1&2). It was evident that the female population far exceeded the male by 42.8% as the percentage of males was recorded as 28.6 % with 71.4% being females. It was recorded and observed that all participants responded to the question concerned with their age group, with 46.4 % (13) of respondents coming from the age group 16-20 with 53.6% (15) of respondents from ages 20 -24. The question that tested the individuals’ awareness of cardiovascular diseases was responded to by all participants with 25 responses recorded as yes and 3 as no (see figure 2, see table 1). The question that tested the participants’ knowledge of cardiovascular conditions was answered by 25 out of 28 (89.3%) participants. It showed that conditions such as Cardiac Arrest and Hypertension were known by 25 participants while 3 did not respond (see table 6). This was followed by Atherosclerosis that was known by 19 participants (76% of respondents) with 3 not responding (see table 5). Conditions such as Rheumatic Fever, Pericarditis and Angina Pectoris were among others that individuals were fairly aware of, with 10 (40%) persons being aware of Rheumatic Fever (see table 6) and 8 persons (32%) being aware of Pericarditis and 9 persons (36%) being aware of Angina Pectoris. The least known conditions were Ischaemic Heart Disease and Endothelial Dysfunction (see table 2). There were only 4 persons (16%) out of the 25 respondents with 3 not responding who were aware of Ischaemic Heart Disease and 1 individual (4%) who was aware of Endothelial Dysfunction. The question that tested the participants’ knowledge of cardiovascular conditions as the leading cause of death, was responded to by all 28 persons. Three persons (10.7%) responded with no while 25 persons (89.3%) responded with yes still 3 did not respond. The question that tested the participants’ awareness of precautionary measures to treat cardiovascular conditions was responded to by all 28 participants with 24 persons indicating yes and 4 no. There were 28 responses as it relates to making dietary/lifestyle changes to

lower the risk of these diseases with 27 (96.4%) respondents saying yes and 1 (3.6 %) individual saying no. There were 17 (60.7%) persons from the 28 respondents who knew persons with cardiovascular conditions and 11 (39.3%) who did not. Sixteen persons (57.1%) knew 1-4 individuals while 1 (3.6%) person knew 5-9 individuals. The 28 individuals all responded to the question that tested their awareness of the life expectancy of cardiovascular conditions with 14 (50%) responses recorded as yes and 14 (50%) as no. Cardiovascular diseases have been estimated to be the leading cause of death and disability-adjusted life years (DALY) lost globally [20]. Low to middle income countries to which Jamaica and Barbados are apart have experienced an increase in the prevalence of cardiovascular heart diseases and 80% of the global burden of Cardiovascular disease occurs in this low to middle income regions of the world [20]. With the increased incidents of same the DALY-healthy years of life lost and combines years of potential life lost due to premature death with years of productive life lost due to disability, thereby, indicating the total burden of a disease as opposed to simply the resulting death. Within the coming decades, DALYs estimate for cardiovascular disease is expected to rise from a loss of 85 million DALYs in 1990 to a loss of 150 million DALYs globally in 2020, thereby remaining the leading somatic cause of loss of productivity. As for coronary heart disease global burden, this is projected to rise from around 47 million DALYs globally in 1990 to 82 million DALYs in 2020 [20]. Looking on the trend seen from the pilot analysis is give insight that the age group between 16 to 25 are seemingly unaware of the range of cardiovascular diseases and therefore if are not properly educated will continue with the same lifestyle habits into old age. There by developing similar health related issues highlighted in the study.

#### VI. CONCLUSION:

Based on the results obtained from the pilot study survey, it was evident increase knowledge is need regarding cardiovascular illnesses by all persons including college students. With the real

sample size for the full study being proposed to be 1000 persons, a more in-depth analysis will better be able to enhance the conclusiveness of the study. It was also realized that there were more persons from age group 16-20 as opposed to age group 20-24 who gave a positive response to the question asking if they were aware of cardiovascular diseases. Cardiac arrest, Hypertension and Atherosclerosis were the top three most known conditions while Ischaemic, Pericarditis and Endothelial Dysfunction were the least known conditions each with percentages of 36% and under. Through in-depth research many successful therapeutics and technologies have been observed in both Jamaica and Barbados for the cardiovascular conditions mentioned. This research has also identified the unsuccessful therapeutics due to their negative effects on witnessed participants.

## VII. RECOMMENDATION:

To increase awareness for cardiovascular conditions, schools and businesses should be encouraged to recognize February as Heart Month, walks such as the cardiovascular march can be hosted locally, and brochures and pamphlets should be made available and accessible to the public. General health seminars should be held at least twice a year at schools and work places to inform and keep the society up-to-date with the prevalence, prevention and treatment of cardiovascular diseases and conditions.

**Supplementary Materials:** No supplementary material.

**Acknowledgments:** We thank the 28 first year Medical Technology students for consenting to participate in this questionnaire.

**Author Contributions:** Data curation, Joneshia Bryan-Thomas; Formal analysis, Joneshia Bryan-Thomas; Investigation, Ava-Gayle Lawrence, Anecia Reid and Georgiene Morgan; Supervisor, Joneshia Bryan-Thomas; Writing-review& editing, Joneshia Bryan-Thomas; Methodology, Ava-Gayle Lawrence, Anecia Reid and Georgiene Morgan; Writing- original draft, Ava-Gayle Lawrence, Anecia Reid and Georgiene Morgan;

**Conflicts of Interest:** The authors declare no conflict of interest.

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# Enhancing the Productivity of Health Information Professionals through Capacity Development: A Case Study of Government Hospitals in Calabar Urban, Cross River State, Nigeria

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DOI: 10.29322/IJSRP.8.8.2018.p8019

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8019>

**Abstract-** The aim of this study is to investigate how 'Capacity development in health information management can promote efficient health services delivery in hospitals in Calabar Urban, Cross River State, Nigeria. Three research objectives and questions were framed which culminated in three hypotheses for the study. A well designed questionnaire was prepared and one hundred copies were printed and distributed to respondents in the sampled hospitals for completion. The data were extracted from the questionnaire and analysed using Chi – square statistical tool to test the hypotheses at 0.05. The result of the study revealed that; capacity development enhances skills of health information professionals to perform their jobs successfully; it serves as a means of improving efficiency in services delivery and also motivate health information professionals to increase their input. The study recommended that; Capacity development should be promoted to sustain skills; promote efficiency and productivity; health information staff should be encourage to attend seminars in order to function effectively, and agency responsible for certification and license validation should formulate policies that will make it mandatory for every professional to attend capacity development workshops.

**Index Terms-** enhancing, efficient health information services, and capacity development

## I. INTRODUCTION

Capacity development has its roots in a range of disciplines which in the 1970s flew the flag for empowerment, e.g. community development, international aid and development, public health and education (Kaplan, 1995). Although these traditions are somewhat inter-related and have, to varying degrees, been concerned with developing healthy communities, it is perhaps not surprising that capacity development as a term has been conceptualized in a diverse range of ways and associated with a plethora of meanings (Omodia, 2004).

Palmer and Short (1994) define capacity development as the process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time. It is about supporting growth – within individuals, groups and across

societies as a whole. It can be viewed from three distinct but related perspectives:

1. Individual: the skills and knowledge vested in individuals, communities and groups.
2. Organizational: the internal policies, systems and strategies that enable an organization to operate and to achieve its goals.
3. Enabling environment: the wider society within which individuals and organizations function.

However, capacity development in health information management will focus on different factors that play important role in organizational setup to ensure effective information management. Individuals can adequately develop themselves and this can be achieve through various national institutions and agencies responsible for human resource development. This study therefore seek to investigate capacity development in health information management for promoting efficient health services delivery in hospitals in Calabar urban, Cross River State.

## II. STATEMENT OF THE PROBLEM

Health information management professionals are the custodian and managers of patients' health information in health facilities. Health information is necessary to improve health outcomes, guide identification of health problems and population needs, inform planning and design of health interventions to address public health problems, guide decision making during allocation of scarce resources and provide opportunity for monitoring and evaluating progress towards achievement of health goals.

Most Health information professionals do not see capacity development as a means of improving on their services which will in turn have positive effect on the services rendered in the hospital to patients. They belief in the knowledge acquired during their initial training at the entry point into the profession. Thus, effort to influence them to attain workshops or further studies which are not back by financial gains becomes a problem as the willingness of the professionals to imbibe the culture of development is not considered. Once they have secure a job, re – training becomes secondary, as their effort will now be geared

towards consolidating their job. These in overall terms does not enhance high productivity among individual professionals in health industry at large.

### III. OBJECTIVE OF THE STUDY

The objectives of this study are;

1. To ascertain whether capacity development will result in the development of sustainable skills among health information professionals in hospitals in Calabar urban of Cross River State.
2. To find out whether capacity development is a means of improving efficient health information services in hospitals in Calabar urban of Cross River State.
3. To confirm if capacity development is a means of motivating health information professionals in hospitals in Calabar urban of Cross River State.

### IV. RESEARCH QUESTIONS

The following research questions were framed for the purpose of the study.

1. Does capacity development results in the development of sustainable skills among health information professionals in hospitals in Calabar urban, Cross River State?
2. Does capacity development serve as a means of improving efficient health information services in hospitals in Calabar urban, Cross River State?
3. Does capacity development serve as a means of motivating health information professionals in hospitals in Calabar urban of Cross River State?

### V. RESEARCH HYPOTHESES

1. Capacity development cannot result in sustainable skills among health information professionals in hospitals in Calabar urban, Cross River State.
2. Capacity development cannot serve as a means of improving efficient health information services in hospitals in Calabar urban, Cross River State.
3. Capacity development is not a means of motivating health information professionals in hospitals in Calabar urban, Cross River State.

### VI. THE CONCEPTUAL CLARIFICATION

Capacity development is a concept which is based on enabling—individuals, organizations, systems—for positive changes, strengthening their capacities to perform effectively in solving problems. This concept is associated with the definition of health promotion in the Ottawa Charter, which integrates values associated with participation, knowledge exchange, ownership, equity, and sustainability. It goes from individual to organizational, community, national, and international levels. It is understood by different approaches, mainly concerning the

interventions that can be invested in providing material aid or training skills. The main debates centre on whether some of the interventions are caring about strengthening the system or whether they are more systemic and sustainable dealing with building local and national infra-structures. Capacity development rests on the notion that change is the norm, because capacity depends on the ability to adapt to change (McPeake, 2000).

Oku (2003) opined that capacity development goes beyond simple training or providing technical assistance, but a foundational strategy outlined in the Ottawa Charter for Health Promotion. Capacity development from the health approach can also be seen as 'the development of sustainable skills, structures, resources and commitment to health improvement and other sectors to prolong and multiply health gains. World Health Organization (2002) saw capacity development, as conceptual approach to development that focuses on understanding the obstacles that inhibit people, governments, international organizations and nongovernmental organizations from realizing their development goals while enhancing the abilities that will allow them to achieve measurable and sustainable results.

Robert (2002) observed that, capacity development is based on the development of sustainable skills, resources, and structures. The capacity of a program is enhance when its effects are multiplied through the work of a network of organizations. It can be seen as both a determinant of sustainability and an outcome of it, which has additional domains relevant to sustainability included enduring over time, multi-level focus, and improved health/concrete outcomes. A focus on capacity development will increase the likelihood that other people and organisations within health and other sectors will also be able to promote health. Highly skilled physicians, nurses, administrators, and ancillary staff are critical to producing high-quality outcomes and effective quality improvement hence hospital growth (Ake, 2001).

### VII. METHODOLOGY

This study adopted survey design in the course of the investigation. Survey design was chosen based on the fact that, the study is intended to gather information about the relationship that exist between the variables and the research problems under investigation. The population of the study was all health information management professionals in government hospitals in Calabar urban, Cross River State, who were available as at the time the study was conducted.

Simple random sampling technique was used for the study. The sample for the study was drawn from four Health Information management departments in four hospitals within Calabar urban (two secondary and two tertiary hospitals). The name of the hospitals so picked for the study were; University of Calabar Teaching hospital, Calabar; Federal Neuropsychiatric hospital, Calabar; General hospital, Calabar; and Dr. Lawrence memorial hospital, Calabar. The total number of Health information management professionals in the four hospitals were one hundred and forty – five (145), a sample of 100 professionals (representing 69%) was purposively used for the study. A 15 items questionnaire was prepared for the study. The reliability of the instrument was tested by the consistency of response, which

was evaluated by repeated pilot testing. Chi square statistical tool was used to test the hypotheses at 0.05 level of significance.

H<sub>0</sub>: Capacity development cannot result in enhancement of skills among health information professionals in hospitals in Calabar urban, Cross River State.

H<sub>i</sub>: Capacity development can result in enhancement of skills among health information professionals in hospitals in Calabar urban, Cross River State.

VIII. RESULTS

**Hypothesis one**

**Table 1: Observed (o) and (e) expected frequency for Hypothesis one**

VARIABLES	YES (E)	NO (E)	TOTAL
Capacity development can result in enhancement of the skills of HIM professionals	60 (56)	20 (24)	80
Capacity development cannot result in sustainable skills	10 (14)	10 (6)	20
TOTAL	70 (70)	30 (30)	100

Source: questionnaire

$$\begin{aligned}
 X^2 &= \frac{(60 - 56)^2}{56} + \frac{(10 - 14)^2}{14} + \frac{(20 - 24)^2}{24} + \frac{(10 - 6)^2}{6} \\
 &= 0.29 + 1.14 + 0.67 + 2.67 \\
 &= 4.77 \text{ calculated value}
 \end{aligned}$$

Decision rule: Since the calculated value 4.77 is higher than the table value 3.84, H<sub>0</sub> is therefore rejected and H<sub>i</sub> accepted. This implies that capacity development in Health information management department can result in the development of sustainable skills among health information professionals in hospitals in Calabar urban, Cross River State.

**Hypothesis two**

H<sub>0</sub>: Capacity development cannot serve as a means of improving efficient health services in hospitals in Calabar urban, Cross River State.

H<sub>1</sub>: Capacity development can serve as a means of improving efficient health services in hospitals in Calabar urban, Cross River State.

**Table 4.7 observed (o) and (e) expected frequency table in relation hypothesis 2**

VARIABLES	YES (E)	NO (E)	TOTAL
Capacity development can serve as a means of enhancing efficient health information services	60 (50)	12 (22)	72
Capacity building cannot serve as a means of enhancing efficient health information services	10 (20)	18 (8)	28
TOTAL	70 (70)	30 (30)	100

Source: questionnaire

$$\begin{aligned}
 X^2 &= \frac{(60 - 50)^2}{50} + \frac{(10 - 20)^2}{20} + \frac{(12 - 22)^2}{22} + \frac{(18 - 8)^2}{8} \\
 &= 2 + 5 + 4.55 + 12.5 \\
 &= 24.05 \text{ calculated value}
 \end{aligned}$$

Decision rule

The calculated value 24.05 was higher than the table value 3.84, H<sub>0</sub> is therefore rejected and H<sub>i</sub> accepted. This implies that, capacity development can serve as a means of improving efficient health information services in hospitals in Calabar urban, Cross River State.

**Hypothesis three**

H<sub>0</sub>: Capacity development cannot serve as a means of motivating health information professionals in hospitals in Calabar urban, Cross River State.

H<sub>1</sub>: Capacity development can serve as a means of motivating health information professionals in hospitals in Calabar urban, Cross River State.

**Table 3: observed (o) and (e) expected frequency table in relation to hypothesis 3**

VARIABLES	YES (E)	NO (E)	TOTAL
Capacity development can serve as a means of motivating health information professionals in hospitals	65 (60)	10 (15)	75
Capacity development cannot serve as a means of motivating health information professionals in hospitals	15 (20)	10 (5)	25
TOTAL	80 (80)	20 (20)	100

Source: questionnaire

$$\begin{aligned}
 X^2 &= \frac{(65 - 60)^2}{60} + \frac{(15 - 20)^2}{20} + \frac{(10 - 15)^2}{15} + \frac{(10 - 5)^2}{5} \\
 &= 0.42 + 1.25 + 1.67 + 5 \\
 &= 8.34 \text{ calculated value}
 \end{aligned}$$

Decision rule

Since the calculated value 8.34 is higher than the table value 3.84,  $H_0$  is therefore rejected and  $H_1$  accepted. This implies that, Capacity development can serve as a means of motivating health information professionals in hospitals in Calabar urban, Cross River State.

### IX. DISCUSSION OF FINDINGS

This study was carried out to investigate how Capacity development in health information management can promote efficient health services delivery in hospitals in Calabar Urban, Cross River State, Nigeria. The result of hypothesis one revealed that capacity development in Health information management department can result in the development of sustainable skills among health information professionals in hospitals in Calabar urban, Cross River State. The data revealed that the calculated value 4.77 was higher than the table value 3.84,  $H_0$  was rejected and  $H_1$  accepted. The result of the hypothesis was in consonant with Adeyemo (2005) assertion that capacity development is the behind the scenes efforts by practitioners to develop sustainable skills that increases effective health promotion programs. It is the development of structures, resources and commitment to health improvement.

The result of hypothesis two revealed that capacity development can serve as a means of improving efficient health information services in hospitals in Calabar urban, Cross River State. This was indicated by the fact that the calculated value 24.05 was higher than the table value 3.84,  $H_0$  was therefore rejected and  $H_1$  accepted. This correspond to Health Reform Foundation of Nigeria (HERFON, 2006) view that building on capacity of an organisation is to bring about improvement in efficiency in services delivery in health care.

The result of hypothesis three also revealed that capacity building is a source of motivating health information professionals in hospitals in Calabar urban, Cross River State. The calculated value 8.34 was higher than the table value 3.84, so  $H_0$  was rejected and  $H_1$  accepted. This was in line with Palmer and Short (1994) opinion that building capacity requires action from within organisations as well as developing strategies that will motivate their work force in the organisation to have a powerful means for effecting change. This study revealed that capacity development sustain skills, enable staff in health

information management department to improve on their services delivery to patients, and as well as motivate health information management staff to be effective and efficient in services delivery to patients in hospitals.

### X. SUMMARY

This study was carried out to investigate how Capacity development in health information management can promote efficient health services delivery in hospitals in Calabar Urban, Cross River State, Nigeria. Three research questions were framed which gave rise to three hypotheses. A well designed questionnaire was prepared and 100 copies were distributed to respondents in the sampled hospitals for completion. The questionnaires were collected back and data extracted for analysis. The result of the study revealed that: Capacity development can result in the development of sustainable skills among health information professionals; it can serve as a means of improving efficient health information services in hospitals, as well as motivate health information professionals in hospitals in Calabar urban, Cross River State.

### XI. RECOMMENDATIONS

Capacity development should be promoted to sustain skills among health information professionals, Health information management professionals should be encourage to attend professional development seminars, incentives should be provided to motivate them to attend workshops and certificates issued from such workshops should be used as bases for promotion.

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# Numerical Analysis of Flow Fields on Effect of Inlet-Nozzle Diffuser for Hydrokinetic Axial Flow Turbine

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DOI: 10.29322/IJSRP.8.8.2018.p8020

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8020>

**Abstract-** This research concentrates on the impact of diffuser and nozzle angles as changed parameters on flow velocity at diffuser passage. Diffuser length, nozzle length, throat diameter are fixed and diffuser and nozzle angles are varied 5° to 30° and 5° to 15° while the flow field analysis has been carried out using commercial software ANSYS CFX. The simulation results also show that diffuser and nozzle angles at (30°,15°) are the optimum angles that accelerates flow to the turbine. The velocity at these optimum angles are higher than other angles which cause the turbine can generate more power output. After getting the optimal inlet- nozzle diffuser design, numerical analysis for the designed hydrokinetic axial flow turbine with inlet-nozzle diffuser have been performed by using ANSYS CFX. This study also focuses on the flow velocity and pressure variation around the turbine due to the effect of inlet nozzle diffuser. Hence, the installation of diffuser around the conventional turbine significantly increases its power output capabilities. The proposed turbine design is intended to use at the irrigation channel so that turbine diameter and flow velocity is considered based on the selected location. According to the simulation results, incoming velocity 1.50 m/s at the throat of the turbine was increased up to 4.03 m/s and the preliminary designed turbine power output 210 W was increased to 288 W by installing inlet-nozzle diffuser to the hydrokinetic axial flow turbine.

**Index Terms-** Inlet-nozzle, Diffuser, Flow velocity, Hydrokinetic

## I. INTRODUCTION

Hydrokinetic turbines, also called free-flow turbines, generates electricity from the kinetic energy present in flowing water, rather than the potential energy from the head. The prime advantage of these type of turbine is, it doesn't require heavy structure dam, and it provides power output directly from kinetic energy from flowing water. The same concept of horizontal axis wind turbine applies at a much smaller scale regarding river and stream flows with water as the acting medium. In each kinetic case involving axial turbines, power production was bounded by the Betz limit, bounding the efficiency of the unit to a maximum of 0.593. Gilbert and Foreman, developed the concept of augmenting a wind turbine with a diffuser, in annular fashion, negating the Betz limit and increasing the power production of the turbine [1]. Diffuser augmentation was applied to hydrokinetic turbines to improve performance with rotor disk sizes that were approximately two orders of magnitude smaller than typical large-scale wind turbines. Mehmood et. al. investigated numerous diffuser designs for tidal turbine application based on NACA hydrofoils [5]. Through the use of the hydrofoils, Mehmood et. al. was able to produce a 23.3% increase in velocity at the throat of the diffuser. Ohya et al. discovered hollow- structure diffuser is as viable as the shrouded form wind turbine for gathering and quickening the wind. Likewise, they found when utilizing a flange of proper height appended to the external periphery of the diffuser leave, a wonderful increment in wind speed. Aly Mo et. al performed about an improvement and investigation of 2-D axisymmetric CFD model of flanged diffuser [8]. Inlet-nozzle diffuser is collecting-accelerating device which shrouds a hydrokinetic axial flow turbine. The present numerical investigation deals with the effect of low pressure region created by diffuser. Also in this analysis, numerical prediction of flow field around the turbine has been carried out with different diffuser and inlet-nozzle angles.

## II. METHODOLOGY

### A. Concept of Inlet-Nozzle Diffuser

The efficiency of a horizontal axis tidal turbine depends on marine current velocity and water depth. Diffuser acts as a flow amplifying device to accelerate incoming flow velocity and inlet nozzle help the flow to enter smoothly. Adding a brim to the diffuser which created a large scale separation vortex to the rear of the brim; thus, the backpressure coefficient greatly decreased. To increase the

water flow velocity, a lower pressure would appear at the back of the turbine to act as a vacuum to suck the water flow and accelerate it towards the blades as shown in Fig 1.

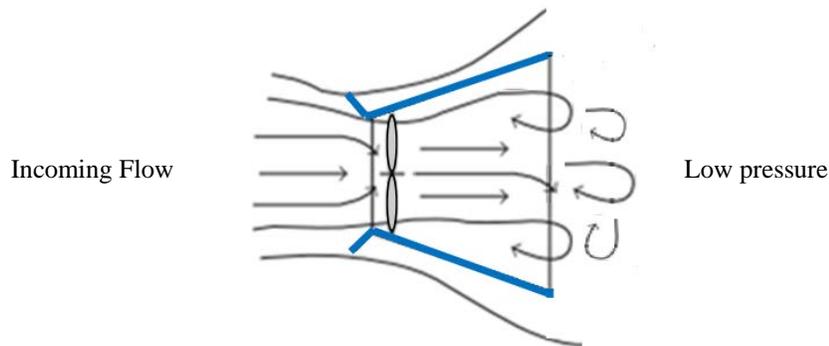


Fig 1. Drop pressure effect of inlet-nozzle diffuser

The concept of diffuser is to increase the power output of hydrokinetic turbine by accelerating the flow velocity that approaches the turbine. To get optimum increased acceleration on the water speed, the pressure inside the hydrokinetic turbine should not be lower than the pressure at the wake of the diffuser. The diffuser is such that more water flows through the blade plane, and more power can be generated compared to a conventional 'bare turbine' of the same rotor blade diameter. Fig. 2 shows stream tubes passing through with and without diffuser turbine.

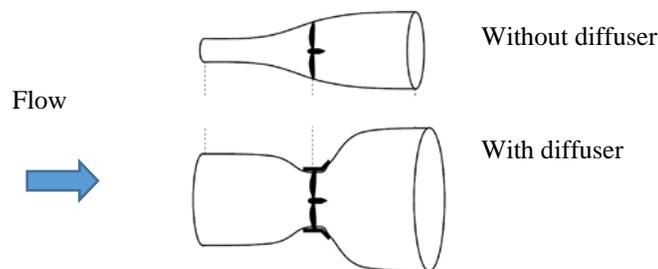


Fig 2. Stream tubes passing through with and without diffuser turbine

*B. Hydrokinetic axial flow turbine design parameters*

The energy flux contained in water streams depends on the density of the fluid, cross-sectional area and fluid velocity. The stream power is

$$P_w = \frac{1}{2} \rho A V_w^3 \tag{1}$$

The turbine extracted power and electrical output power are

$$P_t = C_p P_w \tag{2}$$

$$P_e = C_p \eta_m \eta_g P_w \tag{3}$$

Where  $P_w$  is water stream power,  $P_t$  is turbine extracted power,  $P_e$  is electrical output power and  $C_p$  is power coefficient.

The rated water current velocity is 1.5 m/s, the mechanical and generator efficiency are 0.85 and 0.9, water density,  $\rho$  is 997 kg/m<sup>3</sup> (at 25°C). The length of the blade is equal to 0.3279 m. Subsequently, given the rotor design parameters (e.g., rotor diameter, tip speed, hydrofoil and water current velocity, among others), the main task of the blade design is to determine the chord and twist distributions along the span of the blade. Tip Speed Ratio ( $\lambda$ ) is ratio of the speed of blade at its tip to the speed of incoming flow and is considered one of the important parameter.

$$\lambda = \frac{U}{V_w} \tag{4}$$

Hence, power coefficient is the ratio of power produced by hydrokinetic turbine to power available in water stream:

$$C_p = \frac{\text{Power produced by turbine}}{\text{Power available in water stream}} \tag{5}$$

C. Diffuser Augmented Hydrokinetic Axial Flow Turbine with Inlet-Nozzle

The diffuser augmented hydrokinetic axial flow turbines extract more energy than conventional turbines alone. These turbines are more efficient due to flow manipulation and elimination of tip losses. The diffuser augmented hydrokinetic axial flow turbines are smaller in size for the same power. The designed turbine has three blades. The blades have SG-6041 hydrofoil profile. The rotor diameter is 656 mm. The tip gap was kept as small as practically possible i.e. 5-10 mm. The design specifications of the ducted wind turbine model are given in Table 1. Fig. 3 illustrates geometric parameters of inlet-nozzle diffuser.

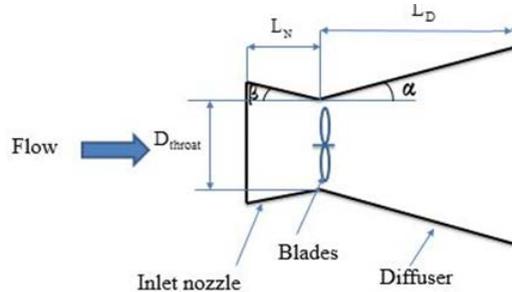


Fig 3. Geometric parameters of inlet-nozzle diffuser

Table 1. Design specifications of the hydrokinetic axial flow turbine with inlet-nozzle diffuser model

Sr.No	Item	Symbol	Value	Unit
1	Nozzle Length	$L_N$	0.2	m
2	Diffuser Length	$L_D$	0.61	m
3	Throat Diameter	$D_{throat}$	0.676	m
4	Rotor Diameter	$D_{rotor}$	0.656	m
5	Inlet-nozzle angle	$\beta$	5,10,15,20,25,30	degree
6	Diffuser angle	$\alpha$	5,10,15	degree

III. NUMERICAL ANALYSIS

A. Simulation Process for Inlet-nozzle Diffuser

(i) Domain Specification and Meshing

In this study, inlet-nozzle angles are varied at (5°, 10°, 15°, 20°, 25°, 30°) and diffuser angles are (5°, 10°, 15°) respectively. Diameter of throat, diffuser length and inlet-nozzle length are fixed. Diffuser model is prepared using AutoCAD as shown in Fig.4. Numerical simulations for different angles of inlet-nozzle diffuser were performed to analyze flow characteristics by deploying an unstructured grid finite volume methodology using commercial CFD software (ANSYS CFX 17.0). The accuracy of results produced through a CFD calculation is reliant upon the mesh that is provided for analysis. Basic meshing techniques consist of a structured or unstructured mesh comprised of one of several element types. In this research, the mesh statistics are 106,608 nodes, 553,620 elements. Fig.4 (a) shows the geometry of inlet- nozzle diffuser and Fig.4 (b) shows the mesh of inlet- nozzle diffuser.

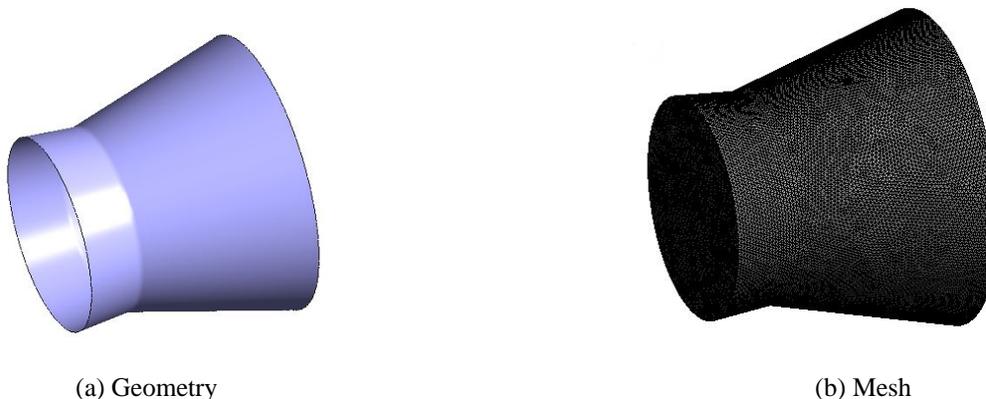


Fig 4. Geometry and mesh of inlet- nozzle diffuser

(ii) Boundary Condition

Boundary condition is velocity inlet of 1.50 m/s and pressure outlet of 1 atm as shown in Fig.5. k-ε turbulence model is used due to its good performance for predicting boundary layer separation with adverse pressure gradient.

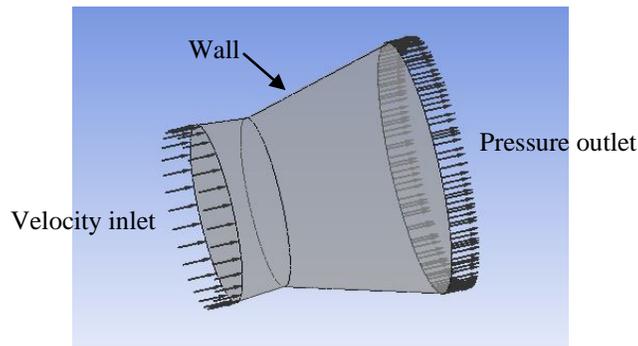


Fig 5. Boundary condition of inlet- nozzle diffuser

(iii) Simulation Domain and Results

The CFD analysis provides a detailed information and visualization of water flow over inlet-nozzle diffuser. These outcomes approve the wonder of speed increment at diffuser throat when inlet-nozzle diffuser is utilized. Velocity of stream field is acquired from contours as shown in Fig.6 (a) to (f) and the velocity increase with inlet-nozzle angles.

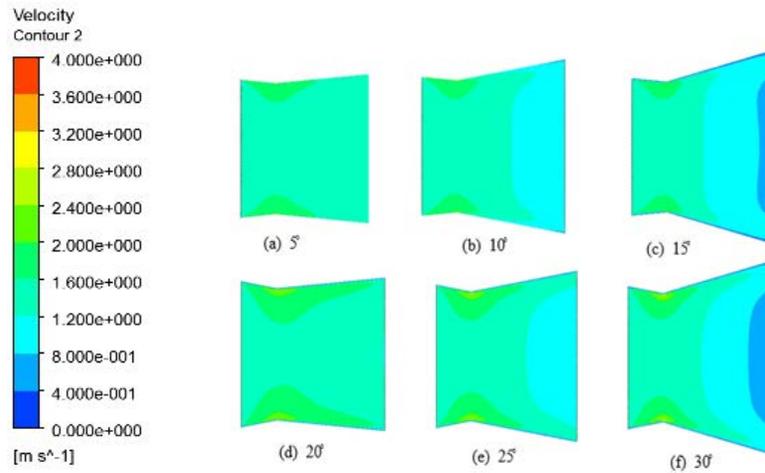


Fig 6. Velocity contours for diffuser angle 5° and inlet- nozzle angle 5°-30°

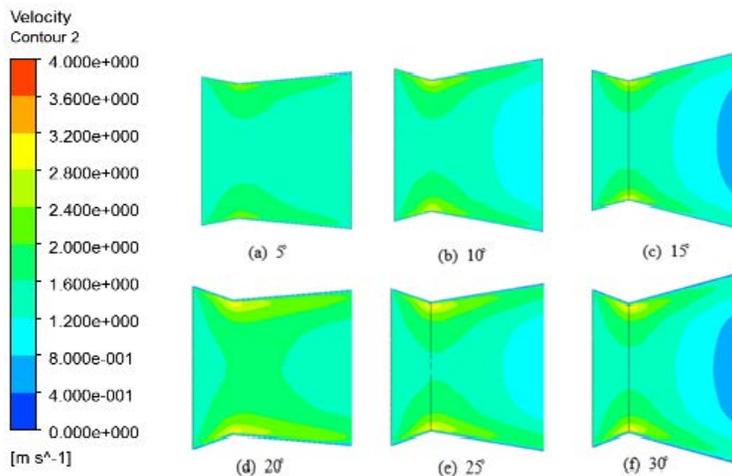


Fig 7. Velocity contours for diffuser angle 10° and inlet - nozzle angle 5°-30°

The velocity variation of diffuser angle 10° and inlet - nozzle angle 5°-30° are described in Fig. 7 (a) to (f). According to the figures, the velocity at the throat is higher than other locations.

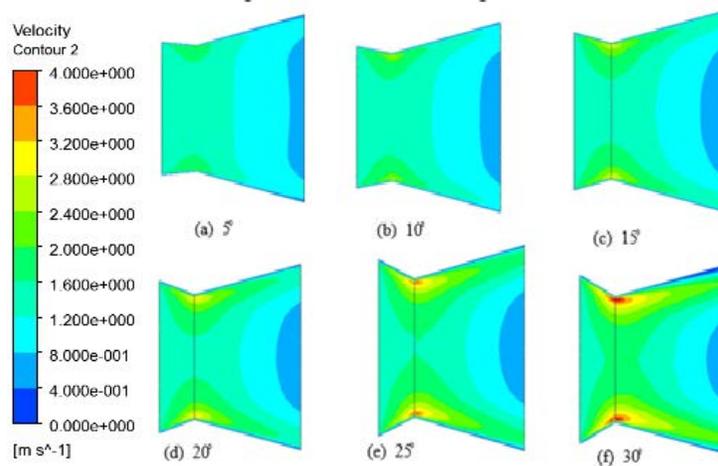


Fig 8. Velocity contours for diffuser angle 15° and inlet-nozzle angle 5-30°

Fig.8(a) to (f) show velocity contours for diffuser angle 15° and inlet-nozzle angle 5-30°. According to the velocity contours, the greater inlet-nozzle angle cause the higher inlet water velocity. It was observed from this analysis that inlet-nozzle can direct and provide smooth flow direction to the blades and also increase the velocity.

Table 2. Velocity variation at the throat with inlet-nozzle and diffuser angles

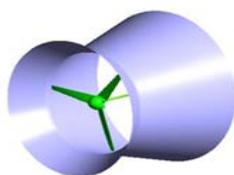
Nozzle angles	Diffuser angles		
	5°	10°	15°
	Maximum velocity(m/s)	Maximum velocity(m/s)	Maximum velocity(m/s)
5°	1.61	1.69	1.6
10°	1.81	1.78	1.76
15°	1.89	2.63	1.97
20°	2.81	2.77	3.03
25°	3.5	3.53	3.52
30°	3.53	3.56	4.03

After performing the simulation for the diffuser design, it was found that diffuser with greater angle was shown the highest increment of water velocity because of low pressure. These simulation results show that the throat of inlet-nozzle diffuser has the highest flow velocity region which optimal position for the rotor blades in order to get an efficient design of diffuser augmented hydrokinetic axial flow turbine with inlet-nozzle. It is noted that nozzle and diffuser angle (30°, 15°) has the greatest velocity magnitude at the throat as shown in Table 2. This aspect results in a higher efficiency of the turbine.

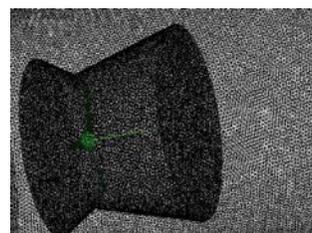
*B. Simulation Process for Hydrokinetic Axial Flow Turbine with Inlet-nozzle Diffuser*

A small scale hydrokinetic axial flow turbine model is considered for the present numerical investigation. The rotor diameter of the turbine is 0.66 m for power output 200 W and the clearance between rotor and diffuser throat section is set to have 5 mm. The optimal design of inlet-nozzle diffuser (30°, 15°) is attached to the turbine.

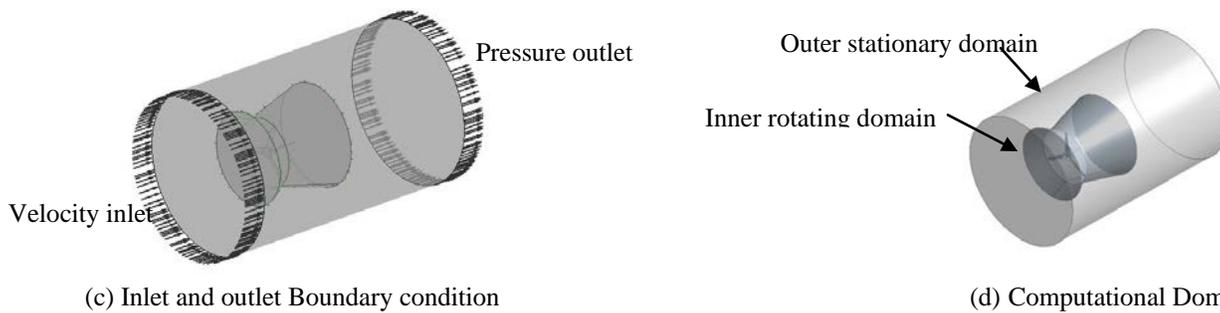
(i) Computational Domain and Mesh



(a) Geometry



(b) Mesh



(c) Inlet and outlet Boundary condition (d) Computational Domain  
 Fig 9. Geometry model, computational domain and mesh of hydrokinetic axial flow turbine with inlet-nozzle diffuser  
 Fig.9 (a) shows the geometry of hydrokinetic axial flow turbine with inlet-nozzle diffuser. The mesh statistics of hydrokinetic axial flow turbine with inlet-nozzle diffuser are shown in Fig.9 (b) and it has 103, 945, 8 nodes and 123, 610, 64 elements. The dimension of outer cylindrical domain is four times of rotor diameter and length is eight times of rotor diameter. Inlet and outlet boundary condition and computational domain are as shown in Fig 9(c) and (d). An unstructured tetra mesh is formed in the flow domain for computations.

(ii)Boundary Conditions

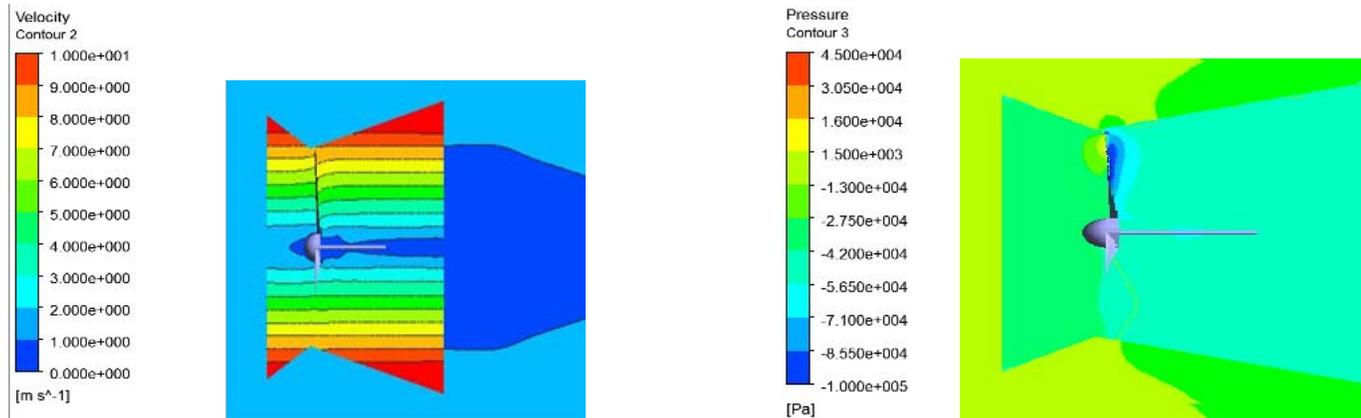
In the computational domain entrance, a uniform velocity profile equal to 1.50 m/s was defined. Standard wall functions with no-slip boundary condition are applied on the surfaces of turbine, hub, shaft, inlet-nozzle diffuser, etc. At the domain output, pressure 1 atm was applied. Additionally, a general frozen rotor interface connection between the rotational and the stationary domain was used. The k-ε turbulence model has been shown to give good performance for flows with pressure gradients such as those appearing in the diffuser augmented hydrokinetic axial flow turbine flow configuration. Details of the boundary conditions are shown in Table 3.

Table 3. Boundary conditions for Simulation Process

Sr.No	Item	Symbol	Value	Unit
1	Density	$\rho$	997	kg/m <sup>3</sup>
2	Pressure	p	101.3	kPa
3	Rotor radius	R	0.3279	m
4	Water velocity	$V_w$	1.5	m/s
5	Rotor angular velocity	$\omega$	27.22	rad/sec
7	Residual error	-	$1 \times 10^{-4}$	-

(iii) Simulation Domain and Results

Numerical simulation of flow field around hydrokinetic axial flow turbine is carried out by ANSYS CFX and the simulated results significantly predict the effect of diffusing passage and inlet-nozzle effect around the rotor blades as shown in Fig 10.



(a) Velocity Contour

(b) Pressure Contour

Fig. 10(a) describes velocity contour, (b) show pressure contour and (c) describes velocity vectors for side view and top view. According from the figures, the incoming velocity starts increasing at the inlet-nozzle and the velocity of the blade tip is higher than that of root. It can be observed from the pressure contour that pressure drop occur across the diffuser. This pressure drop indicates power extracted by the rotor causing its rotation.

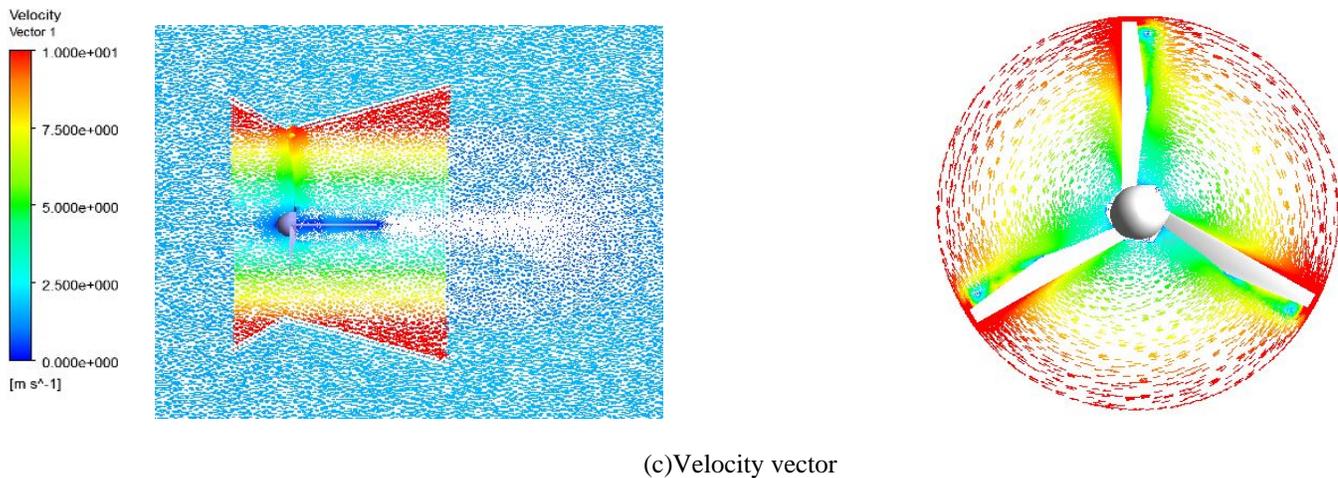


Fig 10. Effect of inlet-nozzle and diffuser in the flow field around the turbine

From the analysis and study on the characteristic of the flow, it was realized that inlet- nozzle can direct and provide a better flow direction and streamlines towards the rotor blades and the diffuser creates the low pressure region that more water flows through the blade plane, and more power can be generated.

#### IV. RESULTS AND DISCUSSIONS

This research demonstrates the effect of inlet-nozzle and diffuser in flow field of the hydrokinetic axial flow turbine. It is observed that inlet-nozzle diffuser can give high velocity so that turbine power output is increased because power generated by turbine is directly proportional to the cube of velocity. From this flow simulation, it is found that when inlet-nozzle diffuser is applied on bare turbine, it produces smooth inlet flow towards the rotor blades and lower pressure region behind the turbine .Due to this pressure region gives significant increase in mass flow rate available for the turbine and also it produces 44 % increase in power output than bare turbine. Table. 4 shows results of simulation process.

Table 4. Results for CFD analysis

Turbine	Velocity(m/s)			Power Output (W)
	inlet	center	outlet	
Without diffuser	1.8	2	2.2	210
With inlet nozzle diffuser	2.4	3	3.1	288

#### V. CONCLUSION

Based on the validated CFD method, the flow analysis of proposed hydrokinetic axial flow turbine with inlet-nozzle diffuser around the flow field i.e. pressure and velocity distribution was performed. This study also provided the useful information and technical data for efficient diffuser design which can be used in low water speed conditions. The function of the diffuser is to help accelerate the flow velocity. In this research, the optimal inlet-nozzle and diffuser angles (30°, 15°) was observed to install the small scale hydrokinetic axial flow turbine. This study is regarding the improvement of hydrokinetic power system with more output, aims at determining how to collect the hydro energy effectively and which kind of hydrokinetic turbine can generate energy efficiently from

the water stream. According to the numerical results, the power output was increased from 200 W to 288 W due to the effect of inlet-nozzle diffuser for the hydrokinetic axial flow turbine. The findings of this research can provide more efficient way for small scale hydropower in remote area.

#### ACKNOWLEDGEMENT

The author wishes to express her deep gratitude to Dr. Sint Soe, Rector of Mandalay Technological University for his valuable suggestions and guidance. The author would like to thank to Dr. Htay Htay Win, Professor and Head of Mechanical Engineering Department, Mandalay Technological University, for her valuable guidance and comments for preparation of the research. And also special thanks to all teachers from Mechanical Engineering Department at Mandalay Technological University for their valuable supervision, guidance and encouragement throughout this paper. The author would like to express her deepest gratitude to her parents.

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# Technical Factors Influencing Integration of Health Management Information Systems in the Health System in Kenya

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DOI: 10.29322/IJSRP.8.8.2018.p8021

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8021>

**Abstract-** The Ministry of Health in Kenya rolled out on HMIS policy in the year 2010. The policy directed that healthcare organizations in Kenya should shift from paper-based health information system to electronic integrated health information systems. However research indicates that HMIS in Kenya are to a large extent still paper based 8 years later. This paper addresses the impact of technical factor on the integration of HMIS. Moreover it also tests whether human infrastructure, IT infrastructure and systems interoperability have an impact on integration of HMIS. Data from a sample of 243 HMIS users were collected and analyzed. Results indicate that technical factor is positively related to integration of HMIS. Whereas a significant relationship was found between human infrastructure, IT infrastructure and systems interoperability. The critical link to integration of HMIS was found to be in systems interoperability, meaning that the more the Health Management Information Systems become interoperable the more likely integration of HMIS is likely to be attained.

**Index Terms-** Integrated health management information system (IHMS); Health System Strengthening; Human Infrastructure; Systems interoperability; Information Technology infrastructure

**ABBREVIATIONS-** Integrated Health Management Information System (IHMS); Community Unit (CU); Community Health Workers (CHWs), Community Health Volunteers (CHVs); Government of Kenya (GoK), Health Management Information System (HMIS), Ministry of Health (MoH), Healthcare Organization (HCO), Statistical Package for Social Sciences (SPSS), World Health Organization (WHO), District Health Information System 2 (DHIS2); Low and Middle income Countries (LMIC); (IT) information technology

## I. INTRODUCTION

Embracing modern technology is reasonably key today, when aiming at improving efficiency and reducing operational costs within a health system. While the integration of information systems and health services, potential benefits cannot be disputed, there are many challenges which affect its adoption. In

fact, majority of organizations have abandoned their newly acquired information systems only to go back to their old manual system. This study examined the extent the three identified technical factors influence Integration of HMIS. They include **i)** IT infrastructure which can be divided into two related but distinct components as technical and human infrastructure. Technical infrastructure is a set of shared, tangible IT resources forming a foundation for business applications (hardware, software and data), **ii)** Human infrastructure includes human and organizational skills, expertise, knowledge, commitments, values and norms. Availability and adequacy of both technical and human infrastructure must be ascertained up-front. It addresses the basic question of whether the information system will work in a technical sense (Odhiambo-Otieno, 2005b). **iii)** System interoperability is the ability of different information systems to communicate, exchange data and use the information that has been exchanged.

Human infrastructure determines human users, such as network administrators (NA), developers, designers. Generic end users with access to any IT appliance or service are also part of human infrastructure, specifically with the advent of user-centric IT service development. Their information needs should be determined upfront. In a study done in Malawi a good information system needs to establish a comprehensive system capable of feeding information to the users at community, health facility, district and national levels (Chaulagai et al., 2005a). All health workers should be oriented on information management and use through trainings. Data requirements should be chosen taking into account the technical skills of the health workers collecting the data, or the available diagnostic equipment in peripheral health facilities. During the designing and implementing of health information, health workers should be involved in the process (Chaulagai et al., 2005a; Odhiambo-Otieno, 2005b). There is a general lack of right capacity in developing countries especially for statistical analysis. Lack of computer literacy and brain drain is also a problem because most of the healthworkers have never used a computer. (Wave, 2009). Therefore, developing IHMSs continues to be a challenge as reported by (Aladdin et al., 2014). Implementations of health information systems has frequently cause unintended

consequences including communication issues, creation of new or more work, and even adverse events such as medical errors. Unintended consequences occur for several reasons including poor fit with clinical workflow, differences in needs between different user groups (that is clinicians and administrators) or the co-existence of paper based and automated processes. The gap between HISs can be taken care of by integration. Constructing effective integrated systems necessitates an understanding of operative work flow and technical considerations as well as achieving interoperability with existing information system (Wanderer & Ehrenfeld, 2013)

The solution is to ensure that the health sector partners involved in the collaboration will be able to work altogether in order to constitute a coherent and homogeneous set of HMIS. The growing chain of healthcare providers results in the need to share and exchange such data according to (Otjacques, Hitzelberger and Feltz, 2007). The collection and sharing of data, however, is affected by privacy concerns, organizational and technical issues have to be solved and taken into account.

### 2.3.1 Information Technology Infrastructure

IT infrastructure refers to the composite hardware, software, network resources and services required for the existence, operation and management of an organization IT environment. It allows an organization to deliver IT solutions and services to its employees, partners and/or customers and is usually internal to an organization and deployed within owned facilities. IT infrastructure consists of the following components: i) Hardware: Servers, computers, data centers, switches, hubs and routers, etc. ii) Software: Enterprise resource planning (ERP), customer relationship management (CRM), productivity applications and more iii) Network: Network enablement, internet connectivity, firewall and security.

Most LMIC use paper-based data collection processes at primary healthcare level and paper and computer-based health information systems at country level (Haux *et al.*, 2007). However, paper-based information systems are often found to generate data with poor quality and are underutilized within the health information management (Lium, Tjora, & Faxvaag, 2008). This affects the integration of data, hence the design of a system matters a lot.

The technical factors are critical to organizations in their adoption decision of internet-based, inter-organizational information systems (IBIS) include establishing costs, network reliability, data security, scalability and complexity (Bouchbout & Alimazighi, 2008; Soliman and Janz, 2004).

The data flowing through the system are extremely valuable, hence data quality, security among other factors are important technical factors for successful implementation (Fenz, Heurix, Neubauer, & Pechstein, 2014). Hardware and software reliability is another factor to be considered for the success of the system, reliability consists of the accuracy of the data, adequate maintenance of the system and the capability of the hardware (Chaulagai *et al.*, 2005b; Lippeveld, Sauerborn, Bodart, & World Health Organization, 2000). The study by Craighead, Patterson, Roth, & Segars, 2006, related reliability of the Electronic Data Interchange (EDI) system with the frequency of downtime that may lead to a lack of faith in the system. Therefore for success, the system should be free from unplanned down-time.

### 2.3.2 Information Systems Interoperability

Complexity of the software has been studied extensively by various researchers and they have concluded that there exists a negative relationship between complexity of the software and successful implementation of these systems. According to Petter, DeLone and McLean, 2008, the information systems for Health System should be accessible, compatible, user-friendly, stable and reliable, requiring minimal training and offering strong after-sales service. The system quality features included in the studies were ease of use, ease of learning, system accuracy, flexibility, sophistication, integration capability and customization. They further included information quality features, such as, usability, understandability, relevance and conciseness.

Eze, Awa, Okoye, Emecheta and Anazodo (2013), stressed that data processing, technical, and electronic standards are essential if an equipment is to be able to interconnect, and that data definitions (standards) and terminologies will be essential if health professionals across different organizations are to communicate. It involves systems configuration, interface development, data standardization and conversion, testing and performance management.

Systems interoperability is also a crucial organizational capability that enables firms to manage information systems (IS) from heterogeneous trading partners in a value net-work (Zhao & Xia, 2014). Inter-organizational systems (IOS) standards are a key information technology infrastructure facilitating formation of interoperability. As an organizational ability to work with external trading partners, interoperability's development depends not only on capability building within firm boundaries but also on community readiness across firm boundaries. (Zhao and Xia, 2014) emphasizes in their finding that interoperability acts as a mediator by enabling firms to achieve performance gains from IOS standards adoption. Consequently, it is crucial for firms to become interoperable in order to coordinate and co-create value with their partners. Interoperability is possible only when a common language is used by various IS, despite heterogeneity in software, hardware, and system architecture. IOS standards contribute to interoperability by providing "shared business terms, functions, processes, and protocols. (Zhao and Xia, 2014) argue that IOS standards adoption enables firms to develop interoperability. Specifically, interoperability is developed via two different paths. The first path is internal capability building. The organizational capability literature suggests viewing capabilities as a hierarchy, noting that simpler capabilities are needed to build more complex ones. Thus, identify standardized data infrastructure (SDI) as a simpler ability built from IOS standards adoption, which can be used as a basis for developing interoperability. The second path considers community readiness across firm boundaries. If the same standards have been accepted by more trading partners, achieving interoperability in dynamic value networks becomes easier. The proposed IHMIS would be in charge of managing (i) information, (ii) functions and (iii) processes among the information systems (IS) of partner organizations involved in the network (Benaben, Boissel-Dallier, Pingaud, & Lorre, 2013). Healthcare Organizations are strongly dependent from their ability to successfully manage collaborations and to assume the involved interoperability functions: exchange of information, coordination of business functions and driving of processes. Therefore (Benaben *et al.*,

2013; Lu, Panetto, Ni and Gu, 2012) recommend considering that crucial position of IHMIS and computed systems, the interoperability functions must be supported by these System.

## II. MATERIALS AND METHODS

A mixed method research design was adopted to determine the factors that influence Integration of HMIS in Mombasa (urban), Kiambu (peri-urban) and Kitui (rural) Counties. A list of all registered community units and health facilities within Kitui, Kiambu and Mombasa Counties was obtained from MoH website as at 15<sup>th</sup> August 2016. The study targeted health organization in-charges and persons responsible for health information management at Tier 2 and 3, and community unit chairs and a CHV at tier 1. Tier 2 refers to the primary care services which comprise dispensaries, health centres and maternity homes and Tier 3 refers to the County referral services, which comprise the former sub-district and district hospitals (MOH, 2012). The total target population was (144\*2) 288 respondents. The sample frame of the study included a representative sample of the health facilities in the different counties. At least 30% of the total population is representative (Borg & Gall, 2003). Thus, 30% of the accessible population was enough for the sample size. Purposive sampling was used to choose the most appropriate respondents constituting a sample size of 104 Government of Kenya (GoK) owned health care organizations selected from a population of 144 GoK HO in Mombasa, Kiambu and Kitui Counties. In facilities where health information and records officers were not available, the in-charge guided the researcher in identifying the most appropriate respondent.

Two instruments (a semi-structured questionnaire and a Key informant interview guide) was designed to measure constructs and factors affecting the integration of HMIS, based on information from past studies and the literature. The questionnaire contained 143 items developed by the researcher, the KII had 10 questions. The face and content validity of the instrument were established by experts from various universities across Kenya chosen based on their knowledge in health informatics and management, public health and business information technology as recommended by McDermott and Sarvela (1999). They reviewed the instruments for ease of use, understandability, relevance, wording, grammar, spelling, readability, and flow. Based on their recommendations, changes were made with wording and items were added or deleted. After revisions were made on the instrument, approval was obtained from the university's institutional review board, the data tools were pretested (n= 31) to check internal consistency. Reliability was established using Cronbach's alpha, attaining a standardized alpha of 0.703.

For the main study, 243 consenting participants were visited in their different working stations and requested to complete the questionnaire. 6 key informants participated in the interviews. Data was analyzed using SPSS and content analysis.

## III. RESULTS

A total of 243 respondents representing 104 health organizations across the three tiers of the health system in three counties participated in the study. Table 1.2 below tabulates the total respondents per tier per county and Table 1.3 describes the demographic characteristics of the respondents.

**Table 1: 1: Tier/Level of operation \* County of operation  
 Cross tabulation**

	County of operation			Total
	Kiambu	Mombasa	Kitui	
Tier 1	20	12	23	55
Tier 2	43	29	37	109
Tier 3	13	27	39	79
Total	76	68	99	243

**Table 1: 2: Demographic characteristics of the respondents**

Characteristics	N=243	
	n	%
	Frequency (n)	Percent (%)
Age		
18-24	6	2.5
25-35	97	39.9
36-45	85	35
46-55	33	13.6
Above 55 years	22	9.1
Total	243	100
Highest certificate of education attained		
Primary School Certificate	30	12.3
Secondary School Certificate	32	13.2
Diploma Certificate	144	59.3
University Degree Certificate	37	15.2
Professional training		
Nurse	91	37.4
Hospital Administration	19	7.8
CHV	54	22.2
Clinical officer	29	11.9
HRIO	27	11.1
Lab Technologist	10	4.1
Medical officer	4	1.6
Nutritionist	4	1.6
Pharmaceutical technologist	5	2.1
Working Experience		
1-10 years	162	66.7
11-20years	49	20.2

21-30 years	21	8.6
31-40 years	9	3.7
Over 40 years	2	0.8

The study aimed to identify technical factors influencing integration of HMIS. Three indicators were addressed; Human Infrastructure, Information Technology infrastructure and systems interoperability. Table 1.4 indicates the means and standard deviations as well as median and mode for all technical factor items.

Table 1.4 implies that all the 243 respondents participated in giving their opinions on this variable. Respondent's average agreement score that they had adequate and qualified human resource was 23.9, average agreement score that their organizations had a good Information Technology infrastructure was 6.9 and average agreement score that the health information systems were interoperable was 19.5. These findings imply that information technology infrastructure was the weakest so was the systems interoperability. The human infrastructure however had a moderate score. This finding implies that information technology infrastructure was the weakest hence systems interoperability became automatically a challenge. The human infrastructure however had a moderate score. The overall analysis on technical factor shows an average agreement score of 50.3 influence meaning there is an attempt to employ technical factor in public facilities however more efforts needs to be made.

**Table 1. 4: Mean and Standard Deviation of the Technical factors**

	Human Infrastructure	Information Systems Technology Infrastructure	Systems interoperability	Technical factor
N	Valid 243	243	243	243
	Missing 0	0	0	0
Mean	23.8519	6.9465	19.4856	50.28
Median	24.0000	6.0000	20.0000	49.00
Mode	22.00	6.00	20.00	48.00
Std. Deviation	3.79466	2.47492	2.71109	7.047

**4.3.1 Test of Hypothesis**

H0: Technical factor was likely not to have an effect on integration of HMIS. This hypothesis intended to test whether there was any significant influence of technical factor on integration of Health Management Information System. The hypothesis H01:  $\beta_1 = 0$  Versus H1= $\beta_1 \neq 0$  was tested. Results in Table 1.5 shows a significant, strong and positive relationship between technical factor and integration of HMIS ( $r = .770^{**}$ ,  $P = .000$ ). This led to rejection of the null hypothesis (H0) and the acceptance of alternative hypothesis (H1). This study, therefore, concludes that technical factor has a significant positive relationship with the integration of HMIS.

Study findings on the specific factors identified in this study also indicated that: Human Infrastructure ( $r = .557^{**}$ ,  $P = .000$ ), IT infrastructure ( $r = .635^{**}$ ,  $P = .000$ ), System

Interoperability ( $r = .644^{**}$ ,  $P = .000$ ) were all were positively and significantly influencing integration of HMIS. The findings indicated that the strongest correlation under the technical factor was between Systems interoperability and integration of HMIS.

**Table 1.5: The relationship between technical factor and integration of HMIS**

	n=243	
	Integration of HMIS	P-Value
Human Infrastructure	.557**	0.000
IT Infrastructure System	.635**	0.000
Interoperability	.644**	0.000
Technical factor composite	.770**	0.000

\*\* Correlation is significant at the 0.01 level (2-tailed).

Results in Table 1.6 show the F-ration is 351.9 which is significant  $P < .001$ . This result implies that we reject the null hypothesis and accept the alternative hypothesis. Therefore, the study concludes that the technical factor is a good predictor of integration.

**Table 1.6: Technical Factor and Integration of HMIS: Model Validity**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	73712.28	1	73712.2	351.9	.000 <sup>b</sup>
Residual	50471.59	241	209.426		
Total	124183.8	242			

a. Dependent Variable: Integration of HMIS

b. Predictors: (Constant), Technical Factor

The study further revealed that Technical factor explains 60.9% of the total variations in the integration of HMIS ( $R^2 = .609$ ), as indicated in Table 1.7. The coefficients in the regression model as shown in Table 1.7 indicate that technical factor will always exist at a certain minimum ( $\beta_0 = 50.034$ ,  $P = .000$ ). However a change in the technical factor also remained positive and significant, in this case  $\beta_1$  as indicated in table 1.7 show that the change will also increase integration by 2.476. This implies that when the technical factor improves, the integration of HMIS will also improve.

**Table 1.7: Technical Factor and Integration of HMIS: Regression Weights**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
(Constant)	50.034	6.702		7.465	.000
1 Technical Factor	2.476	.132	.770	.609	18.761

a. Dependent Variable: Integration of HMIS

The study further broke down the specific technical factor parameters and subjected them to multiple linear regression analysis and all the parameters were predictive of integration of HMIS as shown in Table 1.8. Results indicate that Human Infrastructure, IT infrastructure and System Interoperability in a combined relationship still remained as good predictors to improved integration of HMIS if they were improved. Therefore the increase in any unit of the specific variables would also lead to an increase in the integration of HMIS. Results indicate that a higher increase in the integration of HMIS would occur if IT infrastructure improved. This is an indication that IT infrastructure is quite fundamental in the success of integration of HMIS.

**Table 1.8: Specific Technical factors predictors with integration of HMIS**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
(Constant)	55.262	7.603		7.269	.000
1 Human Infrastructure	1.808	.268	.303	6.750	.000
IT infrastructure	3.317	.441	.362	7.516	.000
System interoperability	2.726	.418	.326	6.519	.000

a. Dependent Variable: Integration

The Key Informant Interview with the Sub County and county management team member's results confirmed what most of the respondents had pointed out. There was shortage of human resources in most of the facilities, health workers were mostly overloaded with work. There was general lack of capacity in analysis and interpretation of data. The county was making attempts to conduct on-job trainings however they were not intensive due to lack of resources. A skilled work force is an essential ingredient for effective integration of HMIS in healthcare. Systems professions, service providers and team leaders in HMIS activities with high skills levels and experience in an organization are important components. However as

reported by one of county HRIO most of the healthcare facilities lacked team leaders for HMIS activities. The in-charges are left to handle HMIS activities yet they have other responsibilities which are more core to them.

The KII respondents agreed that the management teams were aware they needed to put up a budget to improve on Information Technology Infrastructure in their counties and plans were underway. There was also an agreement that there was need to automate and standardize the manual HMIS, there is need to involve the healthcare personnel in the identification of HMIS activities, ensure internet connectivity is enabled in the healthcare facilities, however the challenge was resources. The need to increase the number of computers and ICT systems was identified. More so the respondents felt there was need for the health system to build more capacity in Health Information Managers who can keep truck on the current and future technology needs.

#### IV. DISCUSSION

Technical factors include both technology and human infrastructure. These are resources that any management uses to achieve its goals. Management of the health system is largely affected by how well a health institution has matched its health workers knowledge and understanding about the job and also the ability to use the tools availed to them to make their work easier so that the production levels increases. HO can perform better with quality and resourceful people. Developing IHMIS continues to be a challenge as found in this study. This findings agree with the findings of (Aladdin *et al.*, 2014; Wanderer & Ehrenfeld, 2013; Zhao&Xia, 2014). The major challenge with IHMIS is inadequate use of ICT in healthcare and unskilled health workforce. Investment in capacity development and training in technological, communication and content development of skills will ensure more successful integration of HMIS.

Unreliable power supply and internet connectivity is a problem in all the three counties. The counties need to deal with enabling fiber network, access to reliable power supply, backups, and insufficient infrastructure. The better these things are functioning the greater the chance for successful HMIS integration.

The findings on the influence of Human infrastructure, Systems Interoperability and IT infrastructure regression analysis show that the three technical factors are significant. This study, therefore rejects the null hypotheses and concludes that human infrastructure, systems interoperability and IT infrastructure have significant effect on the Integration of HMIS. The study findings revealed that most of the data collection and reporting tools were paper based, this therefore greatly hinders interoperability, this findings agree with Aladdin *et al.*, 2014 who reported that due to the co-existence of both the manual and automated processes unintended consequences arise due including communication breakdown, creation of more work and even adverse events such as medical errors. This therefore makes it difficult to achieving interoperability with existing information systems. This implies that systems interoperability is a crucial organizational capability that enables firms to manage information systems. This study therefore proposes adaptation of the two critical paths identified

by (Zhao and Xia, 2014) that are important in enabling interoperability. They include, standardizing data infrastructure and creating community readiness to adopt change. Therefore this study findings recommends that healthcare organizations in Kenya need to build collaborations in exchanging information, coordination of their business function and process. If this is acceptable among the healthcare providers then achieving interoperability and value networks becomes easy.

Results from regression analysis in Table 1.7 and 1.8 a multiple regression reveals that the technical factor has an influence on the Integration of HMIS. This implies that the HO need to examine and re-adjust their technical factor to be in line with the changing healthcare environment and realign with the new technical factor requirements for integration of HMIS to be achieved. Technical factor is a dynamic capability and the HO that are able to adjust their technical factor to the new changes will be able to achieve better results in their facilities. This findings are in line with conclusions made by (Petter, DeLone and McLean, 2008) who reported that the information systems for Health System should be accessible, compatible, user-friendly, stable and reliable, requiring minimal training and offering strong after-sales service. This study observes the need to have systems that are easy to use, easy to learning, system accuracy, flexibility, sophistication, integration capability and customization.

The findings in this study are in line with the findings of earlier scholars who did studies aimed at linking technology to HMIS. This study confirms the work done by Eze, Awa, Okoye, Emecheta and Anazodo (2013) who emphasized that technological factor is a key factor in IHMIS and it is unavoidable for HO that want to develop and maintain effective management in line with the current market. The researcher maintained that technology adoption is crucial for improved management of the health system.

Health professionals across different organizations need to understand data processing process, equipment in use, be knowledgeable and skilled for integration of HMIS to be achieved. As (Aladdin *et al.*, 2014) found out that unintended consequences arise when adapting to IHMIS if employees are not well informed about this systems such issues include communication, creation of new or more work, and even adverse events such as medical errors when they do not understand the systems.

Systems interoperability is a crucial organizational capability that enables firms to manage information systems (IS) from heterogeneous trading partners in a value net-work (Zhao & Xia, 2014). Developing IHMISs continues to be a challenge as reported by (Aladdin *et al.*, 2014), this is confirmed by the findings of this study because internet connection, power issues and availability of computers was a big challenge in the HO studied. He also reported that most LMIC use paper-based data collection processes at primary healthcare level and paper and computer-based health information systems at county level, this is a great hindrance to integration of HMIS. This report is in agreement with the study findings.

The study found statistical evidence that technical factor positively and significantly influences the integration of the HMIS. Technical factor accounted for (60.9%) of the total variation in integration of HMIS, it had the highest influence on

integration of HMIS. Study findings also showed that an increase in one unit of the technical factor would increase integration by 24.76%. Under the technical factor, Systems interoperability was found to have the strongest association with integration of HMIS. Therefore the study concludes that it is okay for a health care organization to adopt a health information systems that meets their needs however it is important for the system to be flexible and interoperable with other systems. Petter, DeLone and Mclean, (2008) emphasizes that information systems should be accessible, compatible, user friendly, stable and reliable. Unreliable system with frequency of downtime leads to lack of faith in the system. Therefore the systems adopted should be reliable.

## V. CONCLUSION

It can be concluded that technical factor of a healthcare organization is an important variable that explains, to a great extent, the variation in integrating HMIS in Kenya. Therefore Integration of HMIS in Kenya can be achievable if all the identified study variables were taken into account and improved. The main reason as to why integration of HMIS in Kenya Healthcare organization has not been achieved is because paper based information systems are still greatly in use, therefore hindering systems interoperability. Internet connectivity, power, skilled staff, computer hardware and software are still inadequate in the facilities in Kenya, yet technical factor is the foundation of getting health management information systems integrated. This means that those HCO that are able to adapt to technology in line with the changes in the environment are able to achieve efficiency in their operations by getting there systems integrated. Therefore the HCO should always endeavor to properly develop the IT infrastructure and adopt electronic health management information system.

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# The Strategic Role of Islamic Boarding School on Instilling Nationalism Values in Al-Hikmah and Miftahul Huda Malang East Java Indonesia

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DOI: 10.29322/IJSRP.8.8.2018.p8022

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8022>

**Abstract-** Pondok pesantren or the Islamic boarding school (IBS), as Islamic educational institutions have vital roles in the process of development of nationalism values. This study aims to reveal how the understanding of IBS against nationalism, what is the strategic role undertaken by the IBS in the imposition of nationalism values at Al-Hikmah and Miftahul Huda IBSs. Data collection was done through deep-interviewed with clerics, teachers, and students. After conducting data collection, data processing, data reduction, presentation, and conclusion, this study found that first, there was a strong understanding within the IBS environment toward the meaning of nationalism, which corresponds to the concepts and theories about nationalism. In addition, the forms of understanding and interpretation of nationalism can be seen from several activities such as the implementation of the flag ceremony, the content of nationality, in the form of Pancasila, Nationalism and Civic Education material, and history in the school, as well as activities of local content of pesantren inserted insight and understanding of nationalism to the students taken from classical books and other boarding school materials that can not be found in formal schools. Secondly, this study also found that the IBS has a strategic role in fortifying itself from the idea of radicalism, intolerance and indifference to pluralism. Furthermore, the IBS can also be a place of cultural preservation and place of learning in the process of democracy base on pesantren view. Thirdly, some of the determinants in the nationalism values are in regard to facilities; the teacher's competency, curriculum, method of learning, networking, and others. Otherwise, the inhibiting factors consist of motivation of student, facilities and infrastructure, curriculum, and competence.

**Key words-** Strategic role, Islamic boarding school, and Nationalism values.

## I. INTRODUCTION

*Pondok pesantren* or the Islamic Boarding School (IBS) is part of the long history of the establishment of the Indonesian nation. The IBS has long history before Indonesia was declared a nation. The educational institution functions as an organization for the study of religious knowledge, preserves Islamic traditions, and produces both Muslim scholars and leaders [1]. The IBSs have an important contribution to the era of the struggle for independence. History records many freedom fighters (warriors) emerging from the IBS and many national heroes born from the IBS. The struggle of large families IBS can be said not be separated from the journey of

this nation, both during the colonial era against the Dutch, Japanese and allied forces, including Kyai Haji Hasyim As'ari from Pesantren Tebuireng and Kyai Haji Ahmad Dahlan from Muhammadiyah with the idea of his Jihad Revolution. This attitude is responded and followed by other pesantren spread across the archipelago such as Teuku Umar, Teuku Cut Ditiro, Tjut Nya dien, Diponegoro, Sultan Hasnanudin and others.

Based on the historical facts, it is very difficult to deny the involvement of IBS in shaping and educating the Indonesian nation. However, the development of political constellation and modern educational institutions in Indonesia has distorted the role, hence as if IBS did not have sufficient contribution to the birth of Indonesia as a sovereign and sovereign nation.

Nationalism is a fundamental thing in the life of the nation and the state, because nationalism has been able to guide and lead the nation of Indonesia in the face of various dynamics of life. Therefore, the insight of nationality and nationalism becomes an obligatory that must be known and understood by every element of the Indonesian nation, so that the nation of Indonesia becomes a developed and modern nation.

It should be underlined that nationalism and even nation-state are fragile and porous in many aspects and accentuations. Each ethnic certainly has a different appreciation of nationalism and its implementation. Therefore, the sense of belonging and fellow citizenship also becomes vulnerable. In fact, at the level of imagination about nationalism alone fellow Indonesian society itself is still often different and culminate in things far from expected. The meaning of Nationalism is universal to be interpreted as something narrowly called conflict of interests of a handful of persons. Thus, the simple and humble way of life implanted by *Ulama* and *Kiai* (Islamic clerics) in boarding schools is very significant, especially in the formation of character (character building).

The insight of nationality embraced by the Indonesian nation is the insight of nationalism that based on Pancasila is the insight of nationality based on Belief in God Almighty. Therefore, it has a moral, ethical and spiritual foundation, and wishes to build the present and future of a prosperous, spiritual, material, and spiritual nation in the world and the hereafter [2](Yudohusodo 1996: 13).

The phenomenon of the entry of foreign cultural elements into Indonesia is basically enough to influence the mindset of the Indonesian people themselves. Basically, this phenomenon is not a big problem for the Indonesian nation. Since the beginning of the Indonesian state has never rejected the entry of foreign cultural elements that enter into this country. It is only in this case affirmed that Indonesia does not prohibit the

entry of foreign cultural elements as long as the elements of foreign culture are not destructive or destructive nationalism spirit of the nation, but the cultural element should be enriching the culture of Indonesia.

Lack of public understanding about the values of nationalism in general also affect the pattern of community behavior. The values of nationalism basically derived from the values of Pancasila, or in other words can be said that the values of nationalism is a perspective of the values of Pancasila. In practice, the behavior patterns of Indonesian society still do not reflect the values of nationalism as expected. This fact is contrary to the noble ideals of the Indonesian people listed in the 1945 Constitution and reflected in the points of practice of Pancasila.

Based on the noble ideals of the Indonesian nation, so to fill and continue the independence today, it is indispensable souls of high nationalism of every citizen. In order to realize these goals, it takes a hard and serious effort, and to make it happen does not have to always appear in the eyes of others, but can start from the simplest things to complex things. Simple examples of the application of nationalism in education, practicing in IBS were: (1) the participation of learners and or students in following the flag ceremony, (2) the awareness of the learners at the time of honoring the flag as a symbol of the State, and (3) awareness the learners in complying with the rules and norms that apply as an appreciation of the values of Pancasila and the 1945 Constitution.

The values of nationalism are always associated with the world of education, both formal and non-formal, because to interpret the values are needed an effort from the people of Indonesia itself to behave that lead to the values of Pancasila. The values of nationalism basically have to be preserved and preserved by all circles, all parties, and thorough in all branches of science. One of the studies that will be the study in this research is the institution of Pondok Pesantren. The existence of IBS in education is recognized by the government. IBS is a traditional educational institution led by Islamic clerick. In this IBS the students are teach with various branches of religious knowledge derived from the Koran and Hadith (collection of sayings and deeds of the Prophet Muhammad). Understanding and memorization of the Koran and Al-Hadith is a necessary condition for the student [3].

Nowadays, IBS is tainted by the emergence of "new" boarding school based on Islamic values that tend to be textual and fanatic, so this IBS spread anti-nationalism. As a result, the student who are born become student who behave radicalism and threaten the integrity of Republic of Indonesia. This kind of problem can not be allowed to continue, because it will have an adverse impact on the survival of the nation and the state. To maintain and fill the independence that has been felt to date, required provision of religious knowledge or religiosity high and must be accompanied by provisions of other general science, such as nationalism.

The IBS is one of education institution in Indonesia, which is nonformal. The non-formal education here is a structured, programmed, and out-of-school educational pattern, which generally aims to shape people with strong, virtuous characters and always behave positively. The IBS as a community and as a large educational institution the number and extent of its spread in various corners of the country and has provided shares in the formation of a moral and religious Indonesian man [1]. Such education has also been taught at Al-Hikmah Kuwolu and Miftahul Huda boarding schools where the patterns of learning are very relevant for the cultivation of nationalist values.

In accordance with the results of direct observations in the field and the results of interviews conducted by researchers, obtained information that the pattern of education those IBSs in addition to emphasize the success of teaching the science of religion but requires the students apply and love the values of nationalism in everyday life. From this activity, it is expected that the student later when plunged into the community can love the Republic of Indonesia sincerely. From the results of this temporary observation, researchers assume that IBS basically teaches to the student how to love his country, in this case is IBS with background *Ahlussunnah Wal Jama'ah* or IBS that preserve the Islamic values brought by Islamic clerics.

Based on the above explanation, the researcher assumed that the cultivation of the values of nationalism in daily life was felt obliged to be strengthened again its existence, especially in Al-Hikmah and Miftahul Huda in Malang for the behavior of the student both boarding schools can apply the values of nationalism, but also for the identity of the Indonesian nation that existed from the first, can be embedded well in each studentnya.

The urgency of this research is because nationalism is a value and also a very broad and universal study. On the one hand, nationalism is too great to be littered with the futuristic lusts and opportunists of practical political style, in which the tendency of power is very apprehensive. On the other hand, the modest and humble way of life implanted by islamic clerics in IBS, especially character building is necessary to instill the values of nationalism and state defense.

In previous research suggested that the Islamic peace education influence on the de-radicalization of terrorism [4]. Similarly, it is concluded that the value of nationalism is very influential on the security and stability of the nation. In this case, the researcher found some very significant research gap to be expressed and studied seriously and deeply, at least on two principal aspects, namely: first, the strategic role of boarding school in the inculcation of nationalism values, it is clearly more focused and in-depth than in previous studies that only concentrated on educational institutions in general. As it is known that formal education ranges from 5-6 hours, while education 24 hours IBS. Secondly, IBS emphasizes self-reliance and character education so that nationalism values are more integrated and integral.

## II. MATERIAL AND METHOD

This research is a type of qualitative research. The data of this research are descriptive data. This research was conducted in Al-Hikmah, Kuwolu, Bululawang, and IBS Miftahul Huda, Gading, Malang Regency, East Java, Indonesia. The main data sources in this qualitative research are interview and additional data such as documents and others [5], which consists of primary data and secondary data. Primary data is data collected or obtained directly in the field by people doing research or concerned. Secondary data is data obtained or collected by people conducting research from existing sources. This data is usually from the library or from reports from previous researchers [5]. Informants in this study consisted of teachers, student, ustadz and ustadzah in those boarding schools. Methods of data collection in this study using interviews, observation, and documentation. While the validity of data using triangulation. Meanwhile, for data analysis was done inductively, that was data collection, data reduction, data presentation, and data conclusion.

## III. RESULT AND DISCUSSION

### 3.1. Meaning and implementation of Nationalism in Al-Hikmah IBS

Meaning and understanding of nationalism in boarding school environment was very important. This was because IBS can serve as an effective place to educate students to become guards and fortress for this country, as has been noted by the history where the students became freedom fighters (warrior) of this nation in the days of the struggle for independence. Love the homeland part of the faith is one of the noble teachings of religion that is always integrated into the method of learning within the boarding school, even manifested in everyday life in pesantren until now.

Understanding and interpretation of nationalism is one important factor in determining the success of the values of nationalism can be implemented properly. The understanding teacher, clerics, and stakeholders of IBS ponders becomes very important in this context to interpret and implement this nationalistic value into the daily life of the student, and or to integrate those values into the curriculum of IBS which usually has its own curriculum for teaching kesantantrenan materials.

According to an informant in this case as the caretaker of Al-Hikmah IBS principal (A), described that nationalism is a understanding of love of the homeland in accordance with the proposition *Khubul Waton Minal Faith* (Love the homeland is part of the faith). In this case, he was further said that:

"Nationalism is the understanding of the love of the homeland, it is manifested in the personal attitudes and attitudes of people who manifest in attitudes and behaviors such as high tolerance, mutual cooperation, mutual aid, conscience, etc."

The above statement was a justification for the role of IBS which is known as a place where students were educated to uphold morals and love of their homeland.

With regard to the understanding of the content of nationalism values, the informant (A) was described in detail:

"The values of nationalism are already very clearly embodied in the principles of Pancasila. Therefore, to understand clearly and to be manifested in everyday life, the understanding of nationalism should not be just an idiom and a term. However, he must be the way of life of Indonesian citizens as a whole"

Based on the above exposure can be assumed that the understanding of the leadership of Al-Hikmah IBS so very well understood and very concerned in interpreting nationalism in the life of society. With the correct meaning and in accordance with the ideology of the nation that is pancasila. Then it was certainly not difficult to find a form of nationalistic values in Al-Hikmah IBS. However, understanding alone was not enough to conclude that nationalism has been well implemented. Therefore, it was necessary to do more related research to other sources.

With regard to the importance of planting the values of nationalism in boarding schools, in general, informants say more or less the same thing, that they consider it very important that the values of nationalism are taught, integrated, and practiced in the daily life of the student in Islamic boarding school. This is in order to fortify them from the attitude of radicalism, and extremism and closed understanding that is very dangerous for the Unitary State of the Republic of Indonesia.

Of the many opinions that exist, the opinion the informant (A) stated that;

"The understanding and meaning of nationalism and its implementation in everyday life is a very urgent thing for us. This can be easily applied in Al-Hikmah IBS because

the students come from different regions, ethnics, and cultures. Thus, the culture of tolerance among student is formed by itself."

Based on the above opinion, the informant justifies that in the life of pesantren, the culture of mutual respect respects between young student equal to the senior, respect for teachers or ustadz, and the most important is mutual respect for each other within the existing differences.

Meanwhile, in the opinion of informant B, a male student of Al-Hikmah IBS said:

"The material of nationalism taught in the school is very helpful in understanding the love of our country. So far, we only understand that we must love the homeland, because that is part of faith. However, we can only understand clearly and deeply when we get KDP lessons."

Meanwhile, according to informant C, a female student, when asked the importance of whether or not nationalism was taught in boarding school. She explained that

"Civic education is a mandatory lesson taught in schools. The course is very important for the student, because so far the understanding of love the homeland is understood still in the form of conception or still abstract. So it is very good if the application of nationalism values taught can be implemented well in our daily lives."

Another opinion, expressed by one of the Islamic teacher (D), about the importance of instilling values of nationalism in boarding school, he said that;

"The cultivation of the values of nationalism in Al-Hikmah is inevitable for us in the IBS. Thus, the contents of nationalism must be integrated and manifested in the daily life of the student."

The opinion of ustadz Ainun is an opinion that describes the importance of the values of nationalism must be implemented in the lives of the student.

Other informant (E) argued about the importance of planting the values of nationalism in IBS, she stated that;

"I would argue that one of the reasons for the acts of terrorism and radicalism is that there is no true understanding of nationalism and the non-implementation of national values into the ideology and viewpoint of nation and state in our common life."

The description of Goddess is a very logical explanation of the rampant actions and attitudes of people who fall into a shallow religious understanding, causing the destruction of national values, and dividing the nation, which is diverse, racially, ethnically and religiously.

The role of IBS in the cultivation of the values of nationalism within the life span of IBS is closely related to the activities or programs implemented by pesantren to the students. Based on the results of research through interviews, observations, documentation conducted by researchers at Al-Hikmah IBS, then obtained the following data.

The activities at IBS Al-Hikmah, in general, are divided into two forms of learning activities, namely; first, formal education (formal school), and non-formal education (teaching boarding school). In formal education the students are required to attend formal education in general, which consists of junior and senior high schools.

The forms of activities that describe the meaning of the cultivation of nationalism values in daily life in IBS consist of a) flag ceremony, b) scouting activities, c) Pancasila, Nationalism dan Civic Education, d) Koran study, e) study of interpretation of Koranr, f) Study of Hadith, *Bulugh Al-Maram*, g) Recitation of the Book of Fiqh, h) Congregational prayer

activities, i) *muhadharoh* activities, j) joint discussion activities, k) voluntary work, and l) training activities.

### 3.2 Strategic Role, Inhibiting Factors and Supporting Nationalism at Al-Hikmah IBS

#### Islamic Education Center Archipelago

In the midst of the dynamics of the system of life of the world that began to leave the moral values and social institutions, it seems clear stretching Islamic educational institutions, especially IBS prepare students to become human beings who not only have the competence of science and life skills that comply, but also uphold the moral aspect as a grounding life philosophy. Pesantren is a place where prospective carriers of the country's mandate grow and learn to equip themselves by balancing material and spiritual needs to meet the frenzy of the future. The strength of the pesantren elite is undoubtedly an integral part of the agent of change group is expected to contribute to the enlightenment of society.

The IBS other than as a place to study the science of religion, as well as a strategic place in the center of non-religious education. The religious understanding that forms the basis for other disciplinary understandings is a milestone for the realization of universal values that are in line with the values of nationalism such as fairness, honesty, integrity, and so on.

The internalized learning that is internalized in the study of IBS, especially in Al-Hikmah IBS, as the foundation of the student in instilling the values of nationalism inherently. Based on interviews with informan A, regarding the role of IBS strategist in the cultivation of the value of nationalism, he said:

"Al-Hikmah other than as a religious education center in this area, as well as a place where the student learn about the life of nation and state. The students are taught to organize early, to know the history of the nation, and to be actively involved in the training activities in order to maintain and support the government's activities in instilling the value of nationalism from an early age. As it did the Ministry of Sport, some time ago, which held a state defending training event. We included 50 students to participate in the event. "

Furthermore he also said that:

"With regard to its strategic role, like other IBS educational institutions, Al-Hikmah with its religious platform keeps this nation from values that are against the cultural values of the Indonesian nation. Al-hikmah is the root or foundation that can be portrayed from the cultural roots and noble values of the nation manifested in the daily life of the student."

Based on the above explanation, the informant A asserted that in order to keep this nation on the path of the founder of the nation, the younger generation should be directed to understand their own values. Thus, when exposed to foreign or foreign cultures, or even collided with a new culture that is inconsistent with the cultural values of the nation's roots, they can naturally sort and reject them firmly.

#### Deradicalization of Islam

The IBS has a strategic role in the context of deradicalization, which can be understood as an attempt to stop, neutralize or at least neutralize radicalism. Deradicalisation is defined as disengagement which means leaving or releasing acts of terrorism or radiaklisme by reorientation. The termination referred to is abandoning the various social norms, values, behaviors associated with terrorism networks and radicalism.

Deradicalization or deidelogization means the effort that counter ideology to stop the understanding and spread of ideology of terrorism and radicalism.

In the context of this deradicalisation, restoring the mission of IBS as a traditional educational institution which aims to understand, appreciate and practice the teachings of Islam (*tafaqquh fi al-din*), is a matter of concern to the stakeholders of the IBS. By emphasizing the importance of the morals of a gentle Islam religion, respecting differences, tolerance as the guidelines of daily life, boarding school can be a very strategic container in supporting the values of nationalism can be internalized within the student.

Other Islamic teacher (informant D) said that the radicalism that emerged in the IBS environment was due to the narrow paradigm developed in understanding the relationship between religion and state. He added that:

"Radicalism in the boarding school is a product of closed and narrow paradigm that develops in the understanding of stakeholder IBS in interpreting the relationship of religion and state. They understood textually about the Islamic state by referring to the Koran text partially that the law of God should be enforced within a state. In fact, they should understand the context in relation to the substance of universal Islamic values that must exist within a country. With such understanding, boarding school will be free from radicalism that is very dangerous for the integrity of this nation and state."

Based on above statement, it can be concluded that deradicalization can be a strategic role of boarding school in preventing the ideologies that can reject the Unitary State of the Republic of Indonesia, which has become the common agreement of the founders of this nation.

#### Democracy

In the era of democracy, unity is an important pillar in the relationship of the state. The IBS as one of the faces of Islam in Indonesia has an important role in realizing the value of unity and unity, which is complemented in the form of multicultural education developed in IBS. Life in the IBS is a place for the student in understanding and interpreting the brotherhood as a form of unity. Unity and fraternity in IBS is a very important value in living life during being or processing themselves in the IBS. Students, who are or are from different regions, and different ethnic, ethnic and racial, require them to understand each other.

With regard to democratization in the IBS environment, another Islamic teacher (informant F) explained as follows.

"In the IBS environment, we also always apply the values of democracy in everyday life. For example, when in deciding something, the cleric always invites senior student to discuss together, deliberation, then decided the best together."

According to informant E, she also emphasized that the implementation of democracy in IBS is more emphasized on the issue of democratic decision making that is by involving people who are interested in decision making process or policy. In addition, at certain times, in the process of succession of the boarding school chairman or class president, it is also carried out with democratic values. The most votes become the reference of a person elected to a chairman.

#### Tolerance

The IBS has a very important role in fostering a sense of tolerance seen from the educational learning developed in it. The education of IBS characters emphasizes the tolerance that students always learn. In fact, within the curriculum of the IBS

itself, it is usually integrated in such a way that there is a section or a special chapter that discusses human relationships with human beings or that in the term IBS commonly called *hablum minannas*, namely religious teachings on how to interact with others.

In this context, the informant A explains that student are specifically taught about how to behave with each other, neighbors, friends, older people, even how to treat people different from us. He explained as follows.

"The education of tolerance in the IBS, especially in Al-Hikmah IBS, not only teaches about human relationship with God (*Hablum minallah*), but also how to relate to fellow human beings (discussing the problem of *hablum minannaas*). This is indeed a separate chapter, the chapter of *muamalah* (social relationship). This chapter is closely related to the relationship between the student with other student, with the community of boarding schools, with the clerics or teachers, with older people, with neighbors, etc. Even also describes how the student behave towards people who different from them, different in meaning, not as familiar to them, different racial, ethnic, and cultural, and so on."

Furthermore, he added that:

"*Muamalah* itself is one part of the jurisprudence that explains the rules of Allah Al Mighty which regulates the complete relationship of human beings with other human beings. So, Muslims are already very familiar with the existence of tolerance, because it is part of the science of religion."

Thus, in general it can be concluded, that the IBS very familiar with the values of tolerance. Not only is tolerance also a part of religious teachings that has been very clearly explained from various sources of religion, it also becomes a necessity for student in the IBS consisting of various regions, and from different backgrounds. Therefore, the IBS is a very strategic institution in developing tolerant attitudes, which strengthen the values of nationalism.

#### Plurality

Plurality, for people who exist in the IBS environment is necessary. Therefore, it is important that the boarding school become an institution that treats pluralism and or heterogeneity becomes a force. This needs to be done given the difference at a given moment can be a source of conflict and disunity. By looking at Indonesia that can not be separated from the diversity: good inter-group, religion, culture, ethnic, language, become very reasonable and become a productive movement for the IBS to be involved in taking care of the plurality becomes something that can be contributed to nation and state this.

According to the infromant D, plurality in the IBS environment has become an understanding that is implemented in the daily attitude of the student. He mentioned that based on the existing data in the profile book of IBS, the students of Al-Hikmah in the background of the origin areas have been very varied. Some are locals and not a few come from other regions. There are ethnic Javanese, Madurese, Betawi, and there is a small part that comes from ethnic Sundanese.

The informant A explained more or less the same that:

"Student Al-Hikmah is already plural, mixed up from different regions. Indeed most come from Java, but they also hang out and live together with the Madurese who in fact have a culture that is very different from the culture of Java. Thus, Al-Hikmah IBS is a boarding school that can be considered a multicultural life style."

Based on the above explanation, the red thread that emerges is the strategic role of the IBS in maintaining and developing pluralism as a value that strengthens this nation is vital, considering the student are the next generation of the nation.

Based on the results of interviews and observations, regarding the constraints faced in the Implementation of the nationalism values in daily life in Al-Hikmah IBS consists of a) Inadequate role of government in providing assistance in the support any activities or programs in the IBS, b) lazy attitude of the students, c) less competent teachers. Meanwhile, the factors that contribute in determining the strategic role in planting the values of nationalism in IBS are a) facilities and infrastructure, b) the existence of the IBS-based curriculum that is integrated with the general education curriculum, and c) Networking.

### 3.3. Meaning and Implementation of Nationalism in Miftahul Huda IBS

The success of the implementation of the values of nationalism is determined by various factors, one of which is the understanding of teachers, clericks about the value of nationalism. The teacher's understanding of the value of nationalism will be used when the teachers, clericks interact with students in the learning activities inside the boarding school. Based on the results of interviews that have been conducted researchers known there are various understandings and definitions of nationalism that is understood by teachers, ustads, and kyai, especially in IBS Miftahul Huda Malang.

According to informant G (12-04-2017), in this case as the leader of IBS, explained that nationalism in general is a comprehension of attitude, taste, or acts that express the love of the homeland (*Khubul Waton Minal Faith*). In this case, further the informant G explained that;

"The state of Indonesia is a state of peace (the state of Darul Salam). The Unitary State of the Republic of Indonesia is the final state can not be changed. Because it has become a common coincidence as has been formulated by the founding fathers of this country."

The statement was issued by the informant G on the grounds that the state form is optional thus if one has set goals and choices, then as a consequence of that, he must be preserved and manifested. This is the same as if one has chosen the State of Indonesia as the Unitary State of the republic of Indonesia and has formulated what is the goal, then that person must always run what is a predetermined goal, and help to realize what this nation aspires to.

This notion of nationalism is expressed differently by one of the boarders of the IBS, though in conclusion, more or less the same, as revealed by the informant H;

"In my opinion, that nationalism is an attitude, the attitude of love to the homeland is poured in the form of discipline, honest attitude, respect to friends and parents, and obedient to the law in Indonesia."

The notion of nationalism conveyed by the informant H Fadli Hakim was reinforced by the informant I, as one of the ustadz or lecturer at the IBS, who stated that Nationalism according to him is the understanding that express his love of the homeland. The love of the land according to him is not necessarily shown or practiced directly. It all depends on how we respond to a belief that we think is right. He also added that the Nationalism of Islamic boarding school has been prepared in the matter of boarding school.

For the issue of delivery or application, it all depends on the teacher. There is no special curriculum that discusses nationalism in Mifatahul Huda IBS. Everything is summarized

in the prepared boarding school material. This has been done long ago, so it is impossible for the boarding school to hold significant changes because it will affect other things.

Meanwhile, the results of interviews with student daughter boarding school Miftahul Huda, according to the informant J (female student), nationalism is described as an attitude of love to the homeland. This is also confirmed by another informant K (female student) Zaina, who more or less thinks the same as before that love to the homeland is part of faith. That is, nationalism is an Islamic religious teaching that must also be implemented by adherents.

Meanwhile, the other informants (female students), by conducting separate interviews, one by one with them, their core understanding of nationalism is the notion that explains how one loves his nation. These forms of love are interpreted differently by others. Later, they also explained that the attitude or action of this nationalism is not only respect for the flag, or the flag ceremony conducted by the formal school every Monday, but also can be interpreted as an attitude of tolerance, mutual respect among citizens, respect for others, and prioritizing the interests of the state rather than personal interests if it is struck with the issue.

With regard to the importance of growing the values of nationalism in boarding schools, in general, the informants said something more or less the same that they consider it very important that the values of nationalism be transformed to all student in the IBS. They reasoned that it was what protected them from radicalism, and prevented them from being contaminated with extremist ideals that injure the values of nationalism itself.

In general, Miftahul Huda IBS carries out various kinds of education, including non formal education. In non formal education or education formed by the boarding school itself is a form of Salafiyah study using the kitab kuning (literally mean Yellow Book).

The non-formal education of the teaching system was to use the classical system or madras as well as a sorry system that was fully regulated in the IBS program itself. In the process of learning, the students are obliged to follow the study program at IBS which is directly guided by the caregiver, teacher or independent study which is conducted outside the hours of study (study). Meanwhile, the forms of activities that describe the meaning of the cultivation of the values of nationalism in the sphere of daily life are a) Study of Koran, b) Recitation of the Book of *Tafsir*, c) Study of the Book of Hadith, d) Study Book of *Fiqh*, e) f) Consecrated work, and g) *Bahtsul Masa'il* Activities.

### 3.4. Strategic Roles and Supporting Factors as well as inhibiting Nationalism Investment in Miftahul Huda IBS

#### Become a stronghold of Islamic Radicalism

IBS is a religious institution that is born from local religious traditions in the countryside that still holds closely the values of humanity as a universal value that also became the values that exist in the main source of Islam that is Koran and Hadith. IBS which initially as a center of religious education only, is now transformed in such a way as a modern institution that involved in the intellectual life of the nation.

IBS has a strategic role in the context of deradicalisation, which can be understood as an attempt to stop, neutralize or at least neutralize radicalism. In the context of this deradicalisation, restoring the mission of IBS as a traditional educational institution which aims to understand, appreciate

and practice the teachings of Islam (*tafaqquh fi al-din*), is a matter of concern to the stakeholders of IBS.

By emphasizing the importance of the morals of a gentle Islam religion, respecting differences, tolerance as the guidelines of daily life, boarding school can be a very strategic container in supporting the values of nationalism can be internalized within the student.

About this informant G said that the radicalism that arose in the IBS environment was the result of a closed paradigm that developed in understanding the correlation between religion and state. He also explained that:

"Radicalism, in a positive sense is actually good, that is trying to practice values or religious teachings with a radical. However, if this understanding is only understood textually, it will lead to the truth claims (truth claims) that their most correct understanding and others who are different from them are considered wrong. With such a closed understanding, radicalism becomes a scourge that must be eliminated in this archipelago, because it is not in accordance with the concept of a single state of diversity."

Based on the above explanation, it can be pointed out that deradicalization can be a strategic role of boarding school in preventing the ideologies that can reject the existence of the Unitary State of the Republic of Indonesia, which has become an agreement with the founders of this nation.

#### Container grows Tolerance and Plurality

The IBS other than as a strategic place in the process of deradicalization, it is also very important as a place to foster a sense of tolerance and understanding plurality. Character education developed by IBS is an implementation of tolerance. In fact, within the curriculum of the IBS itself, it is usually integrated in such a way that there is a section or a special chapter that discusses human relationships with human beings or that in the term IBS commonly called *hablun minannas*, namely religious teachings on how to interact with others.

In this context, the informant G explains that students are implicitly learning about how to behave with others, even how to treat people who are different from them. He explained as follows.

"The attitude of tolerance in Al-Huda IBS is an attitude that is integratively manifested in the behavior of the student everyday, they interact with people who are not the same with each other, in the sense that they always interact with students who have culture, backgrounds, races, ethnicities, etc. As for understanding tolerance among religious people, students are also taught as mentioned in the Koran which teaches tolerance "For you your religion and for me my religion, so that they are actually well prepared in the face of difference."

Thus, in general can be concluded, IBS very familiar with the values of tolerance. Not only is tolerance also a part of religious teachings that has been clearly explained from various sources of religion, it also becomes a necessity for student in IBS consisting of various regions, and from different backgrounds. Therefore, IBS is a very strategic institution in developing tolerant attitudes, which strengthen the values of nationalism.

#### As a place of Cultural Preservation

Another factor that makes IBS as a strategic institution in the cultivation of the values of nationalism is that IBS can be a pelesatrian culture of a very effective nation. In the habits of IBS, every event must always feature cultural performances that are usually in the format according to the origin of the

students. The appearance of this local culture can at least be a strategic lesson for the student to always love their own culture compared with other people's culture. Expression of love to this nation can also be expressed through the appearance of culture that can be used as *pencu* spirit of the student to care for and preserve the heritage of this country's ancestors.

In the implementation of the cultivation of the value of nationalism, of course not everything will run smoothly. In the implementation there must be obstacles that hinder the process of planting the value of nationalism. In this part of the problem the researcher will describe the obstacles in the implementation of the nationalism value based on the research results described above. The description of the obstacles to the implementation of the nationalism value is a) Competence, b) Barriers to the use of instructional media, c) Curriculum, d) Obstacles of infrastructure. Meanwhile, for the supporting factor, in this research about the meaning of the strategic role of boarding school in the cultivation of the values of nationalism there are also determinants and also the obstacles faced are a) The Roles of the Teachers, b) Motivation of Student, c) Interaction with the Community Neighborhood Islamic boarding school,

#### 4. DISCUSSION

##### Understanding and Meaning the values of Nationalism in Islamic Boarding School

The most important discussion is about the meaning of planting the values of nationalism in the sphere of daily life in Al-Hikmah IBS and Miftahul Huda IBS. Previously it has been described that according to the results of research and interviews that have been done to the teachers and the students at Al-Hikmah IBS and Miftahul Huda IBS, that each informant interpreted nationalism as a notion that expressed his love for the homeland and the cultivation of nationalism values stated to have been implemented in the sphere of daily life in the IBS. Another thing that is not less important is related to the existence of pesantren boarding material that plays a role in interpreting the strategic role of pesantren in cultivating the values of nationalism in the sphere of daily life in the IBS. As previously stated, the matter of the pesantren boarding school from each of the two boarding schools is different in the curriculum and the method of learning.

Al-Hikmah IBS emphasizes modern learning method, which is trying to integrate its education system by collaborating modern curriculum education system with traditional curriculum. In the modern learning system in question can be interpreted as an educational system tailored to the curriculum adopted by the government, namely by providing opportunities to students to learn general lessons such as other public schools in Indonesia, including in it is also teach the material lessons of KDP in School.

Traditional learning system, in Al-Hikmah IBS is also maintained, as the main goal of student learn religious education. With the traditional method of education, Al-Hikmah IBS, also tried to provide religious studies on nationalism contained in their reference books, such as the study of history books, criteria of leaders, and others.

In contrast to Al-Hikmah IBS, Miftahul Huda IBS used the traditional education system only. In this pesantren, there was not found a formal school like the one in Al-Hikmah IBS. All lessons or lessons given to his santr are related to religious books such as *tafsir*, *hadith*, *siroh* (history), and others.

With regard to forms of cultivation of the values of nationalism in each pesantren hut, it is seen between the two IBS, Al-Hikmah and Miftahul Huda have had a difference of one play,

although in general also found similarities in it. One of them is about the form of learning method in pesantren, Al-Hikmah emphasizes on learning with curriculum based on integration of traditional and modern learning, while Miftahul Huda only using local or traditional curriculum.

Learning with the integration of traditional and modern methods is more due to the Al-Hikmah IBS there are lessons such as public schools, ranging from the level of early childhood, Islamic Kindergarten, junior high school, and high school Islam, in which already contains materials such as Pancasila, Nationalism dan Civic Education, and history. Other forms that can also be seen from the cultivation of nationalism in this boarding school is the presence of flag ceremonies and by teaching national songs at lower levels of education, such as early childhood and Islamic Kindergarten. Meanwhile, for learning with traditional methods more emphasis on the local content of the books in which inserted related to the content of the values of nationalism. With regard to this second model consists of study books of *tafsir*, *hadith*, *fiqh*, history, discussion together, work devotion, and others.

IBS Miftahul Huda while maintaining his traditional learning method, instilling his values of nationalism by integrating the understanding of religious relationship with the state through the study of classical books such as *siroh*, *fiqh* nationality, joint discussion, service and others. All local content developed in the learning in Miftahul Huda is directed to form students who understand religious values deeply and also have an insight into the nationality that can be used as life guidance for them when they are living in society, by holding firm to fair, honest, tolerant, both with neighbors, mutual cooperation, and respectful mutual respect with people who are different from them.

##### The Strategic Role of IBS in Nationalism Instilling

Indonesia, in principle, can not be separated from the boarding school, because historically pesantren has become an important part since the days of struggle against colonialism, until now also actively involved in it in maintaining and caring for Indonesia in its own way and always calling for nationalism (*khubbul wathan minal faith*).

In the reality of social relationships, boarding school has always been a very important force as a social pillar based on religious values. The religious values, applied in pesantren life, became one of the bases for the closeness of the pesantren with the community, the closeness of the pesantren with the community built through psychological and ideological proximity.

Psychological closeness is a relationship born from the psychological niches of rural religious society. Meanwhile, ideological closeness is the relationship of pesantren with community based on religious values. These relationships are based on the hopes and ideals of the Islamic community who yearn for the social order of society based on religious values. Thus, pesantren is born from public awareness that is realized in religious-based education institutions. It is this power that encourages the community to build an institution that becomes a pesantren educational institution.

Based on the findings in the field, with regard to pesantren as a place to plant the values of nationalism, proved to have a very strategic role. Of the two boarding schools used as the object of research, obtained almost the same perspective although there is little difference. In connection with this strategic role, Al-Hikmah boarding school as a boarding school that in fact uses modern methods in learning, at least there are five strategic roles that can be realized in the cultivation of the values of

nationalism in the pesantren environment, namely; pesantren as the center of Islamic Nusantara education, pesantren as a place that acts as a process of deradicalization, as a plural and tolerant educational institution, and pesantren also can serve as an institution in learning democracy.

Meanwhile, for findings related to the strategic role of pesantren in the cultivation of these values of nationalism, from Al-Hikmah IBS, there are at least some points that can be underlined namely; first, boarding school as a place of Islamic education archipelago that is where studying religious values which of course contain universal elements that support the development of values of nationalism; secondly, as a place of deradicalization, or a bulwark of radicalism; third, as a place to learn the process of democracy; and fourth, as a tolerant and plural place. The strategic role that can be played by Al-Hikmah IBS has been assumed quite successfully in the cultivation of nationalistic values, although there are deficiencies that need to be improved for example by adding facilities and infrastructure that support the creation of conducive conditions in the process of planting values - nationalism.

Meanwhile, the strategic role of Miftahul Huda IBS in the cultivation of the values of nationalism, in general is actually not much different, there are some points that are actually in principle the same, that is like the IBS as a bulwark of radicalism, a place of tolerance, and plural, and the latter can also serve as a place pelesatarian culture. Thus, it can be said that boarding school as an educational institution that has its own method in educating the studentnya, not separated from the values of nationalism.

#### Factors inhibiting and Supporting Nationalism Instilling in IBS

The determinant factor in the meaning of planting nationalism values in the daily life sphere in IBS is like the role of teachers, the desire of student, curriculum, facilities and infrastructure, and others. While with regard to inhibiting factors such as those described previously such as facilities and infrastructure, the competence of teachers, curriculum, instructional media, government support and others.

With regard to several supporting and inhibiting factors, each boarding school has a significant difference. Al-Hikmah IBS, for example, feels lack of support from the government related to the process of cultivating the values of nationalism. This happens because so far the government is not providing assistance in terms of infrastructure such as books related to nationalism and others.

In addition, Al-Hikmah IBS also felt that the competence of teachers, especially teachers of Civics is less qualified. In the future, it is important to consider how to provide a serious understanding with regard to national insights and others that can support them in delivering the material to match what is expected.

Meanwhile, for Miftahul Huda IBS, the curriculum becomes a difficult factor to support the systemic nationalism of systemic values. This happens because they have no formal education such as schools that teach material of nationality such as history, Pancasila, Nationalism dan Civic Education and others. Therefore, in the future, it is necessary to think about other mechanisms or methods that can support the effective and efficient nationalism values, especially in the pesantren environment using traditional methods or salaf in the method of learning.

Seeing the obstacles encountered in the meaning of the nationalism values in the sphere of daily life in the IBS, should be the material for introspection for the board and the students

at the boarding school. All sorts of obstacles in the process of meaningfulness of nationalistic values will be overcome if we can relate it to a strong determinant.

In general, the constraint is always opposite or contrary to the deciding factor. If the determining factor is clearly known, then indirectly the things related to the constraints will be easily solved. Obstacles in the meaning of the nationalism values in the sphere of daily life in IBS as described above, is not to be meaningful if all residents in the boarding school has the desire to improve everything related to obstacles for the progress and development of his boarding school, as well as for the success of the meaning of planting the values of nationalism in the sphere of daily life in IBS.

## 5. CONCLUSION

Understanding and interpretation of the values of nationalism in everyday life in the IBS includes the meaning of the value of nationalism seen from the point of view of the kyai, ustadz and ustadzah and representatives of the student. Understanding and interpreting the cultivation of the values of nationalism. This is manifested in several forms of activities such as flag ceremonies, Pancasila, Nationalism dan Civic Education materials, historical material, recitation of classics, consecration, joint discussions, and other activities. The strategic role of Islamic boarding schools in the cultivation of nationalistic values can form as a bulwark of radicalism, a place of tolerance and plural, an effective place for learning democratic processes, and also as a place for cultural preservation.

The determinant factors in the meaning of the nationalism values in daily life at IBS include: the role of the teacher as a motivator and facilitator, the motivation from within the students, the interaction with the community around the boarding school, the curriculum, the competence of the teachers, infrastructures that support the meaning process of planting the values of nationalism within the sphere of daily life in both IBSs, Al-Hikmah and Miftahul Huda.

Obstacles encountered in the meaning of planting nationalism values in daily life in IBS include: the role of teachers as motivators and facilitators who have not been done with the maximal, lack of motivation to learn in self-student, lack of cooperation between the party of the boarding school with other parties (interaction with the community), and the limitations of facilities and infrastructure that should support the process of meaningful implantation of nationalism values in everyday life in the IBS.

Researchers try as much as possible to collect the data. However, the researcher realizes that there are limitations in this research such as; the process in the observation of strategic role that is claimed by each boarding school less than the maximum because it takes a long time to do kroscek in the field related to the existence of some strategic role. So in this study, researchers only describe the results that have been obtained in the field according to data obtained through field informants.

## ACKNOWLEDGEMENT

We thank to Director of Postgraduate School Universitas Brawijaya who were given permission for the research, and team of journal clinic of Postgraduate School Universitas Brawijaya who helped in revising initial manuscript.

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# Design and Implementation of Automatic Aircraft Recognition System by using Image Processing

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**Abstract-** The majority of the aircraft recognition methods assume the successful isolation of the aircraft silhouette from the background. In this system, image processing techniques are first employed to perform the image preprocessing tasks, such as image quality enhancement, noise removal, edge detection and automatic recognition. This system is the specific study of pattern recognition system based on aircraft shape such as wing, tail, nose of vehicle, morphological properties and color based properties. Although various types of automatic aircraft recognition system can be used, image processing with Matlab programming language is used to recognize aircraft. It is to make the system more flexible and refers to the task of selecting, detecting and successfully identifying different potential targets from simple scenes to complex scenes.

**Index Terms-** Aircraft Recognition, Image Processing, Neural Network, Matlab programming

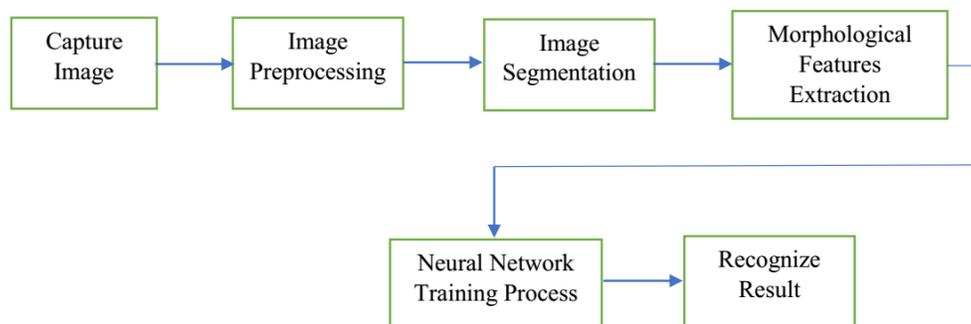
DOI: 10.29322/IJSRP.8.8.2018.p8023

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8023>

## 1. INTRODUCTION

Recognition of modern world aircrafts with the use of manual binoculars in real time is a difficult and risky task. The task of reliably detecting and recognizing an aircraft from single images remains a challenging problem despite advance made in computing technology, image processing and computer vision. Aircraft recognition performance suffers considerably under non-ideal conditions where various forms of image degradation or occlusion are present. Different Automatic Target Recognition System can be classified on the basis of parameters such as input data, sensors and its applications. Aircraft recognition techniques have been reported using a variety of methods. The main subject is to implement software for recognition aircrafts by using image processing. Image processing techniques are used for image analysis. To implement this system, artificial neural network is applied. Matlab programming language, like any other computer vision software, implements the use of the training patterns or the training sets to test the performance of a specific geometric pattern recognition approach. In this system, the programming language is mainly applied.

The design and development of this system is divided into two parts, feature (morphological properties) and recognition parts. This system is shown in Figure 1. In the training step, the offline capture images are to be collected first. These images are preprocessed such as image filtering, image enhancement and etc. Then the aircraft is to be segmented from the background image by image segmentation methods. All the segmented images will be tagged and store in database after learning phase ends. After that the morphological features such as tail, nose and wings of airplanes are detected and the related angles are calculated and saved as feature data set. These features are sent to Neural Network and trained to be understood as the target airplane types. The trained Neural Network is saved in Database. In the implementation step, or testing step, the capture image is acquired from the camera from the computer storage and the same processing stages until morphological feature extractions are done as in the training phase. The feature extractions are applied to the trained Neural Network to recognize the type of aircraft. The result of segmentation aircraft is displayed on the computer monitor.



### Figure 1: Block Diagram of Automatic Aircraft Recognition Process 2. RESEARCH RELATED TO IMAGE PROCESSING

Many researchers have tried various image processing methods, working in different environments; however, most of the work has been done indoors with controlled illumination and an adequate setup for the acquisition of high quality images. In image processing, segmentation is a fundamental method used in many areas. Segmentation is the process of separating an image into distinct regions. Image thresholding and segmentation for feature extraction are the most common. For many features, thresholding operations typically occur first to remove the background from the object of interest and then new thresholds are used to segment regions of interest from clear image areas. The images are thresholded to convert the gray scale information to binary scale information.

Low level processing consists of image filtering and intermediate processing to extract boundaries and regions of interest. At this level, regions of interest are formed and measures describing these regions are collected. High level processing utilizes various methods to classify the regions based on the measures extracted by the low level processing.

In general the largest discriminating power corresponds to morphological features. Color features are not particularly good as classification parameters since many species are light to dark brownish or black. On the other hand, texture characteristics are even less reliable than color ones for classification purposes. Furthermore, if one combines any two sets of features, it was found that morphology plus color features have an edge over the combined use of morphology and texture characteristics. However, it would be enough to consider black and white images, which constitutes an important simplification in system's operation and leads to a reduction in cost. In fact, color images require a much better control of illumination conditions than black and white ones and the required acquisition hardware (RGB camera, frame grabber, etc.) is substantially more expensive.

### 3. SOFTWARE IMPLEMENTATION

Matlab programming language, like any other computer vision software, implements the use of the training patterns or the training sets to test the performance of a specific geometric pattern recognition approach, is applied mainly. The flow chart for automatic aircraft recognition system is shown in Figure 2.

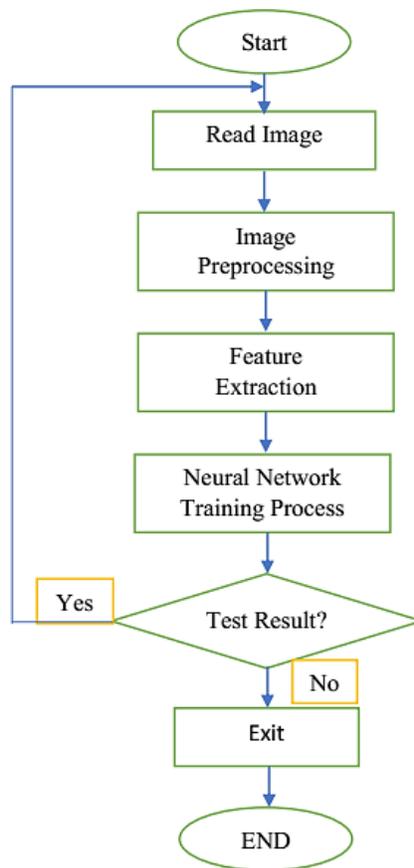


Figure 2: Flow Chart of Automatic Aircraft Recognition System

### 3.1 Image Acquisition

In the first step, aircraft images are acquired using a digital camera (Canon EOS 40D) with resolution of 4000 pixels×3000 pixels was used to record images. Another way is downloading from internet database. They are saved in computer hard disk and kept for training and testing the software. The training database consists of 20 aircraft images and 20 non-aircraft images which may be birds or some photos taking from the sky.

### 3.2 Image Preprocessing

Image preprocessing is required to be able to prepare the raw images to get same size and to get sharpened image.

### 3.3 Feature Extraction

Feature Extraction is implemented by two ways:

- Edge detection
- Boundary detection

### 3.4 Neural Network Creation

After feature extraction process, they have to input to Neural Network. The final design of Neural Network depends on application area. Neural Network are composed of simple elements operating in parallel, so to train the network the numbers of neurons in each network layer need to be fixed. Feed forward Neural Network is used according to the problem. The number of neuron in inputs and output layers of Neural Network is fixed as 120 and 36 neurons.

Neural Network must be trained to classify the correct output using learning rules. Each layer’s output the Network is approximated with a sigmoid function (hardlin). Network is trained by a network training function that updates weight and bias values according to gradient descent momentum and an adaptive learning rate. Network architecture was trained with various SSE values for the different learning rate at each time to obtain fair and independent results. In network architecture, maximum of epochs is 3000, the network saves the information for 20 epochs. The training parameters are as follows:

- Number of input neurons = 120
- Number of output neurons = 36
- Type of transfer function in each layer = hardlin
- Performance function = Mean square error
- Performance goal = 0.001
- Maximum number of epochs to train = 3000
- Epochs between displays = 20

## 4. TEST and RESULT

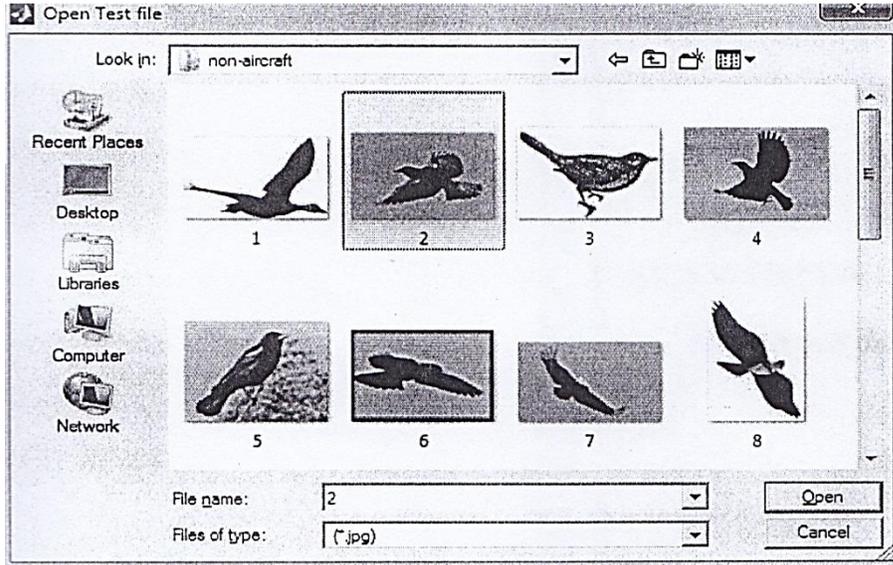
Before running the program, the images are collected firstly. Image from any sources could be used in the program. To test the feasibility of the program, two different groups of images are used. These two groups are aircraft images and non-aircraft images. Twenty aircraft images can be used as input for the program. Here, fighter and commercial aircraft images are chosen. The images of birds are used as the type of non-aircraft because the images of birds can be confused with aircraft images on the sky. The range of original images size for all image are between 100~300.

**Table 1: Classification of Input Data**

	Aircraft Image	Non-Aircraft Image
Number of Images	20	20
Resize of Images	150 x 200	150 x 200
Type of Aircraft	Fighter and commercial	Birds

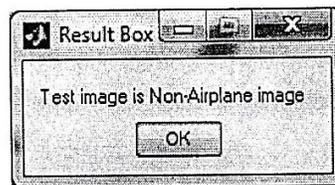
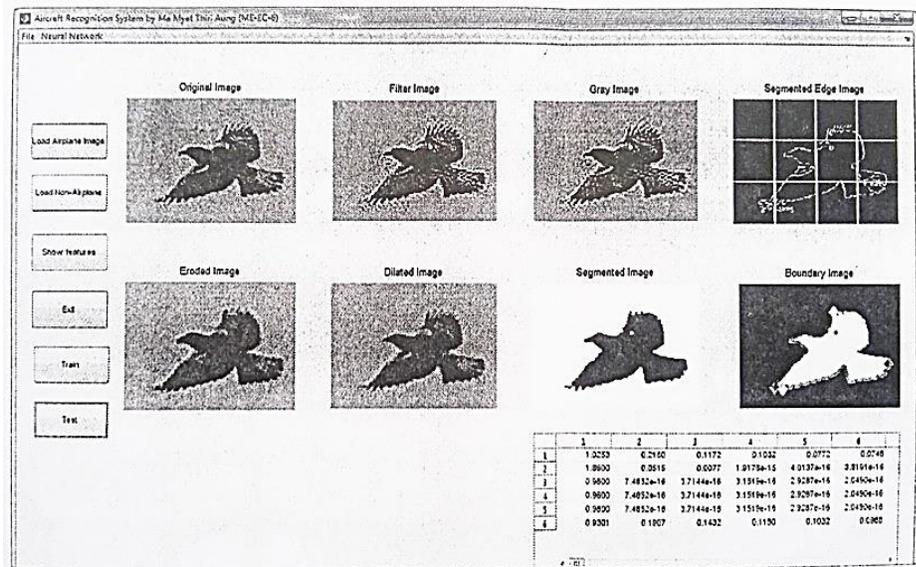
After running the preprocessing part, the program is automatically continued to feature extraction processes. In the feature extraction part,

- While erosion removes pixels on objects boundaries in an image.
- Dilation adds pixels to the boundaries of objects in an image
- Segmentation is applied to separate the object and the background.
- Boundary detection is used to trace the border of an object in a binary image.

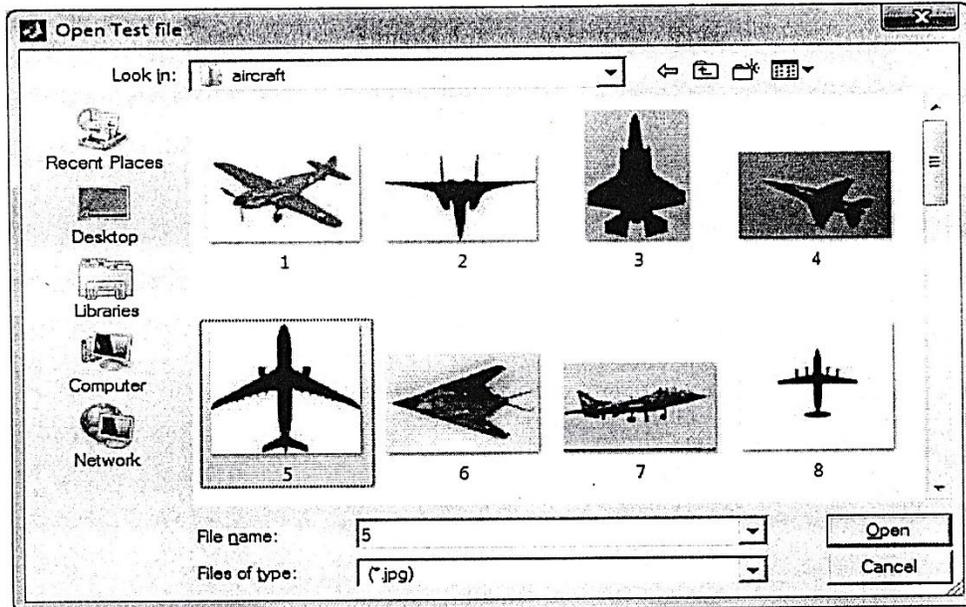


**Figure 3: User Select Non-Aircraft Image Menu**

The image number two is taken from the open test file and the result is appeared in the text box.

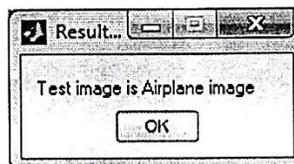
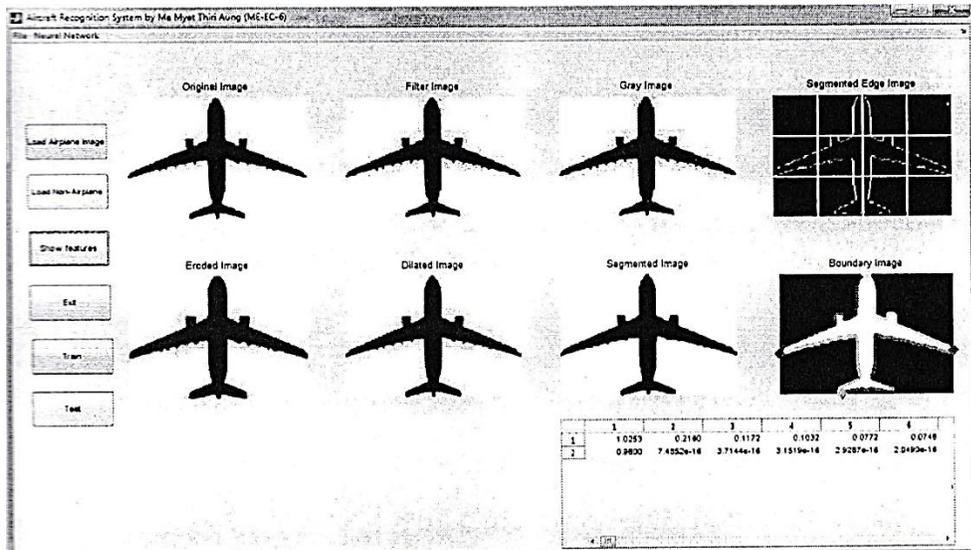


**Figure 4: Result Box for Test Image Number 2**



**Figure 5: User Select Aircraft Image Menu**

The image number five is taken from the open test file and the result is appeared in the text box.



**Figure 6: Result Box for Test Image Number 5**

**Table 2: System Performance Test**

No. of Train Files		Test (Airplane)		Test (No airplane)	
Airplane	Non -airplane	Test file	% Correct	Test file	% Correct
18	18	10	90%	10	80%

**5. CONCLUSION**

Matlab is used as the main implementation tool for recognizing automatic aircrafts using Neural Networks. Matlab is a high performance language for technical computing. It can solve complex numerical problems in a fraction of time required with a programming language such as FORTRAN or C. The software implementation of automatic aircraft recognition system includes five steps.

- Image acquisition
- Image preprocessing
- Feature extraction
- Training in Neural Network
- Testing the system

In this system, various types of aircrafts can be recognized for only below 5000 ft because of using canon camera (EOS 40D). If other devices (eg. radar, satellite, intelligent video automatic target recognition system (IVATRs), etc) are applied, various types of aircrafts can be recognized for above 5000 ft and the system accuracy can be achieved higher than the system which takes the images by cameras.

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# Assessing the Factors Hindering the Effectives Performance of Cooperatives Societies in Mubi Metropolis, Adamawa State, Nigeria

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DOI: 10.29322/IJSRP.8.8.2018.p8024

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8024>

**Abstract:** *This study accessed factors that hindering the performance of cooperatives societies in Mubi metropolis, Adamawa state, Nigeria. In order to achieve the objectives, this study was guided by four research questions and four research hypotheses. The structured questionnaire was used to collect data from randomly selected 381 members of cooperatives in Mubi metropolis. This study recorded 96% returning rate and data collected were analysed with simple percentage, frequency table, weighted average and regression analysis. The results of analysis established that poor meeting attendance is most significant members' factors hindering the efficiency of cooperative societies. Also, corruption, power tussle, incompetency and biasness are the leadership factors limiting the performance of cooperative societies' in the study area. Also, the political interference, lack of business ideas and cumbersome of policies are the societies' related factors affecting the performance of cooperatives societies. Likewise, the lack regulations and monitoring, unfriendly business environment are all the government factors affecting performance of cooperative societies in the study area. The study recommends for the members improvement in attendant and participation in the cooperative activities. Also, the leadership in the cooperative societies should be democratically appointed. Likewise, the state government should improve on policies that dealt with operation of cooperative association in Adamawa sate. Also, the government should assist the cooperative to establish linkages with the several NGOs within and outside the country.*

## Introduction

Cooperative unlike many organizations usually faced with one common problem, which is how to keep balance in the two parts of cooperative business, *efficiency* and *democracy*. Since those who are charged with operation of a cooperative chiefly the board and manager must serve two masters: the imperatives of good business practice and the social purpose of a community of people. Hence, to maintain their special character, cooperatives must be two things in one: a business organization and social movement. This is what makes a cooperative a business enterprise with human interface and so, very difficult to manage. In striving for efficiency, cooperatives often tend to imitate other business, but in pursuing a social purpose they bring out features, which make them different.

Cooperative societies such as the Thrift and Credit societies (CTCS). Cooperatives Investment and Credit Societies (CICS) and/or Cooperative Credit Development Society (CCDS). staff welfare cooperatives can mobilizes funds that will cater for borrowing needs of members through accumulations of shares and savings (Alufohai & Ilavbarhe, 2010). The accumulated funds can be reinvested into diverse business such as; establishment of small-scale enterprises or industries that would provide services, manufacture and market essential commodities at an affordable price. The income so generated is shared among members based on patronage and equity (Babajide, 2013).

One of the purposes of cooperative societies is to help members solve their problems collectively instead of looking up to government for solutions (Adegeye and Dittoh, 1995). However, noticeably of recent cooperative societies has not been significantly play supportive roles as expected on its members. The presence of various internal crises has made it difficult for the cooperative to contribute significantly to economic development of members and state at large. Various studies had tried to identify possible factors responsible for the underperformance of cooperatives societies in our communities and various approaches had been taken to arrive at possible best conclusion. However, none to the best of knowledge of researcher had

considered relating, leadership, society, members as well as government factors to the possible causes of underperformance in cooperative societies. This study therefore, attempt to assess the interplay effects of members activities, leadership types, societies roles and government roles on underperformance of cooperative societies in Mubi metropolis in Mubi North and South Local Government Area of Adamawa State.

The findings from this study will enlighten individual members of cooperative societies to be aware of their attitudes that hindering the performance of cooperatives which in turn reducing the benefits they are recording from being members of cooperative. Also, at the end of this study it is expected that leadership in the cooperatives societies in the study area will aware of their attitudes and styles that limiting the benefit the members are enjoy from participating in cooperative activities. More also, the results from this study will serve as eyes openers for the members and the leaders of cooperatives societies to reposition their societies in a way that interferences of religion, ethnic, culture or political will not distort its performance. Above all, the government agencies responsible for regulation cooperative activities will also realizes aspect of policies require amendment for the smooth running of cooperatives in Adamawa State.

## **Materials and Methods**

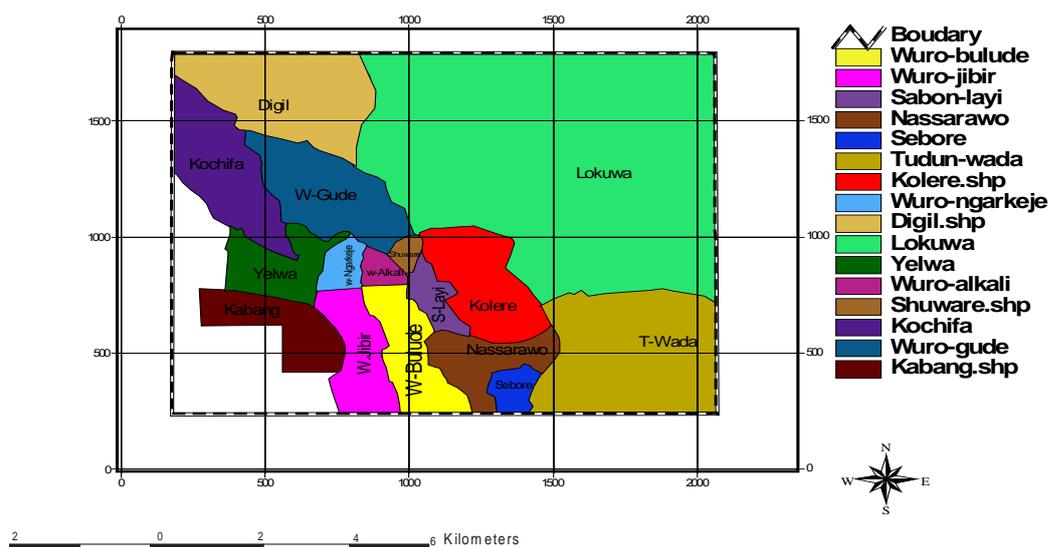
Adamawa state is made-up of twenty-one Local Government Areas, which are zoned into four (4) Agricultural zones based on the climatic and types of crop grown (Kadams and Sajo, 1999). However, this study purposively selected Mubi Metropolis, as results of government presence of various commercial centers, religious bodies, higher institutions, industries as well as traditional administrative offices that make the city a home of many cooperative societies. In all, Mubi Metropolis registered 57 cooperative societies with total of 6,841 members. Taro Yamane sample formula was used to randomly select total of 378 members of cooperatives societies from population. The structured questionnaire was used to collect data from sampled respondents and data were analyzed using simple percentage, frequency count, weighed average, frequency index and regression analysis.

Mubi metropolis as a geo-political area comprises of two Local Government Areas; Mubi North and Mubi South. According to Adebayo, (2004) the area is located between latitudes 10° 30' and 10° 05'N of the equator and between longitude 13° 10' and 13° 30'E of the Greenwich meridian. It occupies a land area of 192,307Km and support a total population 260,009 people (National Population Census 2006). The predominant religions are Christianity and Islam.

Mubi town originated as a farmstead founded by Fali and Gude peasants who settled to cultivate the fertile plains of River Yadzeram. The influx of Fulani cattle rears in the 18<sup>th</sup> century and merchants in the 19<sup>th</sup> century increased the native peasant population (Tini, 2001). This resulted to the emergence of several hamlets in the vicinity. Mubi Township came into existence on 1<sup>st</sup> April 1936 by amalgamating the village units of Lokuwa, Wuro Gude, Kolere, Shuware and the hamlets of Wuro Alkali, Wuro Bulude, Wuro Hamsobe and Wuro Yombe. These settlements were merged to form a central administrative setup called Jimilla.

The growth of Mubi town is traced to the agricultural, administrative, and commercial functions it performs. By 1902, Mubi was a German base from where the neighbouring tribes (i.e Fali, Gude, Kilba, Higgi, Margi and Njanyi) of the region were subjugated. On 1<sup>st</sup> April 1960, Mubi was made Native Authority headquarters. The same year, July 1960, the town became provincial headquarters of the defunct Sardauna province. In 1967, Mubi was made L.G.A headquarters while in 1996, the town was splinted into Mubi-North and Mubi-South Local Government Areas. Currently, the town is the seat of Mubi Emirate Council and the headquarters of Adamawa-North Senatorial District.

Mubi is geographically well placed and functions not only as center of commerce in the region but also extends its sphere of influence to countries such as Cameroon, Central Africa Republic and Chad. Numerous banks, filling stations and hotels exist in the town to support the commercial activities. Fig. 1 and fig. 2 shows the digitized conventional map of the study area and the satellite imagery respectively.



**RESULTS**

**Research Question 1:** what are the members related factors hindering the efficiency of cooperative societies in the study area?

**Table 1: Members Activities that Hindering Efficiency of Cooperative Societies in the Study Area**

Factors	Rating Scale				Freq Indx	Rank
	4 (HS)	3 (S)	2(LS)	1(INS)		
Poor meeting attendant	261(72%)	58(16%)	46(13%)	0(0%)	0.8973	1 <sup>st</sup>
Not participating in teamwork	78(21%)	201(55%)	45(12%)	41(11%)	0.7164	3 <sup>rd</sup>
Unwillingness to over assistance	21(6%)	24(7%)	307(84%)	13(4%)	0.5363	6 <sup>th</sup>
Poor due payment	45(12%)	99(27%)	102(28%)	119(33%)	0.5479	5 <sup>th</sup>
Delayed loan repayment of loan	221(61%)	29(8%)	20(5%)	95(26%)	0.7575	2 <sup>nd</sup>
Not participation in decision making	132(36%)	79(22%)	89(24%)	65(18%)	0.6904	4 <sup>th</sup>

HS: highly Significant, S: Significant, LS: Less significant, INS: Insignificant

The results on Table 1 revealed the respondents rating on the members factors that limiting the performance of cooperative societies in the Mubi Metropolis. The result indicate that majority of respondents (72%) rated poor meeting attendant as most challenges habit of members of cooperatives that is affecting the societies in the study area (index value 0.8973, ranked 1<sup>st</sup>). Also, delayed of loan payment was rated 2<sup>nd</sup>, as indicated by 61% with index value 0.7575. Lack of teamwork spirit among member of cooperatives was ranked 3<sup>rd</sup> by 55% of respondents (index value 0.7164). Not participating in the decision making process was rated 4<sup>th</sup> by most respondents 36%, index value (0.6904). Poor due payment and unwillingness to over assistance to the societies was rated 5<sup>th</sup> and 6<sup>th</sup> as lesser members factors that limiting the performance efficiency of cooperatives in the Mubi Metropolis.

Thus, these results indicated that not attending meeting on regular basis is genesis for many other members bad attitude that affecting the expect function of cooperative societies in the study area.

**Research Question II:** what are the leadership related factors hindering the efficiency of cooperative societies in the study area?

**Table 2: Leadership Activities that Hindering Efficiency of Cooperative Societies in the Study Area**

Factors	SA Fx(%)	A Fx(%)	D Fx(%)	SD Fx(%)	Avg	Remark
Corruption	256(70%)	97(27%)	12(3%)	0(0%)	3.67	A
Power tussle	149(41%)	100(27%)	66(18%)	50(14%)	2.95	A
Incompetent	198(54%)	71(19%)	65(18%)	31(8%)	3.19	A
Biasness	45(12%)	200(55%)	74(20%)	46(13%)	2.67	A
Selfness	202(55%)	91(25%)	44(12%)	28(8%)	3.28	A

The associative challenges to the effectiveness of cooperative societies in the Mubi Metropolis as results of leadership factors were indicated on Table 2. The results on the table indicated that majority of respondents (70%) unanimously agreed that corruption among the leaders responsible for low performance of cooperative societies in the study area (average 3.67). More also, the results on the table indicated power tussle among leaders of cooperatives as factors limiting performance of cooperative societies (average 2.95). Leaders incompetency was also indicated by 54% respondents as challenges facing cooperative societies (average = 3.19). Also, the results indicated that biasness among leaders in their dealing with other members of societies was also expressed by 55% respondents as leadership factors limiting performance of cooperatives in the study area (average = 2.67). More also, 55% of the respondents expressed that the leaders in the cooperatives are selfish (average = 3.28).

The results implied that the sampled members of cooperatives in Mubi Metropolis in Adamawa state, unanimously agreed that the various corrupt practices, power tussle, incompetency, biasness as well as self-centeredness are all leadership factors that affected the expect performance of cooperative societies in the study area.

**Research Question III:** what are the societies related factors hindering the efficiency of cooperative societies in the study area?

**Table 3: Societies Related Factors That Hindering Efficiency of Cooperative Societies in the Study Area**

Factors	SA FX(%)	A Fx(%)	D Fx(%)	SD Fx(%)	Avg	Rmk
Political interference	266(73%)	42(12%)	22(6%)	35(10%)	3.48	A
Lack of good interaction with government agencies	187(51%)	17(5%)	21(6%)	140(38%)	2.69	A
Poor horizontal interaction among societies	209(57%)	13(4%)	24(7%)	119(33%)	2.85	A
Lack of cooperative knowledge	299(82%)	8(2%)	2(1%)	56(15%)	3.51	A
Poor business orientation	221(61%)	100(27%)	41(11%)	3(1%)	3.48	A

Note: SA, Strongly Agree, A: Agree, D: Disagree, SD: Strongly Disagree, Rmk: Remark

The results on Table 3 depicted the outcome of respondents' perception on societies' related factors that hindering the expected performance of cooperatives in the study area. The results indicated that majority of respondents (73%) unanimously agreed that political interferences is affecting the activities of cooperative societies in Muib Metropolis. Likewise, poor vertical interaction such as linking the regulatory bodies among others were identified by (51%) of respondents as significant challenges facing cooperative societies in the study area (average = 2.69). more also, poor horizontal interaction such as making linkage with other

cooperative organisations is expressed by (57%) of respondents ad significant problem facing cooperative societies (average = 2.85). Lack of cooperative knowledge among members of cooperative was expressed by majority of respondents (82%) as one of challenges facing effectiveness of cooperative societies in the study area (average = 3.51). Furthermore,, poor business orientation was identified by 61% of respondents as significant challenges hindering expected performance cooperative among the members in the study area (average = 3.48).

The results from this research questions established that political interference, lack of good interaction with government agencies, poor horizontal interaction among societies, lack of cooperative knowledge as well as poor business orientation are societies related factors that limited the expected effectiveness of cooperative societies among members in the study area.

**Research Question IV:** what are the societies related factors hindering the efficiency of cooperative societies in the study area?

**Table 4: Government Related Factors That Hindering Efficiency of Cooperative Societies in the Study Area**

Factors	SA Fx(%)	A Fx(%)	D Fx(%)	SD Fx(%)	Avg	Rmk
Lack of government regulation/ Government negligence	188(52%)	83(23%)	22(6%)	72(20%)	3.06	A
Lack of government assistance	199(55%)	79(22%)	65(18%)	22(6%)	3.25	A
Poor technical support/cooperative education	209(57%)	119(33%)	24(7%)	13(4%)	3.44	A
Cumbersome cooperative policies	171(47%)	98(27%)	59(16%)	37(10%)	3.10	A
Poor business environment	21(6%)	289(79%)	41(11%)	14(4%)	2.87	A

Note: SA, Strongly Agree, A: Agree, D: Disagree, SD: Strongly Disagree, Rmk: Remark

The results on Table 4 revealed the government related factors responsible for underperforming of cooperative societies in Mubi metropolis, Mubi North and South local government area of Adamawa state. The results indicated lack of government regulation, this was expressed by 52% of respondents (average = 3.06). More also, 55% of the respondents expressed that lack of assistance from government toward cooperative accounted for underperforming of most cooperative societies in the study area (average = 3.25). The results also indicated that most respondents (57%) expressed poor technical support from government toward cooperative development accounted for underperforming of cooperative societies in the study area.

Furthermore, the study identified cumbersome of cooperative policies from government regulatory bodies as challenges from government that limiting the performance of cooperative societies in the study area, this fact was expressed by 47% of the total sampled members of cooperative (average = 3.10). Among all, majority of sampled members of cooperative societies (79%) unanimously expressed that inability for the government to create business friendly environment affected the performance of cooperatives societies in the study area (average = 2.87). These results reaffirmed that lack of government regulation, lack of government assistance, poor technical support, cumbersome cooperative policies and poor business environment are the government factors hindering the efficiency of cooperative societies in the study area.

**Testing of Hypothesis**

Table 5: Results of Multiple Regression Analysis on Significant Contribution Hindrance Factors towards Poor Performance of Cooperative Societies in the Study Area

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error			
			Beta		

(Constant)	21.792	0.757		28.769	0.001
Members factors	0.163	0.126	0.357	16.3	.002
Leadership factor	0.191	0.078	0.327	19.1	.000
Society factor	0.451	0.063	0.295	45.1	.010
Government factors	0.11	0.013	0.319	11.0	.003

ANOVA = 1327.182 p-value 0.001, R= 0.918, R-Square 8.36, Adjusted R-Square =0.883

The regression analysis results as shown in Table 5 indicate that 91.8% of the observed variations in the factors lead to ineffective cooperative societies performance is jointly explained by all independents variables. This implies that all independents variables are strongly associated with ineffective of cooperative societies in Mubi Metropolis in Adamawa state. More so, the results of ANOVA model, revealed F-value (1327.182) with p-value < 0.0001. This implies that model is statistically significant at 0.0%. More so, the R<sup>2</sup>-value (0.836) was depicted for the overall model fitness.

The result of regression analysis in Table 5 shows that all four sampled hindrance factors towards cooperative ineffectiveness are all significant related to overall cooperative ineffectiveness. This implies that members' factors, leadership, society and government collectively contributed 91.8 of hindrances to the cooperative efficiency in the study area. The results on the table indicated that member factors, leadership factor, society factors as well government factor significantly contribute 16%, 19%, 14% and 11% respectively. In a nutshell, all the four null hypothesis were rejected implied that all tested independent variables are significantly contribute toward cooperative underperformance in the study area.

## Discussion

The findings of this study revealed that poor cooperative meeting attendant accounted for majority of members' poor attitude toward cooperative societies and as results leading to underperformance of the cooperative in Mubi Metropolis in Adawawa State. Poor meeting attendant can influence poor teamwork, unwillingness to offer assistance as well as delay in the repayment of loan. This finding agreed with the findings made by Oladeji(1999) that majority of members do finding it difficult to attend meeting at regular interval and this do leads to poor understanding of activities of the cooperative among members. Also, our finding of effect of poor participation as members' related factors affecting performance of cooperative societies in the study area was in accordance with the respective findings made by Mwelukilwa (2010) and Oladejo (2013) that not creating time for cooperative meeting and decision making affected members understanding of important of cooperative to their development. However, the finding made by Onyeze *et al.* (2014) failed to significantly attribute the rate of meeting attendant to the activeness of members. This implies that member's activeness cannot be solely measure by frequency of meeting they attend. He argued further that in this global-village period technology has grown to the extent of someone attending meeting from any far-range distance to the cooperative of hall. However, the findings by Armando (2008) indicate insignificant effect of frequency of meeting attendance on members cooperative participation, the conclusion drawn that non-physical appearance in the meeting affected members understanding about cooperative activities. The delay in the repayment of loan as indicated by the findings of this study can hinder the progress and opportunity to offer others members of cooperative loan at the needed time.

More also, the findings of this study revealed that corruption and other malpractices remaining the bane of poor performance among the cooperative societies in the study area. This finding was in accordance with finding made by Armando (2008) that corruption and leadership are becoming inseparable when aspect of money and other financial benefits are involved. The finding made by Coffie (2011) indicates corrupted leaders as one of the main factors responsible for downfall of majority community projects and cooperative activities. This view was not differed from the finding made by Ebue (2012) that most members of cooperative societies are eying leadership post to get chance of illegally laying hands on societies' purses. More also, the issue of power tussle among leaders is one of the degenerating factors limiting the efficiency of cooperative societies, this was in consonant with the earlier finding made by Elservier(2010) that majority of elite individual join cooperative to become leaders and has access to the financial management which in the end, usually being abused or embezzled. The finding made by Idyorough (2008) reported leadership incompetence, according to Prashanth (2011) majority of leaders in the cooperative societies lacked background of cooperative and as results abused the leadership rights and power and misguided the entire association. The view was not far from the finding made by Reeves (2003) that majority of leaders in the cooperative societies perceive the cooperative as social organization where anyone irrespective of their background and commitment level can become leader and do as they like. Macpherson (2009) faulted leadership system of many cooperative that loans granted to cooperative institutions were most at time channeled to other sectors that attracts fat interest, while many cooperative leaders engross in fund embezzlement, and some leader lack cooperative education. These according to him usually lead to poor returns performance of cooperative as organization.

One of the few leadership traits among the cooperatives in the study area found affecting cooperative effectiveness is biasness of dealing among members as well as self-centeredness by the leaders. This finding was in accordance with the findings made by Reeves (2003) that through improper selection of leadership, the leaders are now found indicated interest in the affair of some members than others or forming caucus, group or allied within the members in the same cooperative association. This according to Idyorough (2008) is one of ill-end of bad leadership. Thus, the cooperatives in the study area had been found suffered from biasness and self-centeredness leadership structure. In a nutshell, it is expected that anyone assumes mantles of leadership in the cooperative societies to be typified by such norms as honesty, fairness, equity, democracy, and mutual fellow feelings.

It was also revealed by the findings of this study that political interference affected the overall cooperative societies' performance in the study area. This agreed with the earlier finding made by Prashanth (2011) that cooperative of nowadays are dancing to the tune of politics. The politics interference delimiting harmony and leads to discrimination among members within an association. Severing the relationship with government agencies also accounted for poor performance among cooperative societies, Godquin (2014) argues that cooperative that linked the mother association will have good monitoring and ensuring leadership complaint with the rules and regulations of the association. Our findings from this study also indicated that rivalry among cooperative association instead of creating linkage is limiting expansion scope and business horizon for cooperatives societies in the study area. Elservier (2010) and Godquin (2014) maintained that horizontal interaction is one of the backbone of cooperative societies, however, the zeal for independency and strive to surpass others inhibiting development and promoting unhealthy rivalry among cooperatives societies. It was also found by this study that majority of societies are lacking business orientations therefore, the chances to run at loss may high business plan and ideas are grossly lacking from leaders to members.

Above all, it was also found by this study that government are failing in coming up with regulations and policies that can propel the development among the cooperative in the study area. The effect of lack of regulation and government intervention was reported by Elservier (2010) as highest sources of failure of association. Godquin (2014) hinted that cooperatives as associations have capacity to transform members and assist other non-members residing in the communities. Cooperative can afford to subsidize commodities for the consumption of members and non-members. However, all these benefits are lacking as results of poor government management and negligence for concern government agencies. Lack of government support was also reported by Reeves (2003) as one of significant factors limiting effectiveness of cooperative in our communities. Government is expected to facilitate linkage between non-governmental organizations within and outside the countries for the association to benefits from assistances offer by these NGO. More also, lack of business friendly environment significantly affected the performance of cooperative association in the study area. The need for business amiable environment for the thriving of cooperatives societies was concluded at the end of the study conducted by Godquin (2014) on impact of business viability in the communities and cooperative activeness.

## **Conclusion**

It could be argued that cooperatives is not the only association facing with multi-challenges, however, the underlining factors for the initiation of cooperatives is to assist members facing their domestic and other socio-economic responsibilities. Therefore, this study had identified that challenges is limiting the expected function of cooperatives in the communities and among the members. The individual members are found playing negative roles not attending the meeting and overall poor participation in cooperative activities. So also, the leadership of the cooperatives are found engrossed in various malpractices, selfishness attitudes, biased dealing with members, struggles for powers and generally lacking cooperative understanding. The contributive role of societies at larges were also established, which ranges from political interference, lack of vertical and horizontal interaction, lack of business ideas. It has also been established by this study that cooperative effectiveness are being affected as results of lack of government regulation, lack of government assistance, poor business environment as well as cumbersome of policies.

## **Recommendations**

In respect to the finding and conclusion drawn in this study, the following are the suggested ways forward to the challenges limiting the effectiveness of cooperative societies in Mubi Metropolis, Mubi North and South Local Government Area of Adamawa State:

- i. The members in the cooperative societies in Mubi Metropolis should improve on their attendant, teamwork, decision making and general participation in the cooperative activities to maximally possible benefits avail in being members of cooperative societies
- ii. The leadership in the cooperative societies should be democratically appointed to give rooms for fairness and rights for others to express their wishes. More also, the leaders in the cooperatives should try to be unbiased and proactive while handling cooperative issues.
- iii. The cooperative societies should maintain its freedom from political influences, religion and cultural affiliation. This can be achievable through visionary and dynamic leaders that opened to all members and deals with societies' issues without biasness. Also, horizontal and vertical interactions should be maintained to ensure sharing of ideas among others cooperatives as well as giving rooms for effective monitoring.
- iv. The state government should improve on policies that dealt with operation of cooperative association in Adamawa sate. Likewise, the government should assist the cooperative to establish linkages with the several NGOs within and outside the country in order to benefit from the array of assistance windows that will enhance their activities.

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# Arendtian Construal of the State and Sovereignty: An Extant Version Stance

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DOI: 10.29322/IJSRP.8.8.2018.p8025

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8025>

**Abstract:** The conception(s) of the State and Sovereignty is not new-fangled at any apposite construal outlook. However, this ought not to be deciphered to connote that an affinity to delve into their comprehension is futile. In this paper, there are a plethora of sub-themes that constitute these two themes of interest. Appertaining to the State, it is ordered by the constitutional structures which partake of proffering a delineating social identity as well as the legitimacy of the State action. Moreover, the society is construed to be the transitional sphere through which individuals can deliberate on varied issues as a sort of nourishment. State sovereignty is comprehended as vastly resounding along with invariant expressions. Varied schools' of thought such as the realists' interpret the State sovereignty from a pragmatist stance. It is in tandem with this department that the concern of whether sovereignty could suffer any brand of obliteration emerges. The interest of this exposition is to delve into the ambivalent nature of the State along with its co-reality, that is, sovereignty. The methodologies that were employed in the pursuit of possible rejoinder(s) to the foregoing problem were hermeneutic and critical approach. Arendtian proclivity to the State's and sovereignty viewpoints were interpreted and later on appraised with an avant-garde lens. It was realized that Arendt thought sovereignty besides autarchy to be the same in human endeavours by differentiating between an idea of rights and rights. Additionally, there ensues to be two sorts of sovereignty, to be precise, external along with internal sovereignties. The lingering enquiry at this juncture is the equipoise and nexus between internal and external sovereignty. Autocracy is by and largely vindicated as the need to surmount temporarily the weakness of dualistic or admixed or functionally separated forms of government. The facilitation is in determining the institution of a legitimate actor entitled to all rights along with privileges of statehood in addition to defining the underpinning strictures of rightful State action. It is germane to accentuate that legitimacy ought to be silhouetted by the construal of power as *the outright will's aptitude to bring into being as well as impose change on that which is* in the correlation between the State and sovereignty.

**Keywords:** Hannah Arendt, the State, sovereignty, transitional sphere, the annihilation of sovereignty, power.

## I. INTRODUCTION

The disquisition intends to embroil itself into the varied facets of both Arendtian as well as extant notions of the State and sovereignty. The titillating issue is that of construing first and foremost Arendt's stance on these two

political along with legal co-realities and later on the bearing of this comprehension in our avant-garde milieus of maneuver. In pursuing the preceding concern, what ought to continuously be the condition sine qua non is the correlation between the State and sovereignty. For the other aspiration to be fruitful, hermeneutics and critical approaches are germane in cognizing the liaison amongst transitional sphere, nature of autonomy, the annihilation of sovereignty and the sorts of self-rule.

## II. ON THE STATE

The inkling of the State is a multifarious, multi-criteria concept. In the present-day epoch, it refers to: a set of systematized institutions with a level of connectedness or cohesion; justifying shorthand descriptions of their behaviour in unitary terms; operating in a given spatial territory. The notion of the State further implies, an area populated by a considerable population structured as a distinct society. These institutions socially accredited function is to define and enforce requisite decisions collectively on the members of that society<sup>1</sup> and their existence creates a public realm distinguished from the sphere of private activity or decision making. Furthermore, each such State ought to correspondingly: claim sovereignty over social institutional as well as effectively monopolize the legitimate utilization of force within the given territory.<sup>2</sup> It ought to be in a position to describe members along with non-members of the society and regulate entry to as well exit from the territory; make strong conceptual or ethical claims to be advancing the common interests or broad-spectrum will of members of the society. Furthermore, be accepted as legitimate by significant groups or elements in the society, command bureaucratic resources<sup>3</sup> to be capable of collecting taxation.<sup>4</sup> Additionally, it should order government affairs effectively, given prevailing transactions costs;<sup>5</sup> substantially regulate societal activities using a legal apparatus and government activities by modes of a constitution and be acknowledged as a State by other States.

The modern-day States ordinarily meet all these criteria simultaneously. Nonetheless, historically, this complex governmental form evolved gradually and to some extent, with particular facets emerging unevenly in diverse milieus and becoming indiscriminate over long time episodes. The processes of State formation have been

strongly influenced by many factors: the transformation from feudalism to capitalism, alterations in military technology, wars, revolutions, imitative effects, geopolitical situations, the rise of nationalism and liberal democracy and the experience of communism, fascism and other forms of outstanding governments in industrialized countries.

Contained by the defining physiognomies set out above, there can be numerous poles apart State variations, with different institutional arrangements. Conditions quite often arise where most defining features are present, on the other hand, one or several facets are missing or called in question creating intricate cases where the attribution of statehood becomes problematical. The multi-criteria nature of the notion, the intertwined web of historically specific pathways of State development in addition to variances in State forms have all contributed to considerable theoretical convolutions in reaching any wide agreement about how to define the State. As Walzer commented in a different context: 'History illustrates a great variety of arrangements and ideologies. Nevertheless, the first impulse of the philosopher is to resist the displays of history, the world of appearances as well as to search for some underlying unity.'<sup>6</sup>

There has been a noticeable affinity for theoreticians to fasten on to one or a few of the defining features above to ignore or de-emphasize others, relegating them to the level of associated aspects or corollaries of statehood. Alternatively, other authors try to identify a small subset of features which form the prime root of State power or eccentricity. Conflicting definitions of the State have thriven, however, they can expediently be grouped into two views. Philosophical approaches, the juridical literature influenced by the Roman law, Marxist State theory and evolutionary systems theory approaches have by and large adopted an *organic* outlook of the State.

Here, the State is comprehended regarding some moral purpose, human drive or social function which call for the coming into existence of a specialized sovereign body, operating in the procedures representative of modern States. For instance, sorting out the exercise of ultimate political power from the lineage or traits of particular individuals. Moreover, amalgamating political regulations as a substitute for retaining the manifold independent or incorporated centers of political autonomy found in feudal arrangements.

All organic methodologies try to institute the indispensable quality of the modern State form, relying on logical argument. Most work follows some form of derivationist technique where the numerous defining features of the State are inferred from its essential purposes or functions within a broader social theory or philosophical apparatus. Much of this literature, especially in Marxist-influenced work, appears to reify the State, creating a unitary social actor to which massive social influence is consigned, however, whose explicit identification or inner workings often remain obscure.

The alternative mode is a methodological individualist view of the State as a compound set of public institutions or public officials, furthestmost frequently those at the central or national government levels alone or on the other hand of all designated governing organizations. This outlook preponderates in pluralist political science, mainstream economics, and historical sociology. It typically yields definitions of the State closer to *trait theory* techniques, which pursue to encompass or reorganize the entangled empirical corollaries of statehood.

The State has also been joined up in copious divergences with equally problematic contrasting terms. These contrasts attempt to clarify the essential core of stateness, nevertheless are usually not exhaustive and hence only aggravate definitional glitches. Typical of such false dichotomies is the State versus the individual contrast, which predominated in Anglo-American liberal thought from the end of the eighteenth century to the 1970s; the State versus civil society contrast in Marx's work, and parallel distinctions in Hegelian-influenced approaches. There was feeding through into the blanker State-centered versus society-centered elucidations of some contemporary neo-elite and novel institutional theory. Moreover, the domestic or welfare State versus the external or power State contrast which has sustained the post-war split between political science and international relations.

Each of these perspectives prioritizes some of the defining features listed above and de-emphasizes others. They point to diverse core elements of the State, the legal system for liberal approaches, the bureaucracy for neo-elite theory, the sphere of high politics for realist theory in international relations.

Hitherto, the State's task in liberal democratic societies remains the foremost enigma in current State theory. Analyzing the historical State of pre-democratic eras or State intervention under modern authoritarian regimes is relatively forthright. Where political power is concerted and regulated blatantly or observable by other power centers by wealth or military force or a secret police, for instance, acute hitches of maintaining the legitimacy of constraints on rulers from transactions costs, of achieving State rationality, *et cetera* may all occur. Typifying the State action and intervention is much more convoluted and enigmatic where a system of political decision making both formally vests ultimate control in the dispersed votes of citizens in addition to yet creates substantial power centers. The aftermath is institutions with an imperative gradation of autonomy, inertia, institutionalized dispositional biases, *inter alia*.

Correspondingly, the liberal democratic State claims unconstrained sovereignty over the social arrangements within its territory, hitherto binds itself formally with an apparatus of legalism and constitutionalism. In addition, in practice, the politically controlled and putatively sovereign liberal democratic State must border with a capitalist economy. It ought to operate in a culture where money is effectively a *dominant good*, transmutable into political power and social influence not just at national level, however, progressively on a global scale.<sup>7</sup>

Societies of States', as is contended here are ordered by constitutional structures. These complexes of metavalues define the social identity of the State and the broad parameters of legitimate State action. Hegemonic ideologies about the ethical intent of the State provide the justificatory foundations for sovereignty and generate norms of pure procedural justice. The latter exerts a profound influence on institutional design in addition to action, defining the *mentalities* of institutional architects and shaping the moral discourse that structures institutional production as well as reproduction. Constitutional structures are not all the same, since culture and history matter. Ideas appertaining to the moral purpose of the State display a discrepancy from one society of states to another, and they inform dissimilar norms of pure procedural justice. It is this variation, we argue, that explicates the divergent institutional practices of historical societies of states. States create central

institutions that reflect their social distinctiveness and as that identity changes, so too do rudimentary institutional practices.

According to Arendt, the prodigious and in the long run, perchance the utmost American origination, for instance, in politics *per se* was the unswerving obliteration of sovereignty in the body politic of the State. The discernment that in the sphere of human undertakings autonomy as well as totalitarianism are the same.<sup>8</sup> The statement can profitably be put together with Hans Kelsen's 1920 *Die Souveranitätsvorstellung Freilich muss Radikal Verdrängt Werden*.<sup>9</sup> He best explained this idea twenty-five years later, when he defined as formerly, sovereignty as the nonderivability of the domestic legal order from and its supremacy over all other sources of law, including and even in particular international law.

Under a sovereignty regime, international law gains its validity only for the reason that a domestic system so recognized it and the laws of other domestic systems, even more indirectly, are realized as valid only for the reason that are the requirements of international law. Sovereignty regimes are, thus, epistemologically solipsistic and politically even worse, potentially. A person whose political attitude is nationalism and imperialism will naturally be inclined to accept the hypothesis of the primacy of national law. A person whose sympathies are for internationalism and pacifism will be inclined to accept the hypothesis of the primacy of international law.<sup>10</sup> The latter will, for that reason, strive for politically or morally at least to suppress sovereignty regimes.

Leaving for another occasion consideration of Kelsen's remarkable though not wholly convincing argumentation for this position, we note that the two perspectives, his and Arendt's, could be comprehended as entirely incompatible or as complementary. Arendt's statement is about the supposed historical fact, whereas Kelsen's is about a moral-political norm rather than a legal norm. An unconvincing way of reconciling them would be to enunciate that what is both fact and a norm in America is mere norm elsewhere and Arendt's appeal to *the long run* gives the impression to suggest such a liaison between a model and its desired normative influence. Nevertheless, it is vacillating that Kelsen would have thought that in the period of the rejection of the

League of Nations or at the time of the founding of the United Nations; Americans were not confronted with the same fateful recourse as other States.

More relevant here is that it is very lucid that Arendt deems the American abolition of sovereignty to pertain to internal affairs only. *First*, for the reason that she explicitly avers that within the body politic and *second* for she even implies very rightly that the point or one of the points of forming a perfect union was to heighten outward autonomy. The duty was to bring together the recompenses of the monarchy in alien concerns with those of antiroyalism in national policy.<sup>11</sup> It would be incongruous to designate this as a fortuitous or thoughtless remark, given that the correspondence of its lunge with the intents of the writers of the amalgamation of several States (Federalism) had to be entirely clear to Arendt.<sup>12</sup>

To Kelsen, though, the suppression of sovereignty would imply that the supremacy of international law would be established vis-a-vis both the internal and external legal orders of States. More classically, then, he considered the external and internal dimensions of sovereignty to be inseparable.<sup>13</sup> On the other hand, in his two cited works, assuming sovereignty, its suppression in the internal life of the state would be devoid of the gist. There is no way, by definition, that he can thus explore the internal constitutional conditions prerequisite for the abolition of sovereignty. Moreover, that is the strength of Arendt's reconstruction of American history or at least of the path that her reconstruction commences though hardly completes. If she does not explore what in the internal constitutional design's linkage to sovereignty promotes imperialism, Kelsen could not in principle do so.<sup>14</sup> Entirely autonomous of his interpretations of sovereignty, Kelsen was hostile to the presidential government that will play a crucial role in the construing of as to the *raison d'être* of his stance; a form that he considered between democracy and autocracy and close to a monarchical form.

### III. TRANSITIONAL SPHERE

Arendt has presented one of the most confronting as well as indeed the most fervent critiques of modern civil society in a whole series of books along with essays.<sup>15</sup> Arendt's core thought merely mentioned antagonist is Hegel. Her attack is concentrated on the concept of society as an intermediate sphere of influence between

private in addition to public, family and political life. Society is a realm of mediations where private interests, activities, and institutions assume public roles while public institutions take on private housekeeping functions. Consequently, to Arendt, institutions such as Hegel's corporations and police do not stabilize and regulate the distinction of public and private but reasonably dissolve the sharp line between them and threaten the integrity and autonomy of both.

Unlike Hegel, Arendt does not pursue synthesis of modern society and ancient republicanism. Instead, she resolutely guards the model of conventional political ethos along with its sharp separation from the private (*Oikos*) sphere against modernity particularly the modern State bureaucracy and mass refinement. Her critique is a normative one underpinned by what is held to be the values of typical public life, concisely: political equality, public discourse, and honour beside private life, to be exact: uniqueness, difference, and individuality. Unlike that of Marx in 1843, whom she in numerous respects resembles, Arendt's is not an immanent criticism. The actual political reemergence and reinstitutionalization of these values call for an almost total rupture with all existing institutions.

History of decline from the emergence of society to mass society, perceived as more or less inexorable deprives modernity of its one admitted achievements, the development and enrichment of the private realm as a sphere of intimacy. Thus, like Walter Benjamin, Arendt consciously practices a form of redemptive criticism that for the sake of feasible future attempts to save some value facets of the past from the perceived disintegration of tradition including the tradition of early modernity.<sup>16</sup>

We examine Arendt's critique in detail for a plethora of *raison d'être*. *Firstly*, she will help us counterbalance the Parsonian conception by proffering rich insights into the dark side of the institutionalization of modern civil society. *Secondly*, the internal aporias of her analysis will help us illustrate that not even Arendt was able to base a modern theory of freedom on the abolition of civil society; she, too, is forced to assume, nevertheless unwillingly, the necessity of its preservation. *Thirdly*, a comparison with the early work of Reinhart Koselleck and Jürgen Habermas will countenance to demonstrate that in the modern universe one can make sense of

Arendt's normatively based project. The project gyrates around the concept of the public sphere, only if it is relocated around the intermediary sphere of the society that she sought to banish.

The conception of the societal in Arendt's text corresponds to the Hegelian *topos*, is undoubted, counterposed to both the political society of the ancient as well as the civil society of the modern liberals. While these two conceptualizations belaboured the public sphere in the case of the ancients and the private in the case of liberalism, the social realm, a creation of modernity obstructed by these two political philosophies entail an admixture along with interpenetration of the two realms and their constitutive principles.<sup>17</sup> To construe the mixture, we must first analyze its components.

Arendt's theory of the public sphere, albeit systematized around a theory of action is derived from her comprehending of the model of ancient republics. She conceives of the *polis* as the organization of the people as it arises out of speaking in addition to acting together.<sup>18</sup> Action, in turn, is grasped as the self-disclosure and even self-renewal of the actor through the medium of speech, feasible only in the presence of others who realize and hear besides hence are capable of establishing the reality of subjective expression.<sup>19</sup> The action is thus continually interaction that both confirms the plurality of unique experience and personality as it institutes a communal universe, relating and separating human actors at the same time. The collective cosmos is the public sphere.

Action or rather an interaction is constitutive of the public sphere,<sup>20</sup> however, it is supposedly only power that can keep it in existence.<sup>21</sup> Power, in turn, is defined as acting in concert on the bases of making and keeping promises, mutually binding one another, covenanting.<sup>22</sup> Arendt's model of action stresses on the striving of the actor for the fame and even *immortality* that can be realized through dramaturgic self-presentation based on the rhetorical skill of finding the precise words at the exact twinkling.<sup>23</sup> Her concept of power points to action-oriented to normative principles that derive their force from the depth-structure of a form of communication founded on mutual recognition and solidarity.<sup>24</sup>

Consequently, the concept of action can be construed as a wide-ranging anthropological constituent of the human condition, nonetheless, the concept of power along with it, a thoroughly institutionalized public sphere appears to require a republican model for its full actualization. Furthermore, Arendt does, in fact, link power more contiguously to political speech than to act in its primordial rhetorical sense.<sup>25</sup>

The public sphere in Arendt's stance presupposes a plurality of individuals' unequal by nature which are, nonetheless, *constructed* as politically equal. According to her, the connotation of the *polis* as *isonomia*, to be precise, equality about the law is that of no rule in the sense of an absence of differentiation into rulers and ruled within the citizen body. Thus, the public sphere establishes a model of interaction tintured by noncoercive discourse among citizens who initially hold and freely exchange a genuine plurality of opinions. This model turns out to be somewhat restrictive. Underpinned by her assortment between action and work, *praxis* and *poiesis* respectively, Arendt at times go along with what she takes to be the Greek exclusion of legislation, the decision by voting and even the founding of cities from the properly public, political activities.<sup>26</sup>

#### IV. NATURE OF SOVEREIGNTY

The State sovereignty is generally comprehended in highly categorical and invariant terms. Realists assume that self-sufficiency is an empirical categorization of the State, that the State resolves for itself how it will deal with both its inner and outer glitches.<sup>27</sup> More socially inclined theorists treat sovereignty as the foundational organizing principle of international society, the precept by which specific political units are identified and licensed as legitimate actors on the international stage. In both cases, sovereignty is assumed to have a fixed import. Whether in practice or principle, self-government is taken to denote the absolute authority of the state within its borders and the absence of any higher authority outside those borders. Alan James delves into this subject matter by accentuating that, sovereignty may be perceived as a moat, cutting the State off from constitutional subordination to other States, thus, expressing the fact of its own constitutional independence.<sup>28</sup>

Most authors admit that the practice of sovereignty never matches the purity of this conception, nonetheless, they maintain that it remains a theoretically powerful assumption, the indispensable point of departure for

comprehending the politics of anarchy. The dawn of international relations, according to Bull is the existence of States or self-determining political societies, each of which possesses a régime and declares autonomy in liaison to a specific percentage of the earth's surface and an exact fragment of the human populace.<sup>29</sup> A recent wave of constructivist erudition has antagonized this categorical appraisal of sovereignty. Instead of treating self-sufficiency as an unambiguous quality of statehood or a definitive benchmark of international society, constructivists argue that autonomy is a variable, social and essentially instituted regime.<sup>30</sup>

The traditional approach has been to acknowledge and then bracket variations in the practice of sovereignty to assume practical uniformity and conceptual consistency for the sake of theory building. Constructivists insist that our reading of international politics will be handicapped until we recognize that sovereignty is a functional category whose empirical contents are not fixed but evolve in a mode reflecting the active practical consensus among coreflective statesmen.<sup>31</sup> Giving flesh to this acumen, a wealth of studies have appeared that explore the socially constructed, historically contingent nature of sovereignty. These range from Ruggie's investigations into the world-historical transition from heteronomous to sovereign systems of rule, through Jackson's, Barkin and Cronin's and Thomson's analyses of significant shifts in the connotation of sovereignty in the modern era, to Bartelson's genealogical history of the conceptual discourse of power.<sup>32</sup>

In a variety of approaches, all of these studies are concerned with the constitutive relationship between the State and sovereignty. The mode of the sense of authority is negotiated out of interactions within intersubjectively identifiable communities and the variety of patterns in which practices construct, reproduce, reconstruct and deconstruct both state and sovereignty.<sup>33</sup> Despite emphasizing the different connotation of sovereignty; its contingent nature as a historically grounded practical discourse constructivists have continued to treat sovereignty as the basic structuring principle of international society. By employing the idea of constitutional structures to conceptualize the normative foundations of global community, we have not only embedded the principle of sovereignty into a broader complex of constitutive meta values, but there has also been an assigning of it a secondary, dependent value. The stance is not intended to deny that sovereignty is the fundamental

organizing principle of our present society of states or that it was any less imperative in structuring the ancient Greek, Renaissance Italian or absolutist systems.

Somewhat, it is to acknowledge what sovereignty is as an organizing principle, precisely, no more or no less. It is a standard that specifies how power and authority will be systematized, a model that mandates territorially demarcated and autonomous centers of political authority. There is nothing in the principle of sovereignty, though, that specifies why power and supremacy should be structured in such a fashion; the only technique to rationalize this form of political organization is by appealing to a set of higher-order values that sovereign States are thought to realize. Moreover, the legitimacy of the sovereign state rests on values other than the principle of sovereignty.

There has been the utilization of the concept of the moral purpose of the State to conceptualize these justificatory values and have suggested that dissimilar hegemonic as about the moral purpose of the state have given sovereignty poles apart denotations in unlike historical contexts. This conceptual move is intended to facilitate a more urbane and systematic construing of the normative foundations of international societies, and to enable us to comprehend their divergent qualities as well as their similarities.

According to David Strang, sovereignty is comprehended as a social status that facilitates States as participants within a community of mutual recognition.<sup>34</sup> Emancipation is, thus, considered the principal identity value of the international life world, the constitutive principle that empowers centralized, autonomous political units as legitimate social agents. A clearer construing of the nature of social identities and of the communicative practices surrounding their production and reproduction reveals, however, that this assumption is logically problematical. All human actors both individual and collective have social identities that enable them to operate in a world of complex social processes and practices. Like other constructivists, here, the definition of social distinctiveness is the sets of connotations that an actor ascribes to itself while taking into account the perspective of others, that is, as a social object.<sup>35</sup>

Social identities, as opposed to other corporate eccentricities, are defined by intersubjective, socially sanctioned and institutionalized gist that define the nature and purpose of agents and agency in a given social context.<sup>36</sup> Such identities fulfil a variability of social-psychological *telos*. Most decisively, they proffer actors with central motives for action. Here, the facet of veracity is in two senses. In a purposive sense, McCall and Simmons contend, social identities provide the primary source of plans for action, informing an actor's objectives as well as the strategies they formulate to achieve them.<sup>37</sup> In a justificatory sense, social identities provide the foundation on which action can be rationalized, providing actors with a reason for being and acting, a *raison d'être*. For instance, a doctor's social identity implies certain forms of action, such as prescribing drugs and doing surgery but also gives reason and sense to those actions.

Lest entrenched within a comprehensive intricate of higher-order values, the precept of sovereignty cannot alone arrange for the State with a lucid communal distinctiveness, nor has it done so in history. Reign, analogous to distinct autonomy, is not a self-referential worth proficient in individualistically proffering actors with essential details for an act. We at this point accentuate that sovereignty has no purposive content. Shorn of reference to some other higher-order values, it cannot independently inform plans of action or strategies to achieve them. Furthermore, the principle of sovereignty provides an inadequate justificatory fountain for action. If one behaves in a manner that annoys, frustrates or merely affects those of the others, they are entitled to enquire about why such a fashion of conduct. Asserting one's independence or liberty cannot engender an adequate response, as they can immediately enquire why the entitlement to such freedoms. At this point, one must ground his claims to independence in some other deep, socially recognized identity values.

Taken to an extreme, this would comprise appealing to intersubjective values that define what it implies to be a fully realized human being. Similarly, when states are forced internationally to justify their actions, there comes the point when they must outstrip mere assertions of sovereignty to more foremost and essential values that warrant their status as centralized, autonomous political organizations. The clarification is an essential facet of international communicative action, and historically it has entailed an ordinary moral discourse that grounds

sovereign rights in deeper values that define the social identity of the State. We are entitled to possess and exercise sovereign rights for the reason that we are ancient polises, renaissance city-States, absolutist monarchies or modern liberal polities.

Recognizing that the identity of the state is grounded in a larger complex of values than simply the organizing principle of sovereignty is the first stride in formulating a more congenial constructivist account of basic institutional practices. For these values not only define the terms of legitimate statehood, they likewise provide states with substantive whys and wherefores for action, which in turn exert a profound influence on institutional design and action. What is more, the values that ground sovereignty have varied from one society of States to another, generating contrasting rationales for state action and transformed basic institutional practices?

#### V. ANNIHILATION OF SOVEREIGNTY

What did Arendt's famous statement mean? It is indeed not problematic to discover why she thought sovereignty and tyranny were the same in human affairs. Arendt realized that the discourse of sovereignty comprising popular sovereignty as the claim to control, rule and assert jurisdictional supremacy by an entire, single political instance within a territorial body politic. Self-government is construed as a matter of the assertion of the will, as the command and ultimate discretion of an uncommanded commander who is *legibus solutus* the source of law and so unbound by law, thus, arbitrary, hierarchical, leveling, homogenizing and solipsistic by definition.<sup>38</sup> To her, the discourse of sovereignty is profoundly antipolitical. It is the discourse of rule and domination that is a projection from the sort of dominium typical of paternalistic rule over a household. Its unifying logic encompasses the attempt to conjure an approach to the ineluctable contingency and plurality of political action and the public sphere.

The concept of freedom associated with the idea of sovereignty is freedom of the unimpeded will, uncompromising self-sufficiency and mastership divorced from the action in concert.<sup>39</sup> It is liberty, to be precise, freedom of choice, ultimately in a monological sense, as opposed to political freedom in a republic, a concept that is inseparable from acting and speaking in the public sphere.<sup>40</sup> Thus, sovereignty, that is rule and

politics, to be exact, no rule is antithetical; the former is soliloquy, the latter communicative or at least interactive. The former involves the solipsistic freedom and assertion of the will and as such is antithetical to freedom, plurality and the exercise of political judgment by a multiplicity of actors communicating, deliberating and acting together in concert.

Sovereignty involves command and obedience; it is an institution of rulership and political hierarchy, not equality.<sup>41</sup> Supremacy is, thus, antithetical to the rule of law, *political* plurality and the existence of counterpowers, equal citizenship and ultimately constitutionalism itself. Accordingly, independence, at least in internal matters, is unbridled discretion, that is, tyranny presently grasped as a dictatorship. Arendt, also, comprehended sovereignty as by definition absolute and linked irrevocably to an embodiment model of representation and hence locatable in one single political instance. It makes no variance whether sovereignty is asserted by the king, by a parliament or in the name of the people. In every case, this discourse unleashes the attempt to appropriate it by a solitary representative instance and as a result, leads to tyranny and the abolition of politics and the rule of law.

For Arendt, the discourse of popular or national sovereignty does not circumvent this dynamic, as evidenced by the case of the French Revolution, for it too is perforce a discourse of the will, in this case, the indivisible general will, which must be unitary and homogeneous.<sup>42</sup> Will and power set above the law as the source of law can refer to the people as well as to the king. The attempt of continental democratic theory and practice, from Rousseau to Sieyes and Carl Schmitt, to put the sovereignty of people in the place of the king being involved. The correlate that as the constituent power, the people are before and unbound by law, henceforth able to amend the constitution through a revolution when they so will. In Arendt's view too, popular sovereignty as the revolutionaries construed it led inexorably to what Claude Lefort has christened the embodiment model of representation first articulated by Sieyes.<sup>43</sup>

Since the people cannot rule directly in modern society, their sovereignty must be represented. A single political instance could embody Peoples' autonomy, be it an assembly, a committee or a president, who, as sovereign

representative, tends to appropriate the political for itself or himself, to the exclusion of all other actors. The upshot is equally disastrous for political plurality and freedom as it would be under absolute monarchical sovereignty. Accordingly, the continental theory of popular sovereignty and especially the concept of constituent power, is a receipt for arbitrariness, populist distortion of republican principles. An invitation to an institutional organ, be it the legislative assembly or the executive, to claim to embody the will and unity of the people, ultimately undermining both the rule of law and political freedom.

The discourse of popular sovereignty is, like monarchical sovereignty, associated with the absolute and with unity and hence ultimately incompatible with constitutionalism. Accordingly, Arendt wanted to be done with the discourse of self-rule altogether. She wanted to keep the place of sovereign power empty.<sup>44</sup> It is quite noteworthy to affirm that, given her own normative theory, this train of thought does not tautologically put Arendt in opposition to external sovereignty. In the aforesaid sense, *first*, for the reason that presenting a united front toward the outside does not, despite the contrary logic of Carl Schmitt's argument in *Concept of the Political*,<sup>45</sup> exclude the public. Deliberative interaction is domestically of equal citizens who initially disagree as long as mechanisms are allowing the generation and enforcement of collective decisions.

Furthermore, it is also the case, *second*, for Arendt never described or imagined external politics as political in her demanding sense of the term. That may leave her and us with the lamentable inference that, in external affairs too where States are often perceived as brands of super-individuals or supermen, analogous to H. L. A. Hart's *Concept of Law*.<sup>46</sup> Sovereignty is tyranny at least concerning States incapable of full clout, a deduction Arendt gave the impression to draw in the context of late-nineteenth-century imperialism.<sup>47</sup> Starved of insisting or at least settling on either of the two apparent remedies implied by Kelsen's quest to abolish sovereignty; world government and sovereign equality.

The conceptual link between external and internal sovereignty is nevertheless strong, despite Arendt's concept of the political that appears to disunite it. There is much to recommend the historically dominant view in legal theory, articulated by Carré de Malberg, for instance, that internal and external sovereignty must be treated as

inseparable and even identical.<sup>48</sup> According to this view, a State indeed could not be supreme at home if it had a state that was its external superior, whose legislators or decision makers could then use whatever advantages they had to dictate the foreign policy of the dependent state to dictate its internal policies as well. The means of violence used to enforce each is the same, even if, for pragmatic elucidations, they are utilized in one case and not the other. Leaving aside when the break occurred, the Canadian federation, for example, was not sovereign as long as Canada was under a colonial status. The East and Central European satellites of the Soviet Union were also not sovereign at home.

## VI. SORTS OF SOVEREIGNTY

A sovereign State is a supreme political organization that has not only inferiors internally, that is, supremacy but also at most equals externally, precisely, independence. Inequality externally vitiates the supremacy internally. Conversely, can a state be at least equal to all others abroad if it is not supreme at home? The classical theory would have denied this also, and this is another reason for the inseparability of external and internal sovereignty. Nevertheless, how could then Arendt imagine that external sovereignty could be erected and maintained in America without internal ascendancy?

In her spirit, Arendt's determinations can be saved from a thoughtful contradiction only by the distinction insisted on by Carré de Malberg, that between *state* and *organ* sovereignty.<sup>49</sup> Such a distinction was fudged by the theorists of absolutism or monarchical sovereignty, however, became crucially imperative to make, according to Carré de Malberg, in the epoch of national or popular sovereignty, when the body of the whole could not rule directly and claims that it could do so would inevitably lead to usurpation.

An *organ*, that is, a person, an assembly or an institution could exercise all the powers of sovereignty that Jean Bodin assigned alternately to the State and its organ, the monarch. Nevertheless, there may be and ought to be, according to Carré de Malberg, under national sovereignty, if not Bodin, Thomas Hobbes and John Austin's State sovereignty short of such an organ. It is more or less the latter that was the epicenter of Kelsen's understanding of sovereignty and even of the sovereign State, as the supremacy of the domestic legal order,

though he wrongly neglected the problem of organ sovereignty in total. Arendt did not distinguish between state and organ sovereignty,<sup>50</sup> on the other hand concerning internal affairs, her fire is directed almost exclusively against the latter. Likewise, it is only organ sovereignty that the Americans banished in her reconstruction.

Accordingly, the American State is sovereign concerning the outside, on the other hand, about the internal life of the republic, at least no organ, institution, person or power holder ever has undivided supremacy, complete legal independence. Each is under the law and checked by other powers. If it were otherwise, as Carré de Malberg argued, national or to the Americans, popular sovereignty would be confiscated in the act of usurpation by a mere branch or organ of power. Organ sovereignty is a modern dictatorship or as Arendt anachronistically asserts, tyranny. Note that state sovereignty is compatible with Arendt's communicative conception of the political and is implicitly treated as such in *The Origins of Totalitarianism*. The preceding is so for the reason that the idea of the State's law is supreme no more excludes the public, deliberative interaction of equal citizens than does external sovereignty.

The reasons are partly the same as in the case of external sovereignty since in state sovereignty the external and internal are proximately linked and according to some are even identical. It is ostensibly otherwise with the concept of organ sovereignty. To cognize how Arendt came to concentrate on that issue devoid of using the actual concept and locate the domains from which she thought it must be banished, it is essential to uncover Carl Schmitt's direct or since she has not left us with the needed references indirect role in her train of thought. Starting from attacks on sovereignty by positivists such as Carré de Malberg and Kelsen, Schmitt admitted that the traditional concept based on the omnipotence of the hidden Supreme Being was political theology the wrong political theology.

Sovereignty, which continuously presupposes representation by and personalization in an actor or an organ capable of decision, necessitates a different political theology with the marvel or the extraordinary as its central concept.<sup>51</sup> In consequence, Schmitt came to concentrate on two extraordinary contexts in which sovereignty

organ sovereignty capable of decision reappears in the modern world, revolutionary constitution making and States of constitutional exception.<sup>52</sup> He had no problems with affirming both as dictatorships, the sovereign and the commissarial, both of which overcome all divisions and separations in the structure of power and temporarily all limitation by law. To Arendt, this way of thinking, which she had to know well from the 1920s when it was advanced both in the form of pamphlets and more severe studies became, noticeably, unacceptable and even reprehensible given her political conception to which we have already alluded. Her conception of the political in *Human Condition* already stood the Schmitt of *The Crisis of Parliamentary Democracy* on his head by adopting the deliberative model derided by the latter as the normatively preferred one.

In *On Revolution*, Arendt's strategy was to use the Americans against Schmitt whose stand-in textually is Sieyes' interpreted in the same one-sided manner of Schmitt himself.<sup>53</sup> It is demonstrable that Sieyes had strong American influences on him; that he accepted the idea of a sovereign constituent assembly with the plenitude of powers reluctantly that he had two concepts of the nation. One under the law while the other in the state of nature, *inter alia*; and that he was continually pursuing some model for constitutional guardianship and was uncomfortable with applying the doctrine of sovereignty to the constituent power as well.

Accordingly, on every conceivable level of internal politics, the American framers discerned rather than unified power. First and foremost, they truly distinguished legalized and tamed the constituent power itself. Instead of conceiving that revolutionary power in the state of nature, they located it in organized bodies. Instead of making the organized bodies of the people as the source of both power and law, they separated the two dimensions and conceived themselves to be at all times under the law. Furthermore, Arendt could have added, instead of fashioning a constituent assembly with the plenitude of powers, unchecked or checked only by a plebiscite, they constructed a many-stage, dualistic constitution-making effort where the drafting assembly was supposed to recommend only.

When it came to the constituted powers, the division of powers entangled their segmental diversity while the separation of powers entails their functional disparity. According to the Madisonian formula of blending

sovereignty between the States and the federal union, sovereign powers monopolized by absolute monarchies and some American state legislatures were shared among these instances. Arendt is a staunch advocate of federalism and even States' rights and remained so even though she perceived the misuse of the principle both in the period before the Civil War and in the period of the civil rights movement.<sup>54</sup> As far as we can tell, the idea that the Americans dispensed with sovereignty appeared first in the famous *We Think Misguided* essay on Little Rock (1959). Here, Arendt identified and defended the States' rights principle as that of the division of power and the fervour that the division of power fortifies the body politic. That was not the American experience with the doctrine and states' rights were only one version of the idea of division of power and federalism to national sovereignty if not to the sovereignty principle as such, but it has also been, repeatedly, a source of disunity and deep conflict.

Arendt, nevertheless, called the doctrine one of the most authentic sources of power for the republic as a whole.<sup>55</sup> How that worked, she never tried to demonstrate beyond entirely abstract considerations about the supposed nature of power, which unlike strength increases when it is divided. As late as the epoch of Watergate, Arendt defended the principle and quite implausibly, realized the enormous growth of federal power at the expense of states' rights as an issue to which movements of civil disobedience should respond.<sup>56</sup> While less is articulated about the separation of powers, the Montesquieuan scheme, reinterpreted it regarding checks and balances, is likewise consistently presented as actually a framework for the enhancement and increase of power. The erstwhile could be a stretch, then again in effect, this argument, partially right and partially wrong, served among other things as the riposte to Schmitt's presidentialism and within that his second extraordinary context in which organ sovereignty inevitably reappears as the state of exception, war, and internal emergency.

## VII. CONCLUSION

If one pays attention to Arendt's deliberations in *The Origins of Totalitarianism*, it turns out to be clear that her claim about the collapse of the nation-state is a constant attack on the terminology. As well, principles of the foremost State in addition to sovereignty theorists of the Weimar Republic, who alleged that they could create a

State order on the theory of the national will as the solitary authentic benchmark. The construal led to the folkloric abhorrence that was predominant in the 1920s and 1930s, and that made communication between the political entities dreary, if not intolerable.

The postulation of the homogeneousness of a nation started the deassimilation course that held not only political conflicts in store, nevertheless, correspondingly shrank a nation's sovereignty on issues such as emigration, naturalization, nationality, and expulsion. Unilateralism in enquiries of security and public safety as an expression of State sovereignty ended practically in the inability of the nation-state to act and, consequently, enforced it similarly to liquefy its constitutional foundation devoid of disentangling the predicament. Due to the gargantuan forfeiture of clout, numerous European States had relinquished the nation-state as a form of government long before World War Two and had instead either instituted totalitarian, fascist or authoritarian regimes or had replaced the parliamentary constitutional State with a party dictatorship.

Furthermore, the salient matters that have been deliberated in this chapter have buttressed the preceding sentiments in some modes. It has been realized that the State is systematized by the constitutional structures which engender it with both the social identity in addition to the legitimacy of its action, to be precise, State action. The society which constitutes part and parcel of the State regarding groundwork as well as a *teleological* dimension(s), serves as an intermediary realm. The nature of the sovereignty is couched in exceedingly uncompromising and invariant *lexes* as this is manifest in the diverse schools of thought such as the realists, whose objective at this juncture is the pragmatic interpretation of sovereignty.

Arendt thought sovereignty and fascism to be the same in the human goings-on. The construal of this enunciation could be palpable when an autopsy of the taxonomy of ascendancy is carried out, siring both external and internal hegemony. The concern here matures into that of the equilibrium between internal and external supremacy. On the interrogations of the purpose(s) of autocracy, there ensues a grasp of its chief role of vanquishing temporarily the weakness of dualistic or admixed or functionally separated categories of government.

The idea of sovereignty attracts certain inconsistencies: the right to self-determination, deassimilation and denaturalization, rightlessness and human rights. On this absurdity of human rights, there is a construing of the nation-state failure to realize human rights. The illustrious contributory stature on the doctrine of human rights is associated with Arendt through her aptitude to enquire about the right to have rights. Constitutional structures facilitate the provision of the orders that define in addition to giving identity to both national and international societies. Likewise, this determines the institution of a legitimate actor entitled to all rights along with privileges of Statehood in addition to defining the groundwork parameters of rightful State action.

Constitutional structures of the society of the States' determines the nature of its elementary institutional practices. Additionally, the State being linked to sovereignty as political as well as legal siamese twins raises the probe into the sovereign inequality, whereby, the concern is whether there is equality in sovereignty both in principle and practice. In the long run, legitimacy related or interrelated outlook(s) grow into being ostensible, such as, what founds legitimacy, what is legitimacy's *modus operandi* in addition to what is it all about meta legitimacy, *inter alia*.

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## End Notes

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<sup>2</sup> Max Weber, 'Politics as a Vocation', in M. Weber, *Essays from Max Weber*. Translated by H. Gerth and C. W. Mills (London: Routledge & Kegan Paul, 1948), p. 78.

<sup>3</sup> Max Weber, *Economy and Society* (New York: Bedminster Press, 1968/1978), pp. 212-226.

<sup>4</sup> Alois Joseph Schumpeter, 'Crisis of the Tax State', *International Economic Papers*, Vol. 4 (1954):5-38.

<sup>5</sup> Margaret Levi, *Of Rule and Revenue* (Berkeley: University of California Press, 1988).

<sup>6</sup> Michael Walzer, *Spheres of Justice: A Defense of Pluralism and Equality* (Oxford: Blackwell, 1983), p. 4.

<sup>7</sup> *Ibid.*

<sup>8</sup> Hannah Arendt, *On Revolution* (New York: Penguin Classics, 1963); Andrew Arato and Cohen Jean, "Banishing the Sovereign? Internal and External Sovereignty in Arendt," *Constellations*, Vol. 6, no. 2 (2009):1-25.

<sup>9</sup> Hans Kelsen, *Das Problem der Souveranitat*, (Tubingen: J.C. B. Mohr, 1920/1928), p. 320.

<sup>10</sup> Hans Kelsen, *General Theory of State and Law* (Cambridge: Harvard University Press, 1945), pp. 383-388.

<sup>11</sup> Arendt, *On Revolution*, *Loc. Cit.*, p. 152.

<sup>12</sup> Arato, A. and Jean, C. "Banishing the Sovereign? *Loc. Cit.*, 1-25.

<sup>13</sup> Kelsen, *Das Problem der Souveranitat*, *Loc. Cit.*, p. 38.

<sup>14</sup> Kelsen, *General Theory of State and Law*, *Loc. Cit.*, p. 301.

<sup>15</sup> Cf. Hannah Arendt, *The Origin of Totalitarianism* (New York: Barnes & Noble, 1951).

<sup>16</sup> Cf. Jürgen Habermas, "Walter Benjamin: Consciousness Raising or Redemptive Criticism", in *Philosophical-Political Profiles* (Cambridge: Massachusetts Institute of Technology Press, 1983).

<sup>17</sup> Hannah Arendt, *The Human Condition* (New York: University of Chicago Press, 1958), pp. 23-24.

<sup>18</sup> *Ibid.*

<sup>19</sup> *Ibid.*, p. 50.

<sup>20</sup> *Ibid.*, p. 198.

- <sup>21</sup> *Ibid.*, p. 200.
- <sup>22</sup> Arendt, *On Revolution*, *Loc. Cit.*, p. 75.
- <sup>23</sup> Arendt, *The Human Condition*, *Loc. Cit.*, p. 26.
- <sup>24</sup> *Ibid.*
- <sup>25</sup> *Ibid.*, pp. 26-27.
- <sup>26</sup> *Ibid.*, pp. 194-195.
- <sup>27</sup> Kenneth Waltz, *Theory of International Politics* (New York: Random House, 1979), p. 96.
- <sup>28</sup> Allan James, *Sovereign Statehood: The Basis of International Society* (London: Allen and Unwin, 1986), p. 39.
- <sup>29</sup> Hedley Bull, *The Anarchical Society: A Study of Order in World Politics* (New York: Columbia University Press, 1977), p. 8.
- <sup>30</sup> Janice E. Thomson, *Mercenaries, Pirates and Sovereigns* (Princeton: Princeton University Press, 1994), p. 13.
- <sup>31</sup> Richard K. Ashley, "The Poverty of Neorealism." *International Organization*, Vol. 38, No. 2 (1984):225–261.
- <sup>32</sup> John Gerard Ruggie, "Continuity and Transformation" and "Territoriality and Beyond" (1993).
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- <sup>35</sup> Alexander Wendt, "Collective Identity Formation and the International State." *American Political Science Review*, Vol. 88, no. 2 (1994):384–395.
- <sup>36</sup> *Ibid.*
- <sup>37</sup> George T. McCall and J. L. Simmons, *Identities and Interactions* (New York: Free Press, 1966), p. 69.
- <sup>38</sup> Arendt, *On Revolution*, *Loc. Cit.*, pp. 30-31.
- <sup>39</sup> Arendt, *The Human Condition*, *Loc. Cit.*, p. 234.
- <sup>40</sup> Arendt, *The Origin of Totalitarianism*, *Loc. Cit.*, pp. 143-171.
- <sup>41</sup> Arendt, *On Revolution*, *Loc. Cit.*, pp. 30-31.
- <sup>42</sup> *Ibid.*, p. 156.
- <sup>43</sup> Claude Lefort, "Permanence du theologico-politique," *Essais sur le politique* Paris: du Seuil (1986).
- <sup>44</sup> *Ibid.*
- <sup>45</sup> Cf. Carl Schmitt, *The concept of the Political* (New Jersey: Rutgers, 1976).
- <sup>46</sup> H. L. A. Hart, *The Concept of Law* (New York: Clarendon Press, 1961), pp. 215-221.
- <sup>47</sup> Arendt, *The Origin of Totalitarianism*, *Loc. Cit.*, pp. 269-270.
- <sup>48</sup> Raymond Carré de Malberg, *Contribution to General Theory of the State* (Paris: Editions Dalloz, 1922/2004), pp. 199-410.
- <sup>49</sup> *Ibid.*
- <sup>50</sup> Cf. Arendt, *The Origin of Totalitarianism*, *Loc. Cit.*, 1951.
- <sup>51</sup> Schmitt, *The concept of the Political*, *Loc. Cit.*, 1976.
- <sup>52</sup> Cf. Carl Schmitt, *Die Diktatur* (Berlin: Duncker & Humblot, 1922).
- <sup>53</sup> Cf. Pasquale Pasquino, *Sieyes et l'invention de la constitution en France* (Paris: Editions Odile Jacob, 1998).
- <sup>54</sup> Hannah Arendt, *Crises of the Republic* (New York: Penguin Books Ltd., 1973), pp. 75-77.
- <sup>55</sup> Hannah Arendt, "Reflections on Little Rock" (1959), in *Responsibility and Judgement* (New York: Schocken, 2003), p. 210.
- <sup>56</sup> Hannah Arendt, *Civil Disobedience* (New York: Schocken, 1970/1971), p. 75.

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# A longitudinal analysis of dengue in Jamaica over the period 2004-2017

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DOI: 10.29322/IJSRP.8.8.2018.p8026

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8026>

## Abstract

**Objectives:** Dengue fever is caused by the *Aedes aegypti* mosquito that is considered to be a vector borne viral disease. Drastic increase in cases in Jamaica is usually noted to be seen during the raining seasons, which spans from May-September each year.

**Method:** Data was obtained from the Surveillance unit at the ministry of Health (MOH) in Jamaica with recordings of dengue reports for the study period (2004-2014). The website for the Statistical Institute (STATIN) was used to obtain data regarding the rainfall activities over the same period. The office of disaster and emergency management (ODPEM) was consulted for appropriate map highlighting Jamaica's flood prone areas. The EBSCO host data base was extensively searched to obtain relevant literature on the incidence of dengue infections worldwide. **Results:** In 2007, Jamaica had 5500 suspected cases of dengue while of that amount only 1550 was confirmed with same. An average of 2139 mm of rainfall was recorded for the same period with temperatures over a period of 1996-2015 showed averages of 28.3<sup>0</sup> C at Norman Manley international airport, 27.6<sup>0</sup> C and 23.7<sup>0</sup>C at Sangster International and Worthy park respectively. 2015 showed 100 suspected cases with only 22 patients truly being infected with dengue.

**Conclusion.** The results show that the dengue infection depends on the seasonal variation of the climate. The rainfall provides places for the mosquitoes to lay eggs and develop to the adult stage. The temperature plays an important role in the life cycle and behavior of the mosquitoes. A very high or very low temperature reduces the risk of the dengue infection. More over continued nationwide knowledge interventions, will continue to greatly aid in the number of confirmed dengue cases to be decreased and hopefully totally eradicated.

**Keywords:** - Dengue, Jamaica, Rainfall, Vector-borne

## 1. Introduction

This research is a retrospective analysis of the frequency with which dengue cases are reported in Jamaica from 2004 to 2017. Dengue is a mosquito borne viral illness that mimics the presentation of other flu like illness. Dengue is categorized as the most reported mosquito borne virus. Uncovered water catchment areas are the best place for this mosquito to quickly replicate. Dengue infections are present worldwide and is especially important in developing countries, where sanitation and proper water storage is at its minimum. Mild non-lethal anicteric forms comprise most cases and can be easily confused with flu, leptospirosis, other mild viral illnesses and *P. vivax* malaria [1]. This research is intended to ensure that health officials are always equipped with the knowledge to prevent large outbreaks and reduce the mosquito population. The fewer mosquitoes there are, the fewer chances of outbreaks. Dengue fever affects the body by causing flu like symptoms, aching muscles and high fever, which can also infect ones blood which causes rash, headache and even fatigue.

## Problem statement

The large number of dengue cases in Jamaica is of great concern and of such greater preventative and eradication methods must be adhered to in curbing the wide spread of this illness.

## Study Context and Conceptual Framework

A holistic analysis of the overall frequency of suspected and confirmed cases will be discussed. The geographical land scape is generally mountainous with plains that serves as water settling regions. Data collection will be validated using reports from individuals, the Ministry of Health, newspapers and journals.

### **Rationale and Justification**

Dengue is considered a major global health crisis with higher cases reported in tropical countries like Jamaica. Preventing frequent outbreaks of dengue must be at the forefront of our minds as the burden placed on the Ministry of Health and other health related entities the sociological and economical cost related to this illness must be mitigated. Addressing factors which directly support the spread of this disease will not only limit the amount of persons becoming affected but lessen the financial burden on the Jamaican economy.

### **Purpose of Study**

The purpose of this study is to highlight the burden dengue outbreak has on Jamaican economy.

## **2. Literature Review**

Dengue fever is amongst the most common mosquito-borne disease in the tropics and the most suspected in patients with fever. With the introduction of chikungunya (2013) and the Zika virus in (2014) it has become more challenging for health workers to diagnose, creating problems for appropriate case management and alleviating fatal events [2]. The global incidence of dengue has grown dramatically in recent decades. Approximately half of the world's population is now at risk. According to the Ministry of Health there were 560 suspected cases of dengue fever across the island of Jamaica (2012) [2].

Mosquitoes transmit the virus by feeding on blood of infected persons. At first, the virus infects and replicates in the mid-gut epithelium of the mosquito and then spreads to other organs until it reaches the salivary glands after 10–14 days where it can be inoculated to another person during subsequent blood meal. On the other hand, mother-to-infant transmission of dengue virus via cord blood or breast milk remains controversial [1, 3, 4].

WHO in their latest estimate states that over 50-100 million dengue infections occur annually. With drastic increases observed over the past 50 years [11]. With increased interventions, dengue still continues to be a public health threat.

It is imperative to note that the age of dengue patients after 2010 was significantly older than that of patients prior to 2010 (mean pooled age: 34.0 vs. 27.2). Possible reasons for this finding may be that younger people now spend more daytime in enclosed air-conditioned environments and are, therefore, less likely to be exposed to mosquitoes [5] and that older people with chronic diseases now visit the doctor more often, causing existing dengue infection to be more likely to be detected [6]. The association between weather and dengue varies across geographical locations and socio-environmental strata [12, 13].

## **Method**

### **Epidemiological data**

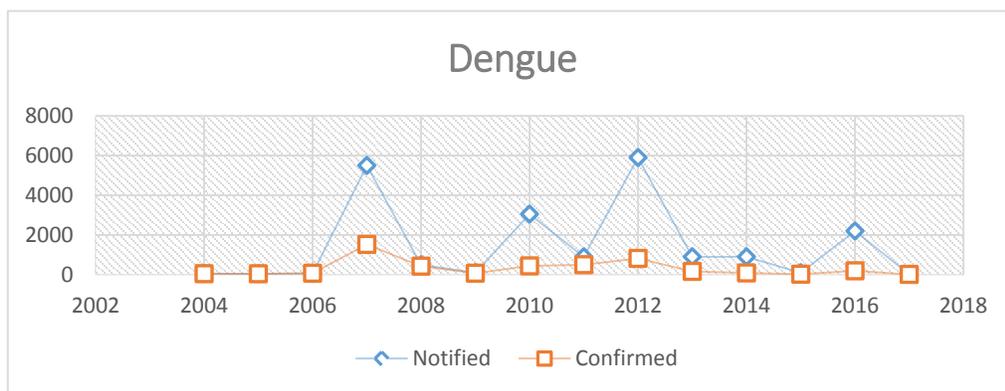
A fourteen year empirical data was collected from the Ministry of health surveillance unit in Jamaica. The dengue surveillance system in Jamaica collects data from the four (4) regional health authorities (southern regional health, west regional health, northeast regional health, and south east regional health authority). These bodies' collects surveillance data then send it to the Ministry of Health (MOH) head office for analysis and dissemination. A quarterly bulletin is prepared and posted on the MOH website for ease of access. The dengue cases are diagnosed by public health care professionals at different locations whether clinics, hospitals or private practices around the island. These health centers report the number of suspected and confirmed laboratory dengue cases to the regional medical officer. For the effective control of disease outbreaks, rapid and precise diagnosis of dengue is of paramount importance. The age and gender differences were not captioned for this study however the frequency of the cases were analyzed.

**Results**

Of the 50 cases that were notified in 2004, 96% of the cases were confirmed (n=48). A similar number of cases were notified in 2005, however a decline of 4 cases was noticed for this year bring the percentage to 88% from 96% confirmed when compared to the previous year. The year 2006

YEAR	Notified	Confirmed
2004	50	48
2005	50	44
2006	56	71
2007	5500	1521
2008	500	428
2009	100	73
2010	3050	440
2011	900	500
2012	5900	817
2013	900	164
2014	900	86
2015	100	22
2016	2200	193
2017	20	12

**Table 1. Year date comparison of notified and confirmed dengue cases in Jamaica from 2004-2017- (Source-Ministry of Health surveillance unit)**



**Figure 1-Comparison of suspected and confirmed dengue cases over the test period [9]**

Frequency: Annual- Wastes material categories					
Categories	2010	2011	2012	2013	2014
Compostables	49			62	55
Plastic	20			12	18
Paper	20			9	17
Cardboard	2			5	2
Textile	3			5	4
Glass	1			3	3
Metal/Tin	2			2	2

<b>Wood/Board</b>	2			1	0
<b>Other</b>	1			0	0
<b>Total</b>	100			100	100

**Table 2. Annual waste material in categories from 2010-2014 [8]**

Month	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
January	102	81	112	117	80	136	89	189	67	101	73	111	78	112	99	83	70	45	117
February	163	69	39	122	40	40	39	45	35	7	97	37	37	140	62	86	51	55	72
March	90	59	194	126	23	58	43	69	122	12	34	236	114	84	45	70	135	69	58
April	143	54	61	54	76	147	125	153	129	176	131	82	140	120	137	88	201	89	121
May	195	96	88	156	209	310	512	235	256	224	127	264	138	270	269	215	140	212	221
June	139	182	106	155	88	49	198	117	50	234	170	116	156	121	203	313	93	90	47
July	135	95	151	103	105	142	83	116	141	488	142	79	153	59	198	205	90	107	46
August	156	109	146	166	62	86	117	233	158	147	180	304	369	145	191	195	214	193	162
September	188	146	186	274	257	139	595	154	454	168	156	152	210	161	561	184	194	206	183
October	240	201	277	270	222	313	132	215	159	578	196	395	261	176	590	254	237	167	121
November	274	136	205	211	112	247	109	147	76	200	240	294	257	90	135	68	159	148	152
December	37	75	219	51	273	190	116	188	160	77	119	69	47	143	107	78	98	92	181
Annual	1,862	1,303	1,784	1,805	1,547	1,857	2,159	1,861	1,807	2,412	1,665	2,139	1,960	1,621	2,597	1,839	1,682	1,473	1,481

**Table 3. Jamaica's Annual rainfall data** Source: Statistical Institute of Jamaica Accessed: May 16, 2016

**Communities in Jamaica that are often implicated with increase dengue cases Table 4**

Parish	Number of affected communities	Reference	Population size	Reference	Land area
St Thomas	29	[8]	94,410	[8]	
Kingston & St. Andrew	87	[8]	66,041	[8]	457.2 km <sup>2</sup>
St. Catherine	95	[8]	518,345	[8]	1,190.6 km <sup>2</sup>
Portland	37	[8]	82,183	[8]	813.9 km <sup>2</sup>
St. Mary	21	[8]	114,227	[8]	114,227 km <sup>2</sup>
St. Ann	30	[8]	173,232	[8]	173,232 km <sup>2</sup>
Westmoreland	54	[8]	144,817	[8]	144,817 km <sup>2</sup>
Hanover	18	[8]	69,874	[8]	69,874 km <sup>2</sup>
St. James	12	[8]	184,662	[8]	184,662 km <sup>2</sup>
Trelawney	32	[8]	75,558	[8]	75,558 km <sup>2</sup>
Clarendon	77	[8]	246,322	[8]	246,322 km <sup>2</sup>
St. Elizabeth	97	[8]	150,993	[8]	150,993 km <sup>2</sup>
Manchester	36	[8]	190,812	[8]	190,812 km <sup>2</sup>
Total	625		2,711,476	[8]	2,711,476 km <sup>2</sup>

**MEAN MAXIMUM TEMPERATURES 1996-2015 (in degrees celsius) [10] Table 5**

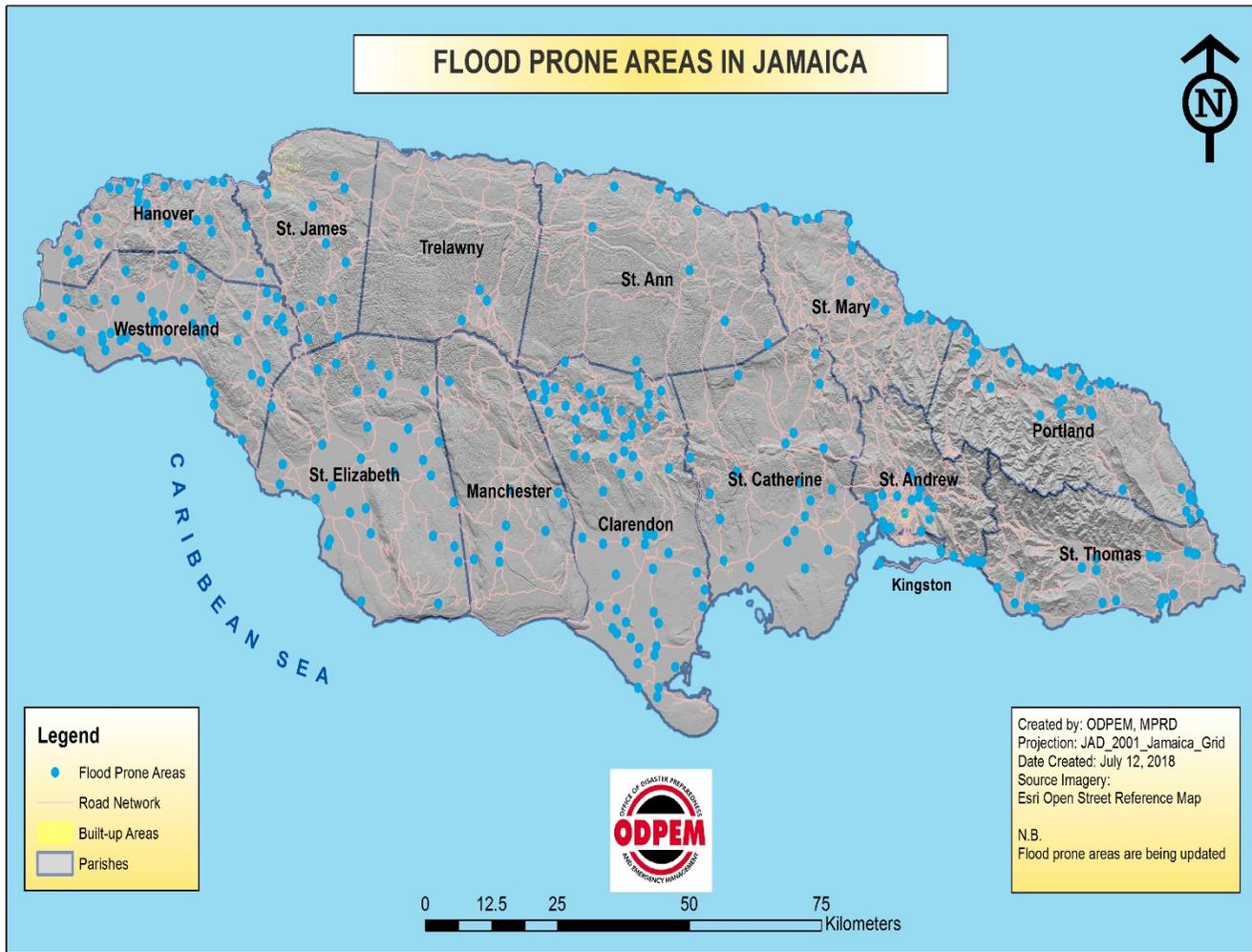
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
Norman Manley Int'l Airport	30.9	30.8	30.9	31.5	31.9	32.6	33.0	32.6	32.8	32.3	31.9	31.3	31.9
Sangster Int'l Airport	29.8	30.0	30.5	31.4	32.1	32.9	33.2	33.4	33.0	32.1	31.2	30.2	31.6
Worthy Park	27.8	28.4	29.2	29.9	30.4	30.8	31.2	31.4	31.1	30.2	29.1	28.3	29.8

**MEAN MINIMUM TEMPERATURES 1996-2015 (in degrees celsius) [10] Table 6**

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
Norman Manley Int'l Airport	23.0	22.9	23.3	24.2	25.1	25.9	25.9	26.4	25.8	25.3	24.4	23.5	24.7
Sangster Int'l Airport	22.1	21.9	22.4	23.4	24.0	24.6	24.8	24.9	24.5	24.2	23.8	22.8	23.6
Worthy Park	15.8	15.4	15.7	16.9	18.1	18.9	18.9	19.2	19.3	19.1	18.0	16.9	17.7

**MEAN TEMPERATURES 1996-2015 (in degrees celsius) [10] Table 7**

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
Norman Manley Int'l Airport	25.6	26.9	27.1	27.8	28.5	29.2	29.5	29.5	29.3	28.8	28.2	27.4	28.3
Sangster Int'l Airport	25.9	26.0	26.5	27.4	28.0	28.7	29.0	29.1	28.8	28.2	27.5	26.5	27.6
Worthy Park	21.8	21.9	22.0	23.4	23.5	24.0	25.1	25.3	25.2	24.7	23.6	21.7	23.7



Map 1: Flood prone areas in Jamaica by parishes [18]

## Discussion:

In 2004 Jamaica experienced the passage of two hurricanes, Charley and Ivan (category 4) in August and September respectively. The confirmed cases of the vector borne virus was seen to be at its lowest during this period however with rainfall measurements reaching only 1807mm. The rainfall activities for 2005 was higher than the previous year however confirmed cases were less than the previous year only with a margin difference of 4 cases. Rainfall activities were higher in 2005 with measurements of 2412mm due to the passage of hurricanes Dennis, Emily and Wilma. In 2006 the rainfall activities were at its lowest compared to the two previous years. Jamaica was noted to be spared hurricanes attacks for this year. While not having an activity hurricane season the dengue cases continued to slightly increase. There were no distinctions in the reports of the symptoms and sign experienced along with whether the cases were imported or local. Of the 56 previously notified cases, an increase of 15 cases bringing the total for 2006 to 71 confirmed cases. 2007 showed the year with the second highest suspected cases of 5500 of this amount only 1521 were confirmed cases for dengue. 2007 was not spared the attack of hurricane as Jamaica experience the ravaging effects of Hurricane Dean with rainfall activities of 2139mm. 2008 had 428 confirmed cases out of 500 that were suspected and notified. That same year experienced two tropical storms, Nicole and Gustav. Rainfall activity remained somewhat normal with rainfall measuring 1960mm. Rainfall activities for 2009 was lower than the previous year, this was recorded as 1621mm. Notified cases also significantly fell to 100 case with only 73 of the cases confirmed. By 2010 the notified cases fell to 3050 with 440 of these being confirmed. In 2012, a 96% increase in notified cases (n=3050) seen. Only 440 of the 3050 cases were confirmed with dengue. The year that followed (2011) had a notified number of island wide of 900 with 44% being confirmed. 5900 notified cases were reported in 2012 showing the highest suspected report, however 14% (n= 817) were confirmed as having dengue. The years 2013 and 2014 both had notified cases of 900 however different in conformed cases as 2013 confirmed 164 as 2014 confirmed 86. The rainfall activities for both years were 1473mm and 1481mm respectively. A similar decrease as seen in 2009 was noticed in 2015, as only 100 suspected cases were reported with only 22 of the 1000 confirmed as having dengue. A spike was reported in 2016, as 2299 suspected cases were reported. However only 193 of that number was confirmed. 2017 should the lowest over notified and confirmed as. 20 suspected cases were reported with only 12 of that number was seen to be true carriers.

Precipitation is often required to create and maintain breeding sites and consequently has a strong influence on vector distribution. Dengue is endemic in Thailand and Latin American countries, where a positive association between dengue prevalence and rainfall has been reported [14].

Similarly, studies have also been reported that in wetter conditions, compared with drier conditions, mosquitoes expand their spatial range, thereby leading to increased risk of dengue infection [15].

In contrast, dry conditions can also lead to epidemics in urban settings, because vulnerable people with little access to water resources tend to store water in unprotected reservoirs near their households. This water attracts *Ae. aegypti*, which is anthropophilic, thus further increasing the risk of transmission [16,17].

There was a positive relationship seen with the type of landscape, whether low land or mountainous with the prevalence of Dengue as seen on Map 1 and Table 4. Due to the lack of adequate recorded information regarding the waste disposal practices of the nation, conclusive statements cannot be made regarding the categories of waste materials frequently implicated in the different parishes (Table 2). What was observed for the recorded period was that compostable waste was the highest waste materials that were collected, while wood/board were the category with the least frequent.

## Conclusion

Dengue is driven by complex interactions among host, vector and virus that are influenced by climatic factors. It is known that with the right conditions, the dengue virus will indeed proliferate. It is clear that with increase in knowledge about this illness and increase interventions, regardless of the increase in rainfall the dengue case will not surpass a certain number.

There are still limitations to this study as many persons who exhibited sign and symptoms of dengue did not report to any medical facility. Additionally, record taking and transfer has always been problem. While plans are afoot to decrease these incidence of none reporting, we had to account for this in the paper.

Author contribution

JBC and AP both contributed to the literature review and the introduction of the paper. JBT contributed to the research design, compilation of documents, analysis of results, first, second and third draft of the manuscript. All others contributed to the final draft.

### Funding

No external funding was received for this research.

### Conflict of Interest

The authors declare that there are no conflicts of interest associated with this research.

### Acknowledgement

We are grateful for the willingness of the ODPEM and MOH for readily providing the needed data for the completion of this research paper.

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# A study on the level of adjustment of the secondary school students of kamrup District with special Reference to Mirza, Assam.

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DOI: 10.29322/IJSRP.8.8.2018.p8027  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8027>

**Abstract:** We know that the ultimate objective of Education is the “All –round development” of the children. Education is that means through which individual gets its refined shape. It enlighten as well as empower people to face all the challenges of life. The education provided through an organized form is termed as Formal Education. School is the basis of this formal education. The term “School” bears a lot in the lives of people. Though the term is simple , yet, it is only the strong weapon by which a biological man is transferred to a social and a real Individual. School life plays a prominent role in the overall development of the students. There are various factors behind the successful school life of a student. The factors may be socio-economical or psychological. Both have immense significance on the attainment of success in the academic life of the student. Among the psychological factors, adjust mental factor plays a very crucial role in the academic life of the student Here in this paper, attempt has been made by the investigator to study such important psychological factor of adjustment of the students of secondary level. As secondary stage is the significant period of student’s life , the study is confined to these group of students . There are number of secondary schools in kamrup District of Assam, the investigator by taking 10 schools from Mirza, which is a major town in south kamrup district ,have conducted the study and the result shows a great variation regarding the adjustment level of the secondary students.

**Key-words:** Secondary students, adjustment level , gender.

## Introduction:

School education plays a very crucial role in the realization of the actual objective of education. School is the active and basic means of Education. It is considered as the “ Foundation” stage of formation of children’s personality. The impact of learning and training, students obtain in the school last throughout their lives. Thus, school education is very much significant in the overall development of the students. There are various determinants or factors which act behind the success of school education. The factors may be social, economical, cultural as well as psychological. Regarding the psychological factors, there are number of dimensions. One of the most important factor is the adjust mental factor. A student can learn better, when he/she is well adjusted to the learning environment. When a girl or boy is failed to make adjustment in the school, it will hinder his or her academic life as well as development of the self. The adjustment is required not only with the classroom but also with the peers, teachers, curriculum and all other school activities or personal’s. A better adjusted student is a better learner.

## Adjustment:

Adjustment has a psychological significance. It is the process and ability of coping with new and dissimilar environment and situation. The concept of adjustment was first used by Darwin in his theory of Natural Selection. The adjustment of a person largely depends on his interaction to the external environment in which he lives. The interaction is not an easy process. It depends upon a number of factors such as internal and external, demand of the individual and the external pressure of the environment. As an achievement , it means how efficiently an individual can perform his or her duties in different adverse as well as favorable circumstances. Adjustment is a kind of interaction between the individual and his/her environment for bringing harmony between them. It is a dynamic and continous life-long process. A well –adjusted person manifests certain behavioural characteristics, he/she has the capacity to conform to the norms of the society. He expresses confidence in him and in others. He /she shows strong sense of security and responsibility. He/she has well defined goals in his/her life and a set of values .The person is then well adapted to reality

and time. Individual difference is a natural phenomenon. Each student differs from the other in regard to number of psycho-physical characteristics. The rate of learning also varies from children to children. As such, regarding the adjustment, students show variations. Some students possess better adjustment capacities, whereas some are very poor in making adjustment with new people or environment. The reasons vary from students to students. The reasons of factors for low adjustment may be genetic or environmental. What may be the reason, first of all, it is essential to be clear with the meaning of adjustment.

### Objective of the study:

Keeping in view the importance of adjustment in the school life, the investigator has formulated the following objective—

1. To study if there are any differences between girls and boys of secondary school of Kamrup district with special reference to Mirza in respect to the adjustment in school?

In the light of the above objective, the following hypothesis is framed.

H01 There exists no significant differences between girls and boys regarding the adjustment in the school.

### Review of Literature

Various studies have been conducted on the area of adjustment. Each study carries its own significance and has lots of implications in the field of education and psychology. Some among them-

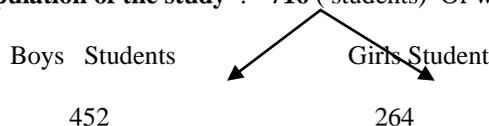
**Tran** (1993) examined the relationship between family living arrangement and social adjustment among a sample of 258 elderly Indo-Chinese refugees, who were aged 55 years and above in the United States. The findings revealed that the elderly who lived within the nuclear or extended family had a better sense of social adjustment than those living outside the family context.

**Renuka** (2008) conducted a study to explore the personality and adjustment correlates of organizational commitment among college teachers of Haryana. Findings revealed that college teachers temperamentally characterized as conscientious, rule-bound, venturesome, socially bold, trusting, adaptable, practical, regulated by external realities, controlled, high in self-concept control and having home, health, emotional and occupational adjustment tend to be more committed to their working organizations/institutions.

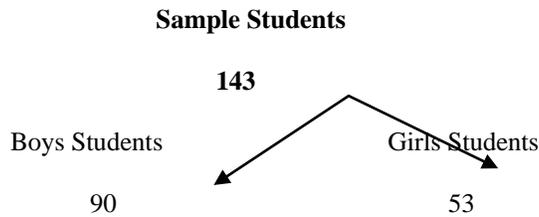
### Methodology :

The present study has been conducted by survey method. The study has been delimited to the class (x) students of the secondary schools of Mirza, Kamrup District. The investigator has taken randomly 10 secondary schools of Mirza.

**Population of the study** : - 716 (students) Of which 20% has been taken for the study.



**Sample of the study**: - 143 (20% of Population)



**Sampling Technique:** Stratified random Sampling has been adopted.

**Tool:** For collection of data from the selected sample, a standardized tool has been used by the investigator. Adjustment Inventory For school students( AISS) developed by A.K Sinha and R.P. Singh which is consists of 60 items on different areas of adjustment has been applied for the present study. The scoring has been done manually as per the instruction of the Inventory. The scored data then have been analyzed through statistics like-t-test and are also presented graphically.

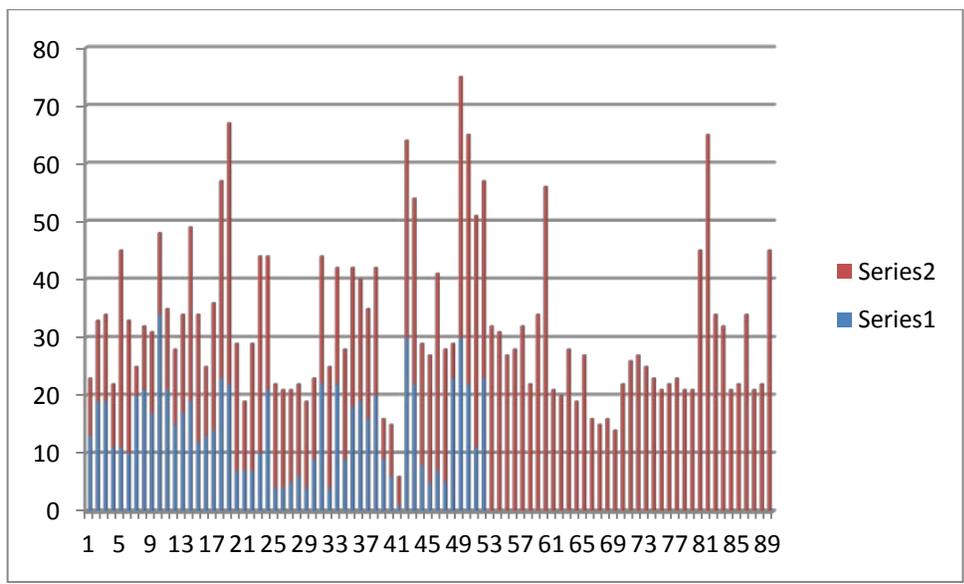
**Result and Discussion:**

On the basis of the analysis of the collected data, the following result have been found . The results are presented in tabular form according to the objective of the study.

**Table No 1.** Significance difference between girls and boys of secondary schools in respect to their adjustment with school.

Variables	N	Mean	Variance	df	t-value	Remarks
Girls	53	23.77	116.86	130	-5.85	Significant at both the level.
Boys	90	14.39	62.723			

**Interpretation of Table no1 :** From the Table No 1, it is cleared that there exists significant differences between the girls and boys of secondary schools in respect to their adjustment with school. As the calculated t-value is greater than the tabulated value at both the level, we can safely reject our null hypothesis.



**Figure 1** Showing the graphical representation of the adjustment level of girls and boys in secondary school.

**Findings Of the Study:**

On the basis of the study conducted so far, the following facts have been derived-

- The calculated mean value of the adjustment of Boys in the secondary school is found to be 14.39 whereas the mean value of the adjustment of Girls is found to be 23.77.
- After applying statistical tool to compare the means, the t-value is found to be -5.86.
- The calculated t-value is much higher than the tabulated value at both the levels.
- From the study, Boys are found to be more adjusted than the girls as they show less negative aspect of adjustment in the school.
- The reasons behind the low adjustment of the girls in the school are supposed to be social, economical and cultural.
- The study reveals the fact that there exist differences in the adjustment of students in the school in respect to their Gender.
- This study brings the fact into light that boys are better adjusted than the Girls in the school.

**Conclusion:** Adjustment is a way of living the life in a peaceful and meaningful manner. It is the ability of people to accept the changes and to lead the lives in accordance with those changes. It is an important components of day-to-day life. In the school life the ability of the student to adjust matters a lot. Keeping this in view, a study has been conducted by the investigator to examine is there any differences between girls and boys regarding their adjustment in the secondary school. Taking 10 secondary schools of Mirza, kamrup District, the study has been conducted. The study reveals there exists significant differences between Girls and Boys regarding their adjustment in secondary schools. Boys show higher adjustability than the boys. Ofcourse, this study cannot be generalized as it is conducted on a smaller area.

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# The Vary Functions of Polder At Heritage Area of “Kota Lama Semarang, Indonesia”

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DOI: 10.29322/IJSRP.8.8.2018.p8028

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8028>

**ABSTRACT----** *Formerly, polder is only functioned as green area for doing sports such as playing soccer, athletic for students and for night market communities as well sometimes. The flooding happened in this heritage area at the wet season. Therefore the local government have an idea to make polder as the water resistant and revitalitation of the rivers of a Banjir Kanal Timur. The problem of heritage area is not only about flooding, but also the land that subsidence 10 cm every year. The heritage building were left by the ownership and the building where deterioration, besides, there are also many criminals, many unarrangement vendors, the bad condition of infrastructure, cause many investors canceled to invest. The method would be used in this research is descriptive qualitative method. The polder functions can be used as recreational place, fishing place, open space for water refreshing, for aesthetic background of view, and also the water resistant around the heritage. It is an attractive point for heritage area.*

**Keywords;** Polder, Function, Heritage Area, Semarang.

## 1. INTRODUCTION

Polder is very important to be chosen as the paper. It is very important to accomodate the flooding in the rainy season. It's created as the recreational place for the people. It could be as a pond for developing fishery and relaxing for the fish. Polder is very important for refreshing the environment and it has a potency for developing a beautiful place. Beside that, the local government have to make it clear every year, as it influences for the bad smell around it, and the government make dredged polder anytime. Therefore the role of water resistant will be successful, and the government put the fishes in the pond. It is very important to clean up the mosquito spots here. When the rainy fall, the floodgates is opened, so that the water will not caused flooding. The communities around the polder have to care to not throw away the garbage in the pond, because it can cause flooding. The management of the polder is not well managed, because the local government have a lot of responsibility of the city. The ability of the polder need another power in order to throw the water away to the other places, for example revitalitation of the *Banjir Kanal* rivers in the southern and in the western part. The important thing, the polder can be used by the people to do water sports, for instance, water bicycle, boat, and others. The character element around the polder is the heritage character.

## 2. RELATED STUDIES

Polder is a well-constrained area, where water from outside of the area should not enter, only rainwater (and sometimes water seepages) in the area itself collected (<http://eprints.upnjatim.ac.id/6643/1/Binder1.pdf>). Polder can also be interpreted as a lowland that forms an area surrounded by an embankments, where in this area the waste water is collected in a body of water then pumped to a higher body of water, until eventually it is pumped into a river or canal that empties into the sea (<http://anggunsugiarti.blogspot.co.id/2012/02/belajar-dari-sistem-polder-negera.html>). In polder there is no free surface flow as in natural water catchment areas, but equipped with a controlling building at its disposal (with a drain or pump) to control outflow (<http://binamarga.pacitankab.go.id/aadmin/.../drainase-sistem-polder.ppt>). The Dutch Government uses a polder system to defend its territory against flood and tide water. The polder system was originally developed by the Dutch Government in the 11<sup>th</sup> century to keep the water level elevated and to protect the area from flooding. Then in the 13<sup>th</sup> century, the polder system is enhanced by the use of a windmill to pump water out of the area that lies below sea level.

The imbalance of urban development that is more concerned with economic growth has been caused flood. This condition need efforts to control flood and tide water with increase technology aspect and management. The polder system is one of the appropriate and effective engineering alternatives to control flood and tide water, it also can support the development of urban areas in low-lying areas prone to be flooded. According to Widaya in Nugroho (2012) it was

mentioned that the polder system consists of embankments that surround the area, retention ponds, drainage systems, pumps, water gates, and other components into one system and designed according to the location and problems encountered. The purpose of developing a polder system is to provide an integrated urban flood control model (<https://bebasbanjir2025.wordpress.com/teknologi-pengendalian-banjir/polder/>). The development of a good polder system provides no benefit in flood control itself, but it can also be used as a tourist attraction or recreation, agricultural land, fisheries, and industrial or office environments. Completeness of physical facilities that must be considered in the design criteria of a polder is (a) drains and reservoirs built as a means to regulate water delivery when the water elevation at the exhaust point is higher than the channel elevation within the area; (b) embankments made with the width, large, high, and surround the area to prevent the entry of water into the area; (c) a water pump that functions to drain water in a body of water that works automatically when the water volume exceeds the planning value (<https://bebasbanjir2025.wordpress.com/teknologi-pengendalian-banjir/polder/>).

Semarang City is one of big cities in Indonesia that has coastal areas. This makes Semarang City can not be separated from the condition where the area is flooded due to sea water seawater and due to flooding. Ground level in the slopes continues to decline every year, as well as rising development in coastal areas by forcing the reclamation has made the distribution of water in the city of Semarang increasingly widespread. To overcome this problem, Semarang City Government has built a *Polder Tawang* that was built as a system to protect the abundant water from outside the area and control the water level inside the *Kota Lama Semarang*. In *Polder Tawang* there is a retention pond measuring  $\pm 1$  Ha. Around the polder there is a pedestrian path with paving block pavement material. On the side of the eastern pool, there is a water pump that serves to regulate the flow of water. Pond *Polder Tawang* is a major building element in integrated *Polder Tawang* building system from water channels, sluices, pump houses, main pools and sewers (Suseno, 2012). Then on the side of the *Polder Tawang* decorated with ornamental lamps shaped like a monument that is mounted lined up to add to the beauty of the polder atmosphere. Vegetation elements contained in open space *Polder Tawang* in the form of grass and palm trees that strengthen the characteristics of urban water space and some other vegetation. However, the element of this vegetation has not functioned properly, because the atmosphere in the *Polder Tawang* still feels arid and hot. Open space is equipped with elements of street furniture in the form of lights, signs, and potted plants. The existence of *Polder Tawang* able to attract the citizens of Semarang City to make the place as a tourist attraction. Even in this pond deliberately sown by fish seeds Department of Marine and Fisheries Semarang City to attract the interests of city residents who have a hobby of fishing and to reduce the odor that often arises from this polder pond (<https://noem3d.wordpress.com/2009/04/14/nongkrongdipoldertawang/>).



Source: Private Document, 2017.

**Fig. 1** Street Furniture in *Polder Tawang*.

According to Kevin Lynch Theory (1981), when viewed from the aspect of appearance dimensions and in terms of sensitivity which includes form, quality, and environmental identity, then the taste created through the shape orientation of the *Polder Tawang* is pretty good. The serial vision that can be captured around the *Polder Tawang* serves as a water-dominated soft landscape to be a force for exploiting the surrounding buildings and causing a watering effect as well as reinforcing the dramatic impression in the city's open spaces (Darmawan, 2005). *Tawang Station* as *grandiose vista* by cultivating landscape elements as a force in generating beautiful scenery (Darmawan, 2015). The presence of a *Polder Tawang* not far from the area of *Kota Lama Semarang* with its majestic ancient buildings provides a tourist atmosphere like in Europe.

### 3. RESEARCH METHODOLOGY

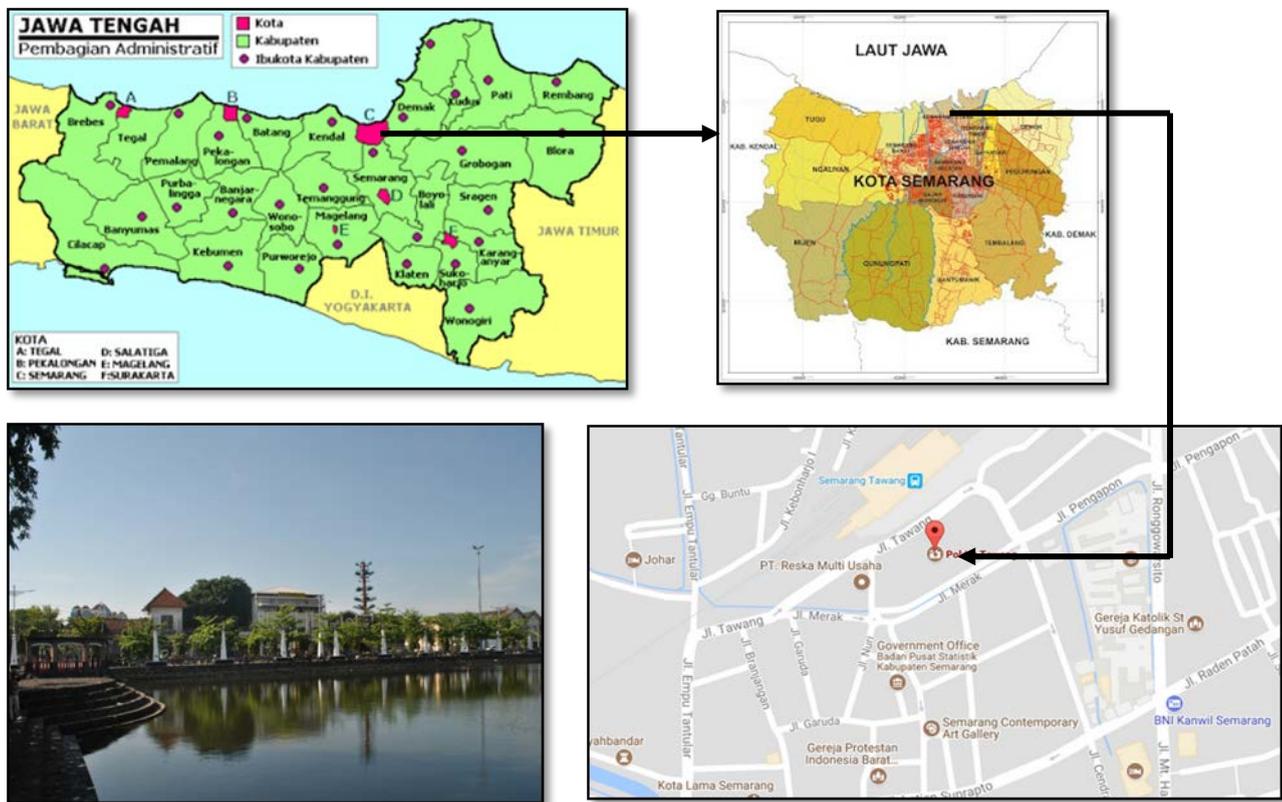
#### 3.1 Approach and Research Method

The research method is used for answering the formulation of research problem that has been determined. In this article, the research approach applied was qualitative approach that emphasized narrative construction or textual descriptive for the researched phenomenon. The method used in this research was descriptive method. According to Arikunto (2006), the qualitative descriptive method describes and explains collected findings in order to gather actual and detailed information, identify problems, and make comparison or evaluation. This method furthermore helps us to determine what other people do in dealing the same problem and how we learn from their experiences in order to make plan and decision for the future. In this article, descriptive qualitative method was used to describe physical condition of polder in *Kota Lama Semarang* and explained the problem also the potential of polder. The type of the research method included surveys that can be used to collect data from certain places naturally. The data collected from observations, interviews, and study of literatures were then selected and grouped systematically based on the needs. After that, the

result of data compilation was analyzed with qualitative descriptive analysis method consisting of steps of analysis using data that described the research object.

### 3.2 Research Site

*Polder Tawang* is located in the front of Tawang Station which is included in Semarang City, Central Java, Indonesia. *Polder Tawang* has an area  $\pm 1$  Ha and has a catch area  $\pm 70$  Ha. *Polder Tawang* is very strategic because it is in the north bounded by railroads from Tawang Station, in the east it is bounded by Ronggowarsito Street, in the south is bounded by Petudungan Street, and in the west it is bounded by *Kali Semarang*.



Source: Author, 2017.

Fig. 2 Located of Polder Tawang.

*Polder Tawang* was built by the Government of Semarang in 1998-2000, it is one of the beautiful places to visit in the *Kota Lama Semarang*. The attractions in this area are Tawang Station, Kodam Supplies Building, Stailan Boarding House. This polder can be accessed from Jl. Merak, Jl. Tawang, Jl. Cendrawasih, Jl. Kedasih, Jl. Kneeling, and Jl. Parrot.

## 4. RESULTS AND DISCUSSION

### 4.1 Polder for Recreation and Background

Many people are jogging around the polder in every morning and evening. The people are walking around everyday in order to take care their belt. Many people, either they are young or elder are fishing in the edge of the polder. The water is not hot or cold, so this condition is perfect to use it as the place for doing water sports such as water cycle, duck cycle, and boat in the pond. While many vendors around the polder sell their foods and drinks. The heritage building at the near of the southern part is the background view of the polder. The palem trees around the polder create the good aesthetic view of polder besides making a fresh place under the trees. Water fountain in the middle of polder create a fresh of the environment and make the enclosure of polder looked beautiful. Street furnitures around the pond are very convience for relaxing while they do the interaction.



Source: Private Document, 2017.

Fig. 3 Activity in Polder Tawang.

#### 4.2 Polder for Water Resistant

For handling the flooding, there are few ways: First, making the polder as water resistant at heritage area. The presence of the polder there will make the flood around it caught in the polder. Besides, the creating of the big river in the western and eastern *Banjir Kanal River* is to revitalization every years and the polder have to minimize the depth of the polder. Therefore, it can fill the polder while they created the channel for throw away the water from the polder. The channel have to make the door to open and close the waters toward the urban waterways.



Source: Private Document, 2017.

Fig. 4 Polder Tawang for Water Resistant.

#### 4.3 Water Fountain as the Aesthetics

Water fountain that turning on in the afternoon would make the environment air being fresh. If it turns on in the night with the combining of the spotlight it would be shine and create a beautiful light. The light creates the environment more live up. Many couples chit chat in the place, the more night, the more it is crowded. In the night, there are a lot of adult than children that visit it. There are still some elderly staying just to chat with other elderly until midnight. Unfortunately, in every morning, the rubbish is straggling in the area of polder. It is needed someone officer to clean up the area. Especially for the dirt in the water, it must be cleaned, as if it is not, it would be appear and causing a bad smell.



Source: Private Document, 2017.

Fig. 5 Polder Tawang for Aesthetics.

#### 4.4 Polder as Waterfront

Surrounding of the polder is the street that full of transportation like car , *becak*, and also motorcycles. Beside the street, it also could be found the heritage building as the background. It would made the area seen more beautiful. If some vendors is not closed to them. Especially, in the front of Tawang Station and the heritage building in the southern part and the rows of light surrounding the polder makes the area seen beautiful.



Source: Private Document, 2017.

**Fig. 6** Polder Tawang as Waterfront.

## 5. CONCLUSION

Based on the results and discussion, it can be concluded as follows:

1. The polder over capacity of flooding at the rainy season is occurred.
2. The polder can be functioned as the interesting recreational place by the community.
3. The polder has a resistant toward the flood.
4. The polder adds the beautiful of the heritage area.

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# Total Quality Management Its Impact on the Performance of Educational Institutions

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DOI: 10.29322/IJSRP.8.8.2018.p8029  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8029>

**Abstract-** The study aimed to Definition the total quality management and its impact on the performance of education institutions in the University of Samarra , This study was based on the analytical descriptive approach, which was composed of the top management and middle administration of the university. The study sample was 52 individual. It found a set of results of which, there is a statistically significant effect of total quality management on the performance of education institutions in the University of Samarra. Based on the findings of the study were presented a set of recommendations was the most prominent of the permanent work on the dissemination of comprehensive quality culture at the University, Engaging employees in the process of strategic planning for quality and benefit from their experience in the field of the application of total quality management.

**Keywords-** Total quality management, Institutional performance, Effectiveness, Efficiency, educational institutions

## INTRODUCTION

Today, institutions are living in various types, especially educational ones, in an environment characterized by dynamism, rapid economic transformation, and technological development, University education has experienced a significant change in recent years by registering a remarkable growth in terms of the student's number enrolled in universities and the number of professors. as well as, the expansion of the number of universities and colleges (Al Khatib,2006), Which had a great impact in the search for everything new And modern to organize the quality management of universities and educational institutions (Al-Samarrai and Al-Nasser, 2012).

This is Prompting the institutions of higher education to apply the standards and procedures of total quality management and to keep pace with the scientific development in various fields in order to obtain the standards of academic accreditation in university education and its application to the administrative aspects in order to provide the best service for internal and external audiences (Al-Mamouri, 2015).

Modern organizations have to achieve total quality in a rapidly changing and highly competitive world of service delivery. Accordingly, these institutions are no longer immune from the face of multiple and diverse challenges but have become a restriction on their performance. Sometimes these restrictions turn into threats in the event of an inability to adapt to (Abu Fara, 2006).

Total quality management has become an entry point for a change of organizations and a target for most institutions, including education. As a result, the total quality, which is considered by many organizations as a successful means of bringing about radical developments in the philosophy of quality management and the participation of all participated parties within the organization to face risks and threats (Kayani, 2012).

studies and researchers published in the field of total quality have confirmed that there is an interest in the issue of total quality in the education sector. Increasingly, this concern with the growing awareness of the importance of this approach and the important role played by the total quality management in the provision of quality education services when applied effectively (Kerr, 2011).

the importance of this study Where is the concept of total quality of modern application topics in the global institutions of higher education field (Al-Mamouri, 2015). So this study came in order to contribute to providing Iraqi universities with a new field study on the reality of the application of total quality management at the University of Samarra .

There is a growing interest in the content of total quality management applications in universities around the world. However, we did not find the concept of total quality in Iraqi universities. In addition to the very slow in its application at the university in question. This is noted by the researcher through field survey of the university under study. also, The researcher identified the problem of the study Through the recommendations and objectives of previous studies Including (fram, 1995) , (Mustafa, 1997) , (Hilali, 1998) , (Nagy, 1998) , ( Gandhi,2015) and (couch, 1997). so this study came to know the impact of the application of total quality management in the performance of educational institutions and in terms of administrative aspects, Therefore, the search problem can be limited by answering the main question : " Total quality Management impact the performance of educational institutions : a field study of opinions top management middle management at the university of samarra" ?.

### CONCEPTUAL FRAMEWORK

**total quality management-** Has acquired the concept of total quality management increasing interest by academics in our time today. As well as being one of the contemporary entrances of business organizations And one of the tools of success and continuation of those organizations. total quality is described as an inherent and comprehensive belief in the leadership and operational style of the organization. With the aim of continuously improving long-term performance by focusing on the requirements and expectations of customers, shareholders and all other stakeholders (Al-Azzawi, 2005). total quality management is an integrated philosophy based on customer satisfaction as the most important goal of the organization in the long term. Through a sharing responsibility between management and staff to pursue continuous improvement of all activities and at all levels of the organization. Which requires constant commitment and strong support from top management to ensure quality in all its aspects and from all sections of the organization (Al-Saman and Saleh, 2005). as an organized methodology that ensures the conduct of activities that have been planned in advance, It is the optimal method that helps to prevent and avoid problems by motivation and encourage administrative and organizational behavior in the optimal performance and use of human and material resources efficiently and effectively (alnhway, 2013).

A number of studies have contributed to enhancing the current study orientation on About Total Quality Management including "Total Quality Management and its impact on improving financial performance " (aldaeasu, 2010). A practical study in a sample of Jordanian commercial banks". pointed Study "The impact of Total Quality Management practices on competitive advantage and organizational performance"(Munizu, 2013). including The study " the impact of Total Quality Management on the running performance of South Korean companies"(Kouame,2017). The researcher found the current study in harmony with the study " Transnational education and total quality management a stakeholder-centered model "(Shams, 2017). also The study " The impact of total quality management on service company performance evidence from Spain"(Psomas and Jaca 2016). And the study " Total quality management performance in multinational companies A learning perspective " (Jimenez et.al,2015).

**Strategic Planning-** is one of the most important dimensions of Total Quality Management (Jawad, 2010). Where the strategic plan is developed by the Quality Council With the possibility of adaptation and coexistence with this change the application of Total Quality Management and the course that the institution will pursue in order to achieve what it wants from the goals (krdi, 2011).

that strategic planning is the first step to reach total quality Educational institutions that seek to achieve using this type of planning and Contributions to decision-making and educates leaders about their goals and determinates the means to achieve them (Fawzi, 2017).

**Employee participation-** Employee participation is a cornerstone of total quality that motivates and encourages Employees to articulate their ideas, and give them sufficient flexibility in their work. They are in fact working directly and they have practical and realistic ideas must take advantage of the optimization processes and solving problems. The introduction of any change must be through them, and therefore the question of integrating them into all operational matters is imperative, necessary and indispensable (Lleo et al., 2017). The human resource is an important part of the total quality of being who will take the leadership process .Therefore, it must be treated as a partner, not as subordinate, and this will deepen loyalty and belong to the organization also create a spirit of creativity, innovation, achieve job satisfaction which in turn will improve performance, achieve total quality (qadat ,2012). Participation is a process of mental and emotional interaction with working groups mobilizing the necessary efforts and energies to achieve the objectives of the Corporation (Irawanto, 2015).

**Continuous development-** It has become the continuous improvement and development of permanent core features of total quality management process Using different methods and means of certified and innovative. It is a comparison of reference of the most efficient methods to activate the development and improvement approach (Mamouri 2015). The quality management program is based on continuous development efforts, and that opportunities for improvement do not end no matter how efficient and effective performance. The level of quality that satisfies the desires and expectations of beneficiaries is constantly changing so, the quality of the service provided is continuously improved and developed to achieve the desired goal (Akbar and Hosseinpour, 2016).

**Performance evaluation** - The performance evaluation process is essential for Total Quality Management because it's important to give sufficient information about the performance performed by the employees Through feedback this in role will motivate employees and raise their morale When praising them or honoring them financially or morally in return for their outstanding efforts, As what is produced by the workers according to the specifications required is the basis for achieving the overall quality (Ayesh, 2008).

**Institutional performance** - Performance means the final results of the organization's activities, The best performance is to achieve the objectives of the organization efficiently and effectively. So the final outcome of the performance of individuals within the organizational units and the performance of other organizational units. Within the overall strategy of the Organization and the Organization's performance in its natural, social and work environment (Alwehabie, 2017). Accordingly, the performance focuses on Competencies and Unique Factors In which the Organization was unique to other competing organizations It is a basis for assessing the performance Through financial indicators and valuation of tangible assets and intangible assets (Al-Ali et al., 2006). Public performance can be affected by the efficiency and effectiveness of organizations (Ozcan, 2014).

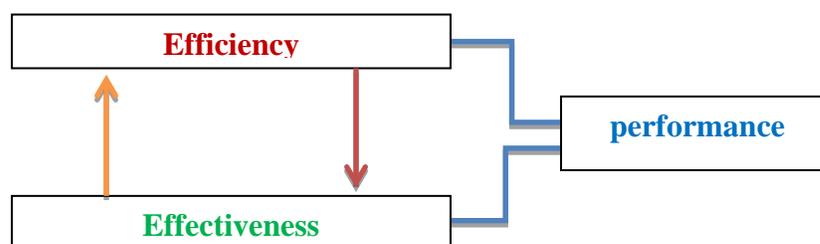


Figure 1.  
Components of performance

There are many studies that dealt with the performance of institutions in general, which have been reviewed in order to develop the current study, including "Impact of Leadership Style of Academic Administrators on Institutional Performance A South Asian State University Case Study" (Khalil and Raheel, 2016). pointed study " Impact of Leadership on Institutional Performance: Evidence from Public Sector Universities of Faisalabad"( Murad and Gill, 2016). The researcher found the current study in harmony with the study " Efficiency and productivity of hospitals in Vietnam "(Linh,2011). also The study " Measuring efficiency, effectiveness and performance of Indian public sector banks "(Kumar and Gulati 2009) .and the study " Logistics firms performance efficiency and effectiveness perspectives "( Wong et .al, 2015).

**Efficiency** - is defined as the best use of available resources, that is, the difference between inputs and outputs in order to achieve added value, Where efficiency is linked to management and when management uses its various tools to better plan, organize, command and control And it is directed towards all functional departments investment inputs for output low cost. When you can get the integration of all activities to achieve the objectives of the organization (al-Azzawi, 2005). Based on the above, efficiency is only the process of converting inputs to outputs at the lowest cost of time (Memon et al., 2017).

**Effectiveness** - Is the degree which the organization achieved its objectives Which are achieved when managers choose those organizations to have the appropriate objectives they can achieve It. therefore, reflects the extent to which senior management has access to material and human resources From the external environment and the internal environment and their optimal utilization (Al-Salim, 2015).also, organizational effectiveness is seen as the organization's ability to create a balance Between internal factors and their external influences With the possibility of fully adapting to the internal and external variables and ensure the achievement of its objectives (Kumari, 2017)

#### PROCEDURE.

##### HYPOTHESES

Ho. No effect is statistically significant at ( $\alpha= 0.05$ ) For the impact of total quality management on the performance of educational institutions at the University of Samarra.

H1. the effect is statistically significant at ( $\alpha= 0.05$ ) For the impact of total quality management on the performance of educational institutions at the University of Samarra.

##### CONCEPTUAL MODEL

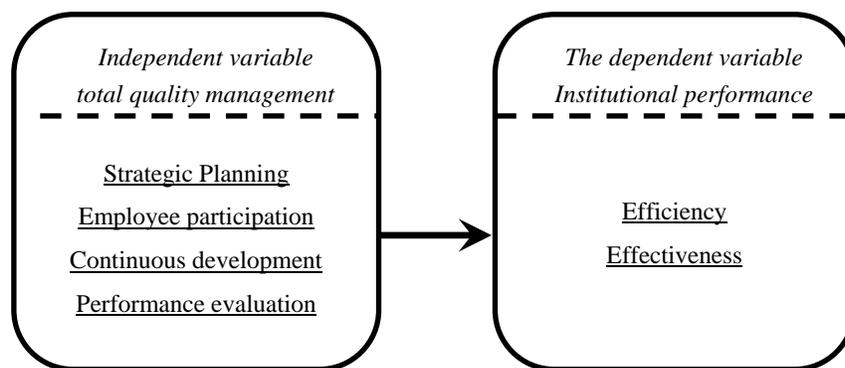


FIGURE 2  
STUDY MODEL

##### POPULATION

The study community consists of senior management and middle administration at the University of Samarra, The sampling unit was formed (University President, Assistant President of the University, Dean, Associate Dean, Head of Scientific Department, Center Director, Head of Administrative Section) (60) individuals. The research sample was taken in a stratified sample method. The questionnaire forms were distributed to the sample of the research sample by (60) forms (52) forms were retrieved Thus it became the sample size is (52) of males and females of a recovery ratio (86.6%).

##### DETERMINANTS

Most research faces difficulties and challenges during the research period In this research can be summarized as follows:

- 1- lack of seriousness of some samples in dealing with researchers, where some of them refuse to answer the questionnaire.
- 2- the lack of conformity between the theoretical concepts on the dimensions of total quality management and what is applied in practice at the University of Samarra the subject of research.

- 3- The results of this study were determined by the degree of validity of the study instrument, its stability, objectively the response of the respondents of the study sample and the scientific secretariat.

LIMITS

The study limits were as follows:

Place Boundary: The study will be limited to the University of Samarra.

Time Boundary: The study was completed during the first quarter of 2018.

Human Resources Boundary: Employees at the University of Samarra are (University president, assistant president of the university, dean of faculty, assistant dean, head of the scientific department, director of the center, head of administrative department)

Scientific Boundary: investigate the relationship between the dimensions of the independent variable the Total Quality Management (Strategic Planning, Employee participation, Continuous development, Performance evaluation), and dimensions of the dependent variable. The Performance Of Educational Institutions (Efficiency and Effectiveness).

METHODOLOGY

The current research follows the descriptive and analytical statistical methodologies for examining and evaluating variables and hypotheses, analysis process was conducted using Statistical Package for Social Science Software (SPSS) including, measures of central tendency, measures of dispersion, multiple regression analysis, Cronbach's' alpha, VIF test, and Kolmogorov –Smirnov test. And the researcher has worked on Check the apparent truth of the questionnaire content by presenting it to (6) arbitrators of the faculty members with specialization from Iraqi universities (University of Baghdad, Babylon University, Mustansiriya University and Kirkuk University). As it was arbitrated by professors from outside Iraq where the questionnaire was sent with a copy of the research plan by e-mail for the purposes of arbitration, Some of the vocabulary judged by the arbitrators have been excluded, some of which have been rephrased in accordance with the culture of the respondents.

DISCUSSIONS

Below are the main characteristics and findings of this research:

In terms of gender distribution, The results showed that the percentage of male respondents was( 96%), while the females were (4%). This is evidence that the senior and middle management of the university is male-dominated.

When we talk about the majority of the sample in terms Age groups The results showed that the percentage of the highest in this study was in the category 38-45, where they accounted (40%), while the age group 46-53 was (38%), and the age group 50 and above was (11%), and the age group 30-37 was 13%. By talking about Educational qualifications The highest percentage of respondents received a Ph.D. (65%). Which is the most prevalent in the study sample, followed by (23%) of the master's degree holders and (12%) of the holders of the bachelor's degree. And the Years of Experience showed that (33%) of the sample had 6-10 years of experience, followed by(25%) with 11-15 years of experience, while (19% )had more than 21 years of experience. Those with 16-20 years of experience were (14%), followed by (9% )with 1-5 years' experience.

Table (1) The Arithmetic mean and dimensions of Total and The Performance Of		No. Dimension	Arithmeti c mean	standard deviations	Degree of approval	standard deviations of all Quality Management Educational Institutions
1.	Strategic Planning	0.50	4.23	High		
2.	Employee participation	0.57	3.58	Medium		
3.	Continuous development	0.59	3.47	Medium		
4.	Performance evaluation	0.56	3.92	High		
5.	Efficiency	0.47	3.93	High		
6.	Effectiveness	0.41	4.05	High		

The results in Table (1) showed that the sample trends are positive towards the paragraphs mentioned in the strategic planning field And to a high degree. The general arithmetic mean was 4.23, And the standard deviation is (0.50). This explains the response of the study sample Which shows that strategic planning A factor for the success of organizations Which seeks to achieve total quality. While the sample trends are positive towards the paragraphs mentioned in the Employee participation field And to a medium degree. Where the general arithmetic mean was (3.58) , the standard deviation is (0.57). And The university does not depend On the application of the concept of total quality to involve employees. This is mainly explained by the results of this study. also, the general arithmetic mean was (3.47)and the standard deviation was (0.59). This explains that the answers of the sample of the study Which shows that the continuous development at the University of Samarra It was substandard To achieve the desired goals in the application of total quality. as well as, the general arithmetic mean was (3.92) and the standard deviation was (3.92). the direction of the paragraphs mentioned in the evaluation of performance So the university focuses and permanently To evaluation the performance of employees In order to correct performance Towards the right direction In an environment characterized by constant change, parts of the requirements of achieving total quality. The results of the study showed that the general arithmetic mean of the field of efficiency (3.93) and the standard deviation of (0.47). This explains that efficiency was a high degree According to the results of the study Which confirmed that the senior management of the University of Samarra Are working to invest the resources available to increase employee productivity And reduce excess activities For the best service. Table (1) showed That general arithmetic mean of the field of effectiveness (4.05) and a standard deviation of (0.41). This explains that the field of effectiveness was high degree According to the results of the study Which confirmed that the senior management of the University of Samarra acts effectively To serve the community and to achieve its goals Through the integration. linking of various departments and colleges, Harmonious with internal and external environment.

Below is the discussion of the research’s hypotheses:

Table (2)  
 Analysis of variance test to determine the impact of total quality management on the performance of educational institutions

Source of Variance	Sum of Squares	DF	Mean Square	F Calculated	Sig	R Square	Adjusted R2
Between Groups	4.073	4	1.018				
Within Groups	2.861	47	.0600	16.966	0.002	0.766	0.587
Total	6.934	51					

The results of statistical analysis showed in a table (2) showed That there was statistically significant effect total quality management on the performance of educational institutions level of significance in the levels of the total dimensions ( $\alpha = 0.002$ ). Which is below the significance level ( $\alpha = 0.05$ ) Thus, they are statistically significant. As well as the calculated (F) (16.966) While the (F) table (2.52) at degrees of freedom (4,47) Thus, the calculated F is greater than the table F. The correlation coefficient (R = 0.766) was at the significance level ( $\alpha = 0.05$ ). The coefficient of determination (R2) was (0.587). Based on the above We rule out the hypothesis (H0) and accept hypothesis (H1) Which states Having an effect The dimensions of total quality management (Strategic planning, Employee participation, continuous development, performance evaluation) On the performance of educational institutions in its dimensions (efficiency, effectiveness) at the University of Samarra.

CONCLUSIONS

1. The existence fit strategic plans that put by the University Administration (top management, middle management) With the requirements of applying total quality management at the University of Samarra, This result is consistent with the study (alhijar,2004).
2. The results confirm and statistical indicators, However, the university shares all employees In improving the performance of the university And significantly, This result is consistent with the study (eulwan,2005).

3. as well The university implements continuous improvement approach is clearly Through training courses for employees In line with developments in the labor market, This result is consistent with the study ( regauld, 1993) .
4. The results of this study confirmed that the university A fair and realistic set of procedures is used In the evaluation of performance within a specified quality standard Which are linked to a clear and declared reward system When the positive results, Away from the threat of punishment when negative evaluation results emerge, This result is consistent with the study ( alquirean,2004).
5. The presence of the impact of the application of total quality management On the efficiency and effectiveness of the University of Samarra at the significance level Which will contribute to the achievement of quality goals And adapt to the changing environment, For community service , Achieving the integration of the University's goals and the goals of society as a whole, This result is consistent with the study (bduh,2003).

#### RECOMMENDATIONS

The researcher suggests a set of recommendations which are as follows:

1. To work continuously to spread the culture of total quality in the University And at all levels by organizing Seminars, conferences, and workshops for total quality management And organizing training courses for employees in this regard.
2. Giving employees in organizations that seek to achieve total quality Sufficient space for effective participation To apply field quality Taking views and the proposals they make.
3. Involving employees at the University of Samarra Who cares about the quality Strategic planning process for quality And benefit from their experience in the application of total quality management.
4. Statistical data collection and using them continuously With a view to continuous improvement and development, For different levels of performance Within the university institution, And confront any problem shown by interpreting these data.
5. Strive towards the application of an appropriate system of motivation In a scientific and thoughtful way to honor the distinguished After the completion of the process of evaluating the performance Aiming to motivate their colleagues towards better performance.
6. Preparation of a comprehensive quality management manual It includes both principles and special dimensions total quality management To serve as a roadmap for the work of the Iraqi universities.
7. Continuous updating and periodic review Of the mechanisms and means of applying the concept of total quality Followed by universities Local and regional levels in order to benefit from them.

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#### ACKNOWLEDGEMENTS

This research was supported/partially supported by (University of Samarra). We thank our colleagues from our university who provided insight and expertise that greatly assisted the research, although they may not agree with all of the results in the paper. We would like to thank Mr. Baraa Mohammed Al-Hilali for his support and his experience to finish this paper. Also my thanks and gratitude to my guidance professor Shawqi Naji Jawad from Amman Arab university for his opinions in this field. The special thanks for Mr. Othman Talib Al-Mamouri for completing the structure of the paper .

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# Response Surface Methodology For optimisation of hot air drying of water yam slices

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DOI: 10.29322/IJSRP.8.8.2018.p8030

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8030>

**Abstract:** Response surface methodology was used to investigate the effects of temperature, thickness and time on the drying of water yam slices and to determine the optimised condition for hot air drying. The predominant falling rate drying regime was observed. Experiments were performed at air temperature of 60°C, 70°C and 80°C, slice thickness of 4, 6 and 8mm and drying times of 60, 165 and 270minutes. Based on response surface and desirability functions, the optimum conditions for water yam drying were: air temperature 70°C, 74.9°C, slice thickness 6mm, 6.6mm and drying time 165minutes, 116.1minutes for untreated and treated water yam respectively. At this point, the predicted responses for drying rate were 0.000345kg/m<sup>2</sup>s, 0.000358kg/m<sup>2</sup>s respectively.

**Keywords:** water yam, temperature, slice thickness, drying time, hot air drying, optimisation.

## 1.0 INTRODUCTION

Water yam is the most economically important yam species which serve as a staple food for millions of people in tropical and subtropical countries. It is a crop with potential for increased consumer demand due to its low sugar content necessary for diabetic patients (Oluwole et al, 2017). In Nigeria, Water yam (*D. alata*) is another important species of the dioscoreacea family grown in some parts of Nigeria for its large roots with fine edible white flesh. It seems unnoticed when compared to other varieties of yam and is often regarded as food for the poor (Hoover, 2000). According to Baah, 2009 water yam contains high level of Total Dietary Fibre (TDF) which makes it suitable for management of pile, constipation and diabetes. It is also rich in Vitamin C, beta carotene, vitamin E, calcium, potassium, magnesium, copper and antioxidants. These nutrients are known to play vital role in general body upkeep as well as immune functioning, wound healing, suppression of blood sugar, bone growth and anti-ageing. Dried water yam slices are used as an excellent source of starch, which provides calorific energy, suitable for producing weaning foods. Processed water yam flour and slices have a high market price internationally than cassava slices (Baah, 2009). They provide protein three times more superior than the one of cassava and sweet potato. Processing of the tubers into a more stable product will increase shelf life and availability, and enhance its utilization. One potential problem in processing of water yam into chips is the discolouration and darkening of the product. This has been attributed to enzymic browning reactions as a result of the presence of water soluble phenolic substances in yam (Akubor, 2013). Pretreatment methods such as blanching, sulphating and dripping into oil have contributed to the improved mass and heat transfer as well as product characteristics (colour, texture, vitamin retention, etc) of food (Kaymak-Ertekin, 2002, Taiwo et al, 2002)

Drying is a complex process accompanied by physical and structural changes. There is a continuous change in the dimensions of differently shaped food particulates during drying as a result of water removal and internal collapse of the particulates (Senadeera et al., 2005). The drying process is the use of products with low water activity, thereby inhibiting the production of microbial reproduction and enzyme activity, and can give the flavor of a good product to achieve long-term storage, easy to transport, easy to consumer spending. (Aboltins, and Uptis, 2011) Optimisation is required to ensure rapid processing while maintaining optimum product quality. Response surface methodology is a powerful tool for optimizing of many engineering applications probably because of its high efficiency, simplicity, and comprehensive theory. It can save a lot of time and can build models accurately and quickly in an optimization design (Nazghelichi et al, 2011). It has been frequently used in the optimisation of food processes (Varnalis et al, 2004, Wani et al, 2008). The aim of this study was : (a) to investigate drying behaviour of water yam (b) to study the effect of independent variable on the dependent variable and (c) optimization of the water yam drying in a hot air dryer.

## 2. MATERIALS AND METHODS

**2.1 Sample preparation:** Good quality freshly harvested water yam used for the experiments were procured from New Market, Enugu. Hot air dryer were used for the experiment. Proximate analyses of the samples were conducted according to the AOAC, 2004.

**2.2 Experimental procedure:** The samples were peeled with a stainless knife and cut into chips of different thickness of 4mm, 6mm and 8mm using vernier caliper. The sliced samples was pretreated by soaking for 5 min in 0.5% sodium metabisulphite (Na<sub>2</sub>S<sub>2</sub>O<sub>5</sub>) solution. There were treated and untreated samples for each. The initial moisture content was determined according to official method (AOAC, 2004). The chips were loaded into the hot air dryer for drying process. Steady state of temperatures was achieved in the dryer before the chips were loaded. The drying process was performed at 60°C, 70°C and 80°C. The samples were removed from the dryer and weighed manually at 30 minutes interval to monitor moisture loss. Drying process was truncated when two consecutive sample weights remained constant. The experiments were replicated.

**2.3: Experimental design matrix:** The experiment was designed using Response surface methodology (RSM) of design expert software 11. Central Composite Design (CCD), face center, tool was used in the design process. Temperature, thickness and time were the considered factors while moisture content and drying rate were the expected responses of the study. The design matrix for the experiments is shown in Table 1. The RSM was used to analyze the responses. The ANOVA and graphical analyses of the drying were carried out. The mathematical models in terms of coded were obtained. The models in terms of coded factors were used to make predictions about the response for given levels of each factor. The high levels of the factors were coded as +1 and the low levels of the factors were coded as -1. Optimum drying parameters were also obtained, and the results were validated using percentage deviation.

**Table 3.1: Experimental Design Matrix**

Std	Run	Factor 1 A: Temperature °C	Factor 2 B: Thickness Cm	Factor 3 C: Time Minutes	Response 1 Moisture Content g water / g solid	Response 2 Drying Rate kg/m <sup>2</sup> s
9	1	60	0.6	165		
16	2	70	0.6	165		
8	3	80	0.8	270		
5	4	60	0.4	270		
18	5	70	0.6	165		
12	6	70	0.8	165		
19	7	70	0.6	165		
4	8	80	0.8	60		
14	9	70	0.6	270		
2	10	80	0.4	60		
15	11	70	0.6	165		
6	12	80	0.4	270		
13	13	70	0.6	60		
20	14	70	0.6	165		
1	15	60	0.4	60		
3	16	60	0.8	60		
17	17	70	0.6	165		
11	18	70	0.4	165		
7	19	60	0.8	270		
10	20	80	0.6	165		

**2.4 Effective moisture diffusivity**

The simplified equation of Fick’s law of moisture diffusion was adapted to determine the effective moisture diffusion from the samples during drying. It is simplified according to Srikiatden and Roberts, (2005) which is represented thus:

$$MR = \frac{M - M_o}{M_o - M_e} = \frac{8}{n^2} \sum \frac{1}{(2n-1)^2} \exp \frac{(-2n-1)^2 \pi^2 D_{eff} t}{4l^2} \text{ ----- 2.1}$$

Where Deff is the moisture diffusivity (m<sup>2</sup>/s), t is the drying time (s), l is the half of the slab thickness (m), MR= dimensionless moisture ratio, Mi = instantaneous moisture content (g water/g solid), Me =equilibrium moisture content (g water/ g solid), Mo = initial moisture content (g water/ g solid). However, due to continuous fluctuation of relative humidity of the drying air in the dryer, equation 5 is simplified in equation 6 according to Dimente and Munro, (1993) and Goyal et al., (2007).

$$MR = \frac{M_i}{M_o} = \frac{8}{n^2} \sum \frac{1}{(2n-1)^2} \exp \frac{(-2n-1)^2 \pi^2 D_{eff} t}{4l^2} \text{ ----- 2.2}$$

The effective moisture diffusivity (Deff) was calculated from the slope of plot of ln MR against drying time (t) according to Doymas, (2004) and is represented in equation 2.3

$$k = \frac{Defft}{4l^2} \text{-----} 2.3$$

Where k is the slope. The model that best described the drying behaviour of the samples was used to evaluate the moisture diffusivity of the samples.

### 3 RESULTS AND DISCUSSION

#### 3.1 Proximate analysis of water yam

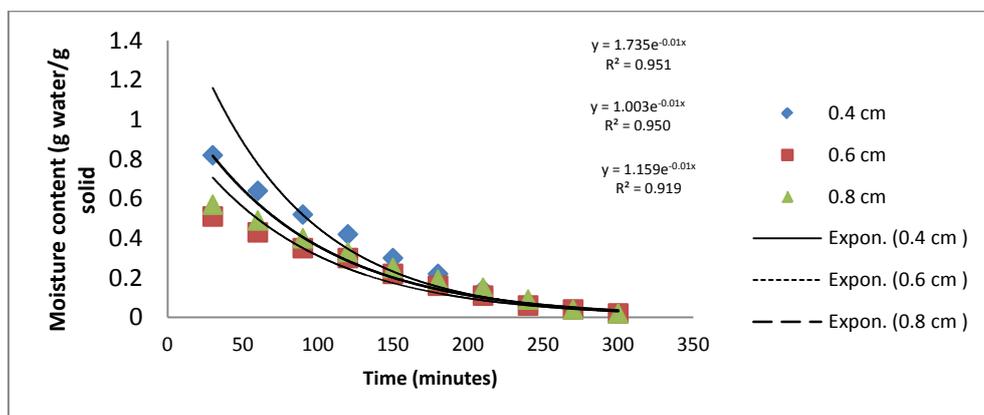
The proximate analyses of the water yam are presented in Table (3.1). Proximate analysis was used to characterize each of the samples in terms of moisture, ash, lipid, fiber, protein and carbohydrate contents. Table shows the characteristics of the raw samples with moisture content having the highest percentage in all the cases. Table presents also the proximate analyses (at drying temperature of 60°C, 70°C and 80°C) of the treated and untreated food samples respectively. The moisture content reduced drastically with corresponding increase in percentage of the carbohydrate. The application of heat caused the evaporation of water from the samples. This observation is in agreement with previous findings (Kared and Lund (2003), Velic et al., 2007). It was also revealed that the reductions of moisture content were relatively higher in the treated samples compared to the untreated samples.

**Table 3.2: Proximate analysis for treated and untreated water yam**

Sample	Moisture (%)	Ash (%)	Lipid (%)	Fiber (%)	Protein (%)	Carbohydrate (%)
Raw Water Yam	76.34	1.83	2.86	2.70	1.93	12.77
Treated Water yam @ 60°C	4.55	1.60	2.50	2.55	1.76	87.04
Untreated Water yam @ 60°C	3.90	1.50	2.40	2.50	1.70	88.00
Treated Water yam @ 70°C	3.70	1.30	2.35	2.55	1.60	88.50
Untreated Water yam @ 70°C	3.20	1.20	2.25	2.18	1.50	89.67
Treated Water yam @ 80°C	2.80	1.25	2.15	2.18	1.48	90.14
Untreated Water yam @ 80°C	2.20	0.77	2.05	1.49	1.43	92.06

#### 3.2 Moisture Contents of the samples

The results of the moisture content versus time of the treated samples at various temperatures and thickness are presented in Figures 3.1-3.6. From the graphs, moisture content decreases with time in an exponential manner. The graphical results revealed that moisture content continued to decrease till the equilibrium point. The final moisture content of each of the sample represent moisture equilibrium between the sample and drying air under dryer conditions, beyond which any changes in the mass of sample could not occur (Akipnar and Toraman 2013). Moisture content at equilibrium usually decreases with increases in temperature (Barbosa-Canovas and Juliano, 2007). The results gotten are in agreement with the observation of many researches (Doymaz 2005, Togrul and Pehlivan 2004). The result from the study indicated that samples pretreated with sodium metabisulphite dried faster than the untreated samples. Again, the treated samples showed high degree of lightness. This implies that sodium metabisulphite pretreatment results in some degree of bleaching or prevention of enzymatic browning of the chips. A similar situation was reported by Buckman *et al.*, (2015).



**Fig. 3.1: Moisture Content versus Time, Untreated Water Yam at 60 °C**

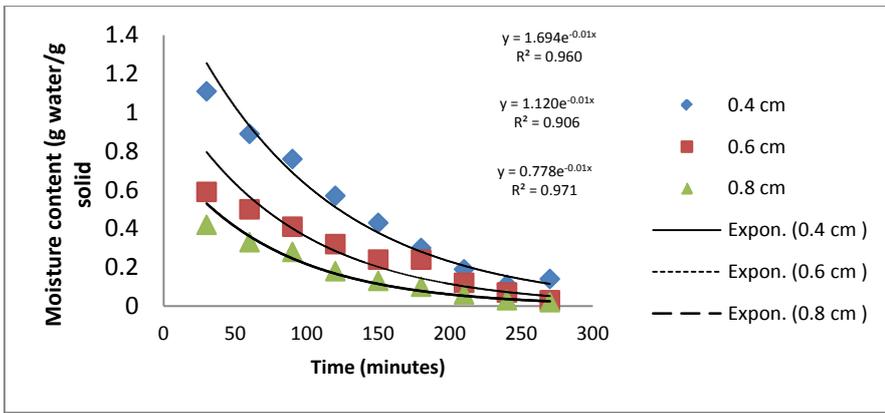


Fig. 3.2: Moisture Content versus Time, Untreated Water Yam at 70 °C

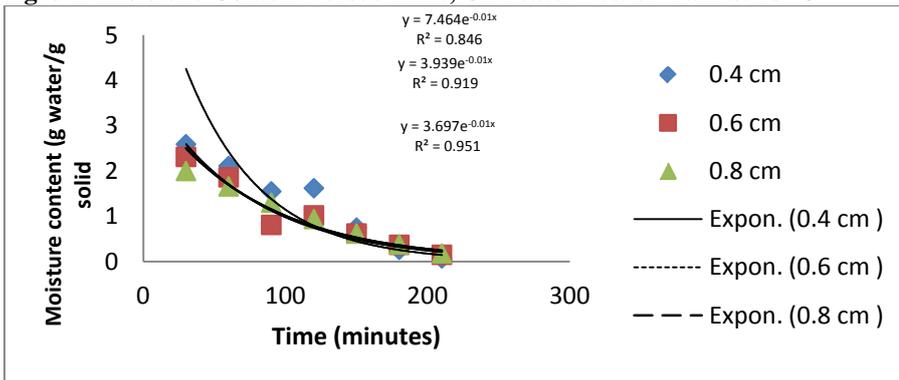


Fig. 3.3: Moisture Content versus Time, Untreated Water Yam at 80 °C

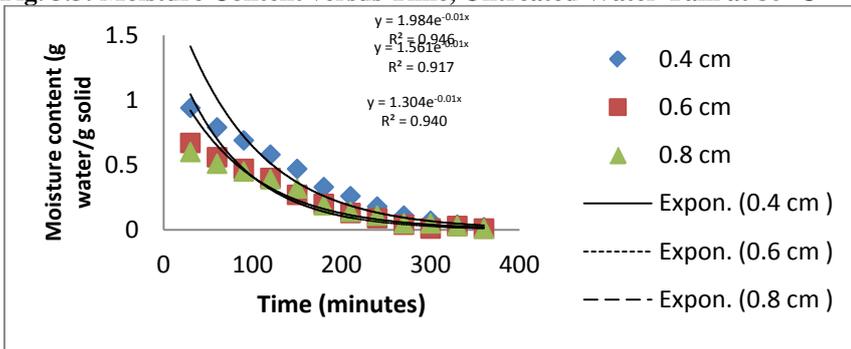


Fig. 3.4: Moisture Content versus Time, treated Water Yam at 60 °C

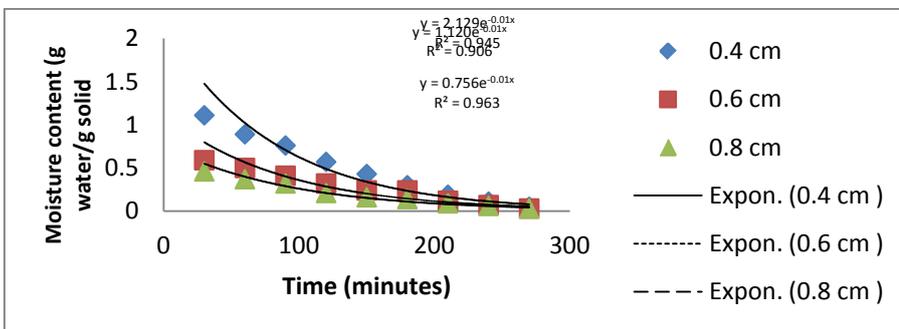


Fig. 3.5: Moisture Content versus Time, treated Water Yam at 70 °C

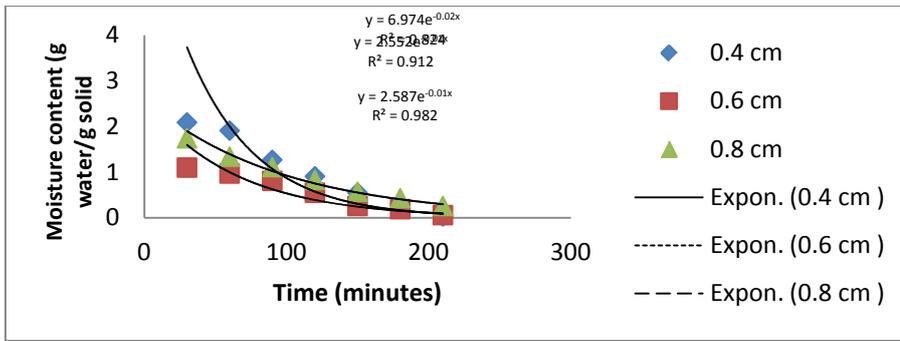


Fig. 3.6: Moisture Content versus Time, treated Water Yam at 80 °C

### 3.3 Relationship between Moisture Ratio and Drying Time

The graphs of  $\ln(\text{MR})$  versus time of the food samples are presented in Figures 3.7-3.12. For each sample, graphs were plotted at various temperatures (60 °C, 70 °C, 80 °C) and sample thickness (0.4cm, 0.6cm and 0.8cm). To attain linear graphs, the data involving dry basis moisture content versus time were transformed to  $\ln(\text{MR})$  versus time (Akipnar and Toraman, 2013).

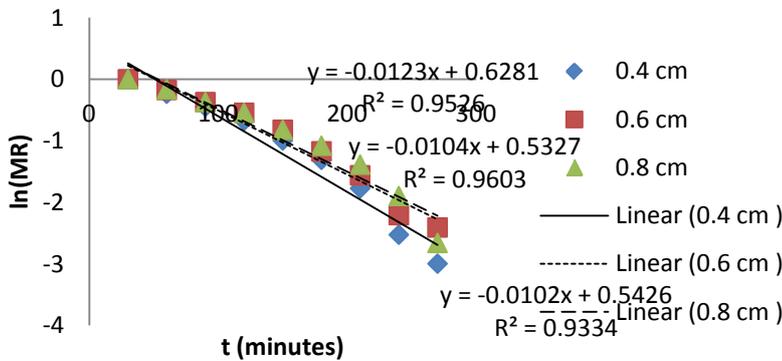


Fig. 3.7:  $\ln(\text{MR})$  versus Time of Untreated Water Yam at 60 °C

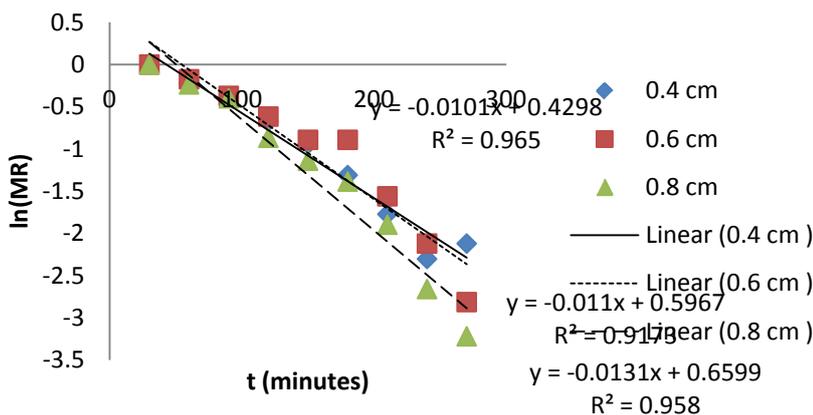


Fig. 3.8:  $\ln(\text{MR})$  versus Time of Untreated Water Yam at 70 °C

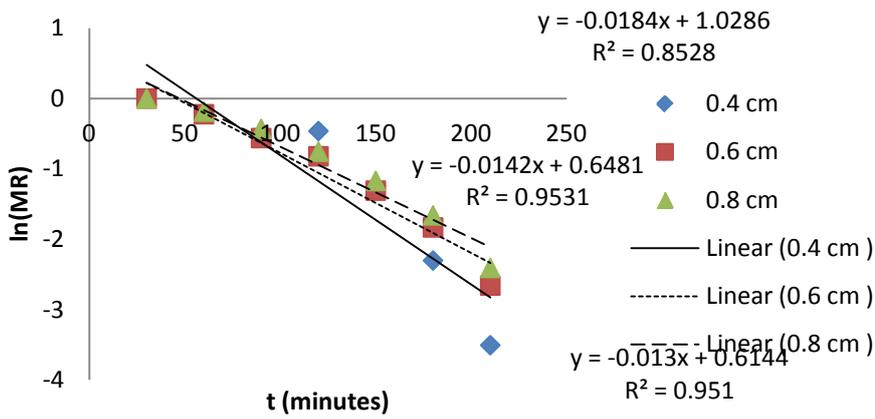


Fig. 3.9: ln(MR) versus Time of Untreated Water Yam at 80 °C

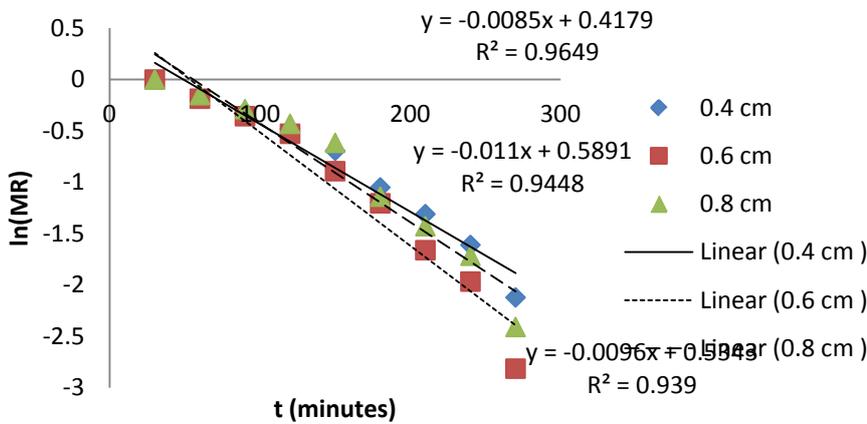


Fig. 3.10: ln(MR) versus Time of treated Water Yam at 60 °C

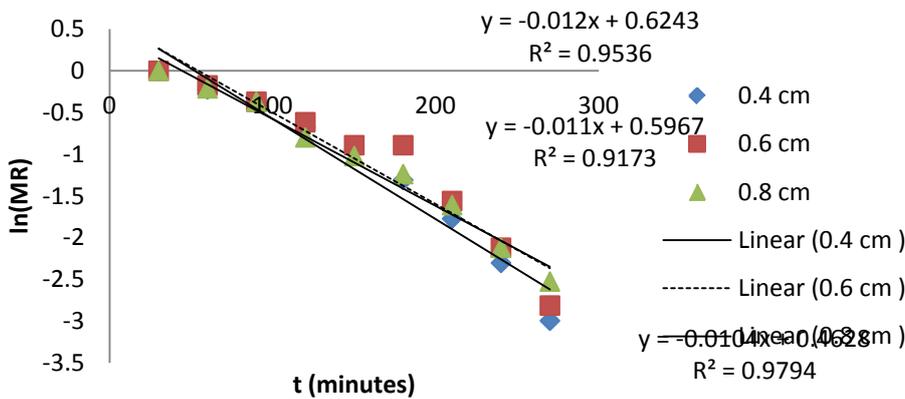
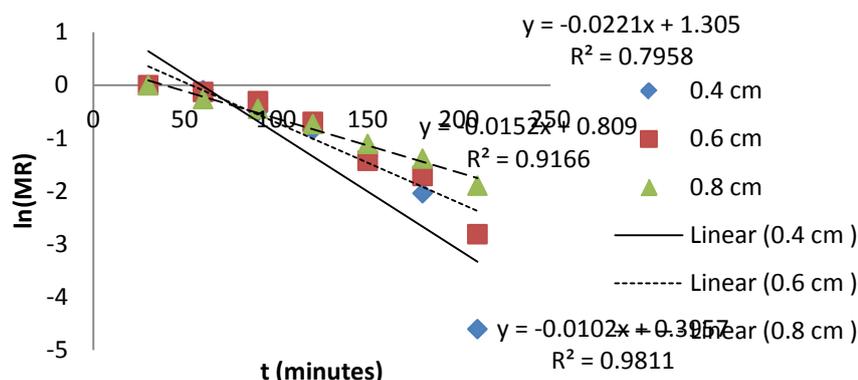


Fig. 3.11: ln(MR) versus Time of treated Water Yam at 70 °C



**Fig. 3.12: ln(MR) versus Time of treated Water Yam at 80 °C**

**3.4: Effective Moisture Diffusivity for untreated and treated water yam**

Experimental diffusivities were determined by plotting experimental drying data in terms of ln MR against time (minutes). The effective diffusivity was calculated using the method of slopes. Effective moisture diffusivity depends on the moisture content and increases with decrease in moisture content. The values of effective diffusivity for hot air drying of wateryam range from  $1.1 \times 10^{-9}$  to  $9.23 \times 10^{-10}$ . This is similar to other crops like apricot, agave and figs (Mahmutoglu et al, 1995, Babalis and Belessiotis 2004).

**Table 3.3: Effective moisture diffusivity for untreated and treated water yam**

Sample	Temperature (K)	Effective Moisture Diffusivity $\times 10^{-10} \text{ m}^2/\text{s}$		
		Thickness, 0.4cm	Thickness, 0.6cm	Thickness, 0.8cm
Untreated water yam	333	3.32	6.32	0.11
	343	2.73	6.68	0.14
	353	4.97	8.26	0.14
Treated Water Yam	333	2.29	6.68	0.10
	343	3.24	6.68	0.11
	353	5.97	9.23	0.11

**3.5: RSM Results of the Samples**

The results of the Response Surface Methodology (RSM) are presented in Tables (3.3-3.4). Each of the Tables presents experimental data of moisture content and drying rate obtained at various drying conditions (factors) of temperature, thickness and time. Unlike data of one factor at a time, the RSM results show the effects of the interaction of the considered factors on the responses. Tables (3.3) present the data for the treated food samples, while those of the untreated samples are shown in Tables (3.4). The variations of drying rate of the treated and untreated samples can be attributed to structural adjustment of the compositions of the treated samples.

**Table 3.4: RSM Results for the Untreated Water Yam**

Std	Run	Factor 1 A: Temperature °C	Factor 2 B: Thickness Cm	Factor 3 C: Time minutes	Response 1 Moisture Content g water / g solid	Response 2 Drying Rate kg/m <sup>2</sup> s
9	1	60	0.6	165	0.12	0.000345
16	2	70	0.6	165	0.13	0.000343
8	3	80	0.8	270	0.01	0.000623
5	4	60	0.4	270	0.04	0.000314
18	5	70	0.6	165	0.13	0.000343

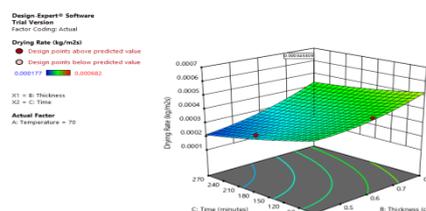
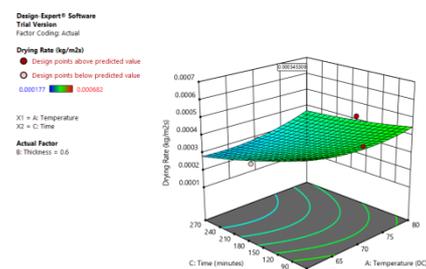
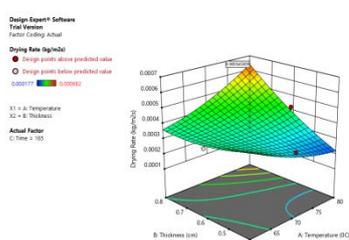
12	6	70	0.8	165	0.07	0.000443
19	7	70	0.6	165	0.13	0.000343
4	8	80	0.8	60	1.66	0.000682
14	9	70	0.6	270	0.03	0.000282
2	10	80	0.4	60	2.11	0.000265
15	11	70	0.6	165	0.13	0.000343
6	12	80	0.4	270	0.02	0.000177
13	13	70	0.6	60	0.5	0.000439
20	14	70	0.6	165	0.13	0.000343
1	15	60	0.4	60	0.64	0.000566
3	16	60	0.8	60	0.49	0.000439
17	17	70	0.6	165	0.13	0.000343
11	18	70	0.4	165	0.24	0.000321
7	19	60	0.8	270	0.04	0.000331
10	20	80	0.6	165	0.34	0.000423

**Table 3.5: RSM Results for the Treated Water Yam**

Std	Run	Factor 1 A: Temperature °C	Factor 2 B: Thickness Cm	Factor 3 C: Time minutes	Response 1 Moisture Content g water / g solid	Response 2 Drying Rate kg/m <sup>2</sup> s
9	1	60	0.6	165	0.15	0.000309
16	2	70	0.6	165	0.13	0.000374
8	3	80	0.8	270	0.06	0.000319
5	4	60	0.4	270	0.11	0.000308
18	5	70	0.6	165	0.13	0.000374
12	6	70	0.8	165	0.09	0.000353
19	7	70	0.6	165	0.13	0.000374
4	8	80	0.8	60	1.34	0.000341
14	9	70	0.6	270	0.03	0.000318
2	10	80	0.4	60	1.91	0.000106
15	11	70	0.6	165	0.13	0.000374
6	12	80	0.4	270	0.02	0.000152
13	13	70	0.6	60	0.5	0.000439
20	14	70	0.6	165	0.13	0.000374
1	15	60	0.4	60	0.79	0.000439
3	16	60	0.8	60	0.51	0.000444
17	17	70	0.6	165	0.13	0.000374
11	18	70	0.4	165	0.24	0.000384
7	19	60	0.8	270	0.05	0.000306
10	20	80	0.6	165	0.14	0.000312

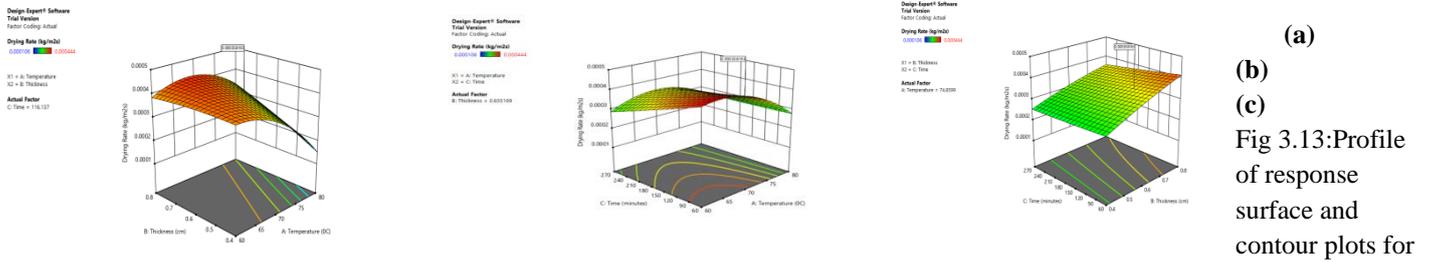
**3.6: Graphical Results of the RSM**

The 3-D plots of the drying plots of drying rate versus the considered factors of temperature, thickness and time in Figures 3.13 and Figures 3.14 for the untreated and treated water yam respectively.



(a) (b) (c)

Fig 3.13: Profile of response surface and contour plots for drying rate versus (a) temperature and thickness (b) temperature and time (c) thickness and time of the untreated water yam.



drying rate versus (a) temperature and thickness (b) temperature and time (c) thickness and time of the treated water yam

**Table 3.6: ANOVA for Drying Rate of Untreated Water Yam**

Source	Sum of Squares	df	Mean Square	F-value	p-value	Significant
<b>Model</b>	2.757E-07	9	3.064E-08	60.78	< 0.0001	Significant
A-Temperature	3.063E-09	1	3.063E-09	6.08	0.0334	
B-Thickness	7.656E-08	1	7.656E-08	151.90	< 0.0001	
C-Time	4.409E-08	1	4.409E-08	87.47	< 0.0001	
AB	1.183E-07	1	1.183E-07	234.79	< 0.0001	
AC	5.671E-09	1	5.671E-09	11.25	0.0073	
BC	3.741E-09	1	3.741E-09	7.42	0.0214	
A <sup>2</sup>	3.413E-09	1	3.413E-09	6.77	0.0264	
B <sup>2</sup>	3.036E-09	1	3.036E-09	6.02	0.0340	
C <sup>2</sup>	3.782E-10	1	3.782E-10	0.7504	0.4067	
<b>Residual</b>	5.040E-09	10	5.040E-10			
Lack of Fit	5.040E-09	5	1.008E-09			
Pure Error	0.0000	5	0.0000			
<b>Cor Total</b>	2.808E-07	19				
<b>Std. Dev.</b>	0.0000	<b>R<sup>2</sup></b>			0.9820	
<b>Mean</b>	0.0004	<b>Adjusted R<sup>2</sup></b>			0.9659	
<b>C.V. %</b>	5.83	<b>Predicted R<sup>2</sup></b>			0.7701	
		<b>Adeq Precision</b>			31.3573	

The Model F-value of 60.78 implies the model is significant. There is only a 0.01% chance that an F-value this large could occur due to noise. P-values less than 0.0500 indicate model terms are significant. In this case A, B, C, AB, AC, BC, A<sup>2</sup>, B<sup>2</sup> are significant model terms. The Predicted R<sup>2</sup> of 0.7701 is in reasonable agreement with the Adjusted R<sup>2</sup> of 0.9659; the difference is less than 0.2. Adeq Precision measures the signal to noise ratio. A ratio greater than 4 is desirable. The ratio of 31.357 indicates an adequate signal. This model can be used to navigate the design space.

**Table 3.7: ANOVA for Drying Rate of treated Water Yam**

Source	Sum of Squares	df	Mean Square	F-value	p-value	Significant
<b>Model</b>	1.167E-07	9	1.297E-08	7.35	0.0022	Significant
A-Temperature	3.318E-08	1	3.318E-08	18.80	0.0015	
B-Thickness	1.399E-08	1	1.399E-08	7.93	0.0183	
C-Time	1.340E-08	1	1.340E-08	7.59	0.0203	
AB	1.990E-08	1	1.990E-08	11.28	0.0073	
AC	1.073E-08	1	1.073E-08	6.08	0.0333	
BC	7.031E-10	1	7.031E-10	0.3984	0.5420	
A <sup>2</sup>	1.208E-08	1	1.208E-08	6.84	0.0258	
B <sup>2</sup>	1.882E-10	1	1.882E-10	0.1067	0.7507	
C <sup>2</sup>	8.205E-12	1	8.205E-12	0.0046	0.9470	
<b>Residual</b>	1.765E-08	10	1.765E-09			
Lack of Fit	1.765E-08	5	3.529E-09			
Pure Error	0.0000	5	0.0000			
<b>Cor Total</b>	1.344E-07	19				
<b>Std. Dev.</b>	0.0000	<b>R<sup>2</sup></b>			0.8687	
<b>Mean</b>	0.0003	<b>Adjusted R<sup>2</sup></b>			0.7505	
<b>C.V. %</b>	12.40	<b>Predicted R<sup>2</sup></b>			-0.0728	

	Adeq Precision	9.7024
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The Model F-value of 7.35 implies the model is significant. There is only a 0.22% chance that an F-value this large could occur due to noise. P-values less than 0.0500 indicate model terms are significant. In this case A, B, C, AB, AC, A<sup>2</sup> are significant model terms Adeq Precision measures the signal to noise ratio. A ratio greater than 4 is desirable. The ratio of 9.702 indicates an adequate signal. This model can be used to navigate the design space.

### 3.7: Final Equation in Terms of Coded Factors

Mathematical models (with significant model terms) of the drying rates as function of temperature (A), thickness (B) and time (C) are expressed in Equations (4.1) – (4.20). . In all the sample models, the highest power of the variables is two, indicating that quadratic model is adequate for the description of the drying rate with respect to temperature, thickness and time. It was also observed that there were interactions of the factors in the drying process. The positive signs in the models indicate synergetic effects, while the negative signs show antagonistic effects of the factors. The equation in terms of coded factors can be used to make predictions about the response for given levels of each factor.

Untreated Water Yam

$$\text{Drying Rate} = +0.0003 + 0.0000A + 0.0001B - 0.0001C + 0.0001AB + 0.0000AC + 0.0000BC + 0.0000A^2 + 0.0000B^2 \quad (3.1)$$

Treated Water Yam

$$\text{Drying Rate} = +0.0004 - 0.0001A + 0.0000B - 0.0000C + 0.0000AB + 0.0000AC - 0.0001A^2 \quad (3.2)$$

### 3.8: Optimum Parameters of the Drying Rates

The optimum parameters of temperature, thickness and time with corresponding drying rates of the samples are shown in Table 3.8

Samples	Optimum Temperature °C	Optimum Thickness Cm	Optimum Time minutes	Optimum Drying Rate kg/m <sup>2</sup> s
Untreated Water Yam	70.0	0.60	165.0	0.000345
Treated Water Yam	74.9	0.66	116.1	0.000358

### 3.9: Validation of the Results

The validation of the results is presented in Table 3.8. The model of the drying rate was validated by considering the percentage deviation of the predicted data from the experimental data. In all the samples, percentage deviation is less than 5%, which confirm that the models are adequate for the description of the drying process.

**Table 3.8:** Validation of Optimum Results

Samples	Optimum Temperature °C	Optimum Thickness Cm	Optimum Time Minutes	Predicted Drying Rate kg/m <sup>2</sup> s	Experimental Drying Rate kg/m <sup>2</sup> s	Percentage Deviation %
Untreated Water Yam	70.0	0.60	165.0	0.000345	0.000348	0.86
Treated Water Yam	74.9	0.66	116.1	0.000358	0.000364	1.65

## CONCLUSION

Response surface analysis was effectively used to determine the effect of temperature, drying time and slice thickness on drying rate. The air temperature of 70°C, slice thickness of 6mm and drying time of 165minutes was proposed as the optimum independent variable for un treated water yam, while 74.9°C,6.6mm and 116.1minutes for treated water yam. At this optimum condition, the predicted response for drying rate was 0.000345kg/m<sup>2</sup>s and 0.000358kg/m<sup>2</sup>s for untreated and treated water yam respectively.

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# Enhancing the Operational Effectiveness of Information and Communications Technology (ICT) Centres of Nigerian Universities: A Case Study of Ignatius Ajuru University of Education, Port Harcourt

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DOI: 10.29322/IJSRP.8.8.2018.p8031

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8031>

## Abstract

*The modern world is supported and sustained largely by technologies that are developed to sense, measure, acquire, process, store, transmit, transform and display information in digital format. The collection of these technologies constitutes the Information and Communications Technology (ICT) which has the amazing potential to determine the dynamics of life. Understandably, the educational system of any nation must have a transformational relationship with ICT. Consequently, the authors have carried out a deep techno-surgical analysis of the ICT Centre of Nigerian Universities exposing their strengths, weaknesses and opportunities. The goal is to develop a strategic planning programme that will immensely enhance the effective operation and management of the centres and provide the universities with the capacity of delivering the needed quality and technology-driven education in line with the realities of the dynamic society. The Ignatius Ajuru University of Education, Port Harcourt was used as a case study.*

**Keywords:** Information, Communication, Technology, Operational, Effectiveness, Universities, Enhancing.

## Introduction

The constraints initially posed by the non-availability of Information and Communication Technology (ICT) facilities and resources in the education sector has led to the establishment of ICT centres in almost all tertiary institutions in Nigeria. It has since become a vital requirement for accreditation of university programmes in the country. Both the National Universities Commission (NUC) and the National Board for Technical Education (NBTE) which are the regulatory bodies for the universities and polytechnics respectively have included it in their list of requirements. Furthermore, the ubiquitous nature of ICT has made every nation to produce, use, import and export ICT products and its enabled services. ICTs revolution has created huge global opportunities for value and extraction (Agada, 2008).

The application of ICT is almost unlimited as its ranges from medical to entertainment, from education to communications, from publishing to photography, from security to power supply, from weather forecast to business transactions and more. ICT has the potential of creating employments (Odekunle et al, 2008). It has already demonstrated so in the telecommunications sector of the Nigerian economy. The serious challenges facing Nigeria's security system has made the federal Government to explore the use of ICT facilities in providing the highly needed security solutions that it demands. The installation of computer-based cameras in Abuja

and Lagos and the utilization of an unmanned aircraft for oil pipelines surveillance operated by the Nigerian Air Force are living examples. No wonder the Nigerian ICT policy as documented in the ICT policy document of 2002 focuses on the production and utilization of its technologies. It is therefore, understandable why the educational system of any nation must have a transformational relationship with ICT.

However, many years after the establishment of ICT centres in Nigerian Universities, it has become imperative to carry out analytical review of the operations of these centres. As a result of the multi-dimensional nature of ICT, a dissectional approach has been applied in the form of a detailed technical audit of one of the universities. The Interview-Based Research were used for the collection of data as it is the appropriate approach when a researcher desired information about the operations of an entity (Avwokeni, 2009).

It is hoped that data collected and analyzed from this university will have a lot of common bearing with a good number of universities in Nigeria since almost all of them are operated with a common goal and with a similar operational approach.

### **Service Requirements of ICT Centres in the Nigerian Universities**

The ICT centres in the Nigerian universities are established to provide the following services or at least provide the platform for the provision of these services:

- **Registration of Students and Payment of Fees:** Currently, almost all Nigerian Universities use the online method of registration of students and in some cases, payment of relevant fees. This is usually achieved by logging into the university portal and supplying information in relevant fields. The information is saved in the database by clicking a save or send button. This registration includes the registration of courses and also enables students to register from different locations. This exercise requires the internet.
- **Uploading and Access to Students' Results:** The ICT centres are responsible for providing the platform and the required infrastructure for uploading of students' academic records by academic staff. It also makes it possible for students of these institutions to have access to their results by logging into the university portal and providing the needed security information such as their passwords and matriculation numbers.
- **Provision of Online Research Materials:** In the modern world, information needed for the purpose of research can easily be acquired through the internet and other online connectivity. The ICT centres are vested with the responsibility of providing of providing the university system with access to e-learning materials to support that which is provided by the library.
- **Provision and Management of a Computer Network:** It is the responsibility of the ICT centres to provide the university community with a computer network. This requirement is vital to enable communication and sharing of resources. A network is also required for the implementation of group policies, authentication of users and other related security policy management issues.
- **Provision of Access to the Internet:** The ICT centres are expected to make the provision for access to the internet. The internet is a worldwide network of computers and servers. They are expected to achieve this by sourcing, selecting and contracting an Internet Service Provider (ISP) to deliver internet connectivity to the university with a bandwidth adequate enough to cope with the size of the university community.
- **Provision of Information Technology (IT) Based Training to the University Community:** The staffs of the universities are expected to be trained by the ICT centres on various skills in Information Technology (IT). These skills includes how to use the computer to compute results, how to access the university portals and upload, edit and view students' results in

accordance with the privilege that is granted to the user. Training on other basic IT courses such as the use of Microsoft office, CorelDraw, etc. are also to be provided by the centres.

- **Provision of Training and other Relevant Services to the Society to generate Revenue:** The society is also expected to benefit from the university ICT centres. Similar training programmes are also provided to the society. However, these training and services are expected to generate revenue for the university.
- **Resolution of Problems and Conflicts encountered in the use of ICT Services:** It is expected that problems encountered in attempt to use the facilities and services provide by the ICT centres should be successfully resolved at these centres. This is possible because they have the administrative privileges of the network and also have skilled manpower to handle such complaints. This also includes systems maintenance.
- **Provision of Computer-Based Testing Centre:** The university ICT centres are required to establish and manage a computer-based testing centre for the university and other relevant establishments. The Post-UTME examinations currently taken by candidates seeking admission into Nigerian Universities is one example of this requirement. Recently, the United Tertiary Matriculation Examination (UTME) Board is also administering a computer-based examination.

### The Strengths of ICT

The discussions on the strengths, weaknesses, opportunities and threats are centred on the data collected from the oral responses and the technical audit carried out by the researchers. Although, these discussions relates to the ICT centre of the Ignatius Ajuru University of Education, Port Harcourt, they are very common to many Nigerian Universities.

- The ICT centre of the Ignatius Ajuru University of Education (IAUE), Port Harcourt and those of many Nigerian Universities have qualified IT personnel. The data collected shows that a good number of staff has various qualifications in terms of degrees and certificates in computer science and other IT-related fields.
- The centre has also provided a number of IT training programmes to the staff and is currently training the staff in the use of the University portals and Cisco-based trainings.
- There are adequate computer systems and room spaces for various training programmes.
- The ICT centre has also liaised with IT Company to create a domain name, designed the university website and uploaded relevant records to the portals. Consequently, activities of the university can be viewed online and students academic records can be uploaded and accessed from any location.
- Staff of the university has also been issued domain e-mail addresses to enhance communication.
- The centre enjoys massive support from the Department of Computer Science. These include the staff that has immensely assisted it in its service delivery.
- All the technical staff of the centre are registered with the Computer Professional Registration Council of Nigeria (CPN) - the regulatory agency for all IT related activities in Nigeria.

### Weaknesses of ICT Centres

- **Lack of Effective Intranet:** The centre has not been able to install and manage an effective intranet that covers each of the three campuses.
- **Lack of professionals with Professional Qualifications.** Interviews with a good number of staff indicates that there are few certificied personnel with professional qualifications such as MCP, MCSE, CCNA, MCTS, SCSA, CCNP, CCSA, etc.

- **Poor Method of Funding:** In spite of the fact that the ICT centre do lack sufficient funding, the method of funding of the centre represents a major set-back in providing the centre with the required capacity for effective service delivery. Imprests are ridiculously meager and funding is based on approvals from the Vice Chancellor (VC) of the University on request and not based on annual budget - a typical retrogressive syndrome in Nigerian university system. The most frustrating issue is that approved fund are hardly released as at when needed. According to the responses, only approvals that have the imprimatur of the bursar are released promptly.
- **The centre has not been able to develop an IT policy for the institution:** In spite of the years of existence, there is no IT policy in place for the university. Computer systems with various conflicting capabilities and operating systems are procured for the various departments. This has serious implications in the installation and configuration of group policy and user authentication in the network when an effective intranet is eventually installed.
- **It is also a weakness of the ICT centre of the IAUE for its inability to link the three campuses of the University for effective and toll-free communications.** The university has three campuses namely: The Main Campus (located at Rumuolumeni), St. John s Campus and the Ndele Campus. The Ndele Campus is about 45km from the main Campus and about 65km from St. Johns Campus. This calls for the need to link them with an effective communication system.
- **The responses also show that very few fund-generating training programmes have been organized by the centre since its inception.**
- **There is no computer-based testing Centre:** The centre has not been able to install and configure a functional computer-based testing facility of its own.
- **Extremely Poor bandwidth for Internet Service:** The data below shows a comparative analysis of the bandwidths used by some selected tertiary institutions in Nigeria. The table shows the bandwidths of some institutions from the Western and Southern parts of Nigeria.

**Table 1: Internet Bandwidths of Some Institutions**

Institution	Internet Bandwidth	Voice Service
Obafemi Awolowo University, Ile-Ife	45Mbps	No
Rivers State University of Science and Technology (RTUST), Port Harcourt	2Gbps	No
University of Ibadan	45Mbps	Yes
IITA, Ibadan	10Mbps	No
Ignatius Ajuru University of Education, Port Harcourt	3Mbps	No

Source: *iPNx and IT Centre of Rivers State University, Port Harcourt (2012)*

From the data shown above the IAUE ICT is with the least bandwidth that is not even adequate to sustain a small secondary school.

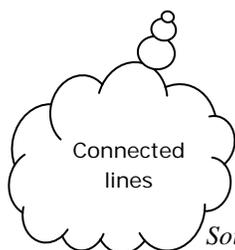
- **Poor Maintenance Culture:** Computer systems, radios for wireless access including batteries for inverters are poorly maintained. The centre is unable to effectively support the University in the maintenance of computers and other IT related systems.

## Opportunities for ICT Centres

- **There are opportunities to earn reasonable amount of revenue from the provision of research resources to the University Community and the society:** Various online tools exist to improve the availability of technical resources and increases students’ interest in Science, Technology, Engineering and Mathematics (STEM) topics, Daniel A. O. et al (2012).
- According to the data presented below, there are wonderful opportunities in the development of mobile applications.

**Table 2: Monthly Subscriber Data for Active GSM lines**

Operator	March, 2017	April, 2017
Mobile (GSM)	151,999,197	148,774,015
Mobile (CDMA)	217,566	217,566
Fixed wired/wireless	152,500	153,804
<b>Total</b>	<b>152,369,263</b>	<b>149,145,385</b>



Source: Nigeria Communication Commission (NCC, 2017)

The World Bank in its World Development Indicator (WDI) of 2004 puts the total GSM lines in Nigeria at thirty two million (32,000,000). Also Nigeria is the largest GSM market after China Agada (2008). It is observed that from the data provided by NCC, there is amazing increase in mobile lines within a month. Between March 2017 and April 2017, there is an increase of three million two hundred and twenty-eight thousand eight hundred and seventy-eight (3,228,878).

However, Techpoint puts the current figure at two hundred and sixteen million lines (Techpoint, 2018).

- **There is a large market for IT training in the country:** This is evidenced by the proliferation of numerous training centres in both the urban and rural areas. A well developed ICT centre can earn revenue from this. The presidential initiative on computer literacy has created additional opportunities for ICT centres across the country to support computer literacy and even earn revenue from it.
- **There are also opportunities for the centres to create employment:** It has been shown that IT has reliable potential of generating employment whether classical, keyisian or the growth employment model is considered (Odekunle et al, 2008).
- **The security challenges faced by the security agencies in Nigeria require modern solutions built around IT:** There are opportunities in creating IT-based security solutions that can be patented for amazing income in the future.
- **The fact that a University ICT centre is not a secular business corporation presents good opportunity for effective service delivery:** According to Aaron (2010), a business corporation’s operation is rooted in the logic of the pathological pursuit for profit inherent in the nature of the corporation. He argued that corporation cannot even with the best of intentions, make meaningful impact on host communities, mainly because of the structural constraints arising from the profit-seeking ethos which drives corporate behaviour. A University ICT centre is a unit under the University administration and does not pay taxes and is therefore not subjected to the unhealthy competition that business corporations experience. Thus, the major

goal will be effective service delivery instead of the primary goal of profit and can therefore support its host community better.

### **Threats in the Future Operation of the Centre**

- **A major threat identified by the study is that of funding:** The poor method of funding constitutes a major threat to its future operation. The threat is escalated by the financial abnormality practiced by the bursary department of the institution. The situation where approval can only be released if it has an express declaration of nihi obstat from the bursar is a crucial threat to the entire system.
- **Lack of an IT policy is another major threat to the smooth operation of the ICT centre:** There is no IT policy in place, so computers of different versions of operating systems (OS) are procured and this has serious implications on the network especially in the smooth implementation of group and security policies.
- The ridiculously low Internet bandwidth is a crucial challenge to the future operation of the IAUE ICT centre.
- The lack of adequate fund-generating programmes places additional financial burden on the centre.

### **Strategic Planning Programme to Enhance Effective Operation and Management of University ICT Centres**

The strategic planning programme provides solutions to the weaknesses, explores ways of tapping into the numerous opportunities revealed in this paper, presents a guideline for sustaining the strengths and overcoming the threats posed in the future operation and management of ICT centres in Nigerian Universities.

- **A major requirement for effective operation of a University ICT centre is the installation and management of an intranet.** A reliable network highly optimized to cope with the complexity of university academic and service requirements is a sine qua non.
- **Funding of the ICT centre must be based on annual budgets and supplementary budgets.** This will enable the centre to plan for its programmes effectively.
- **The centre must set up advanced hardware and software laboratories capable of supporting academic activities and developing products and applications that are essential to the development of IT.**
- **Fund-generating training programmes calendar must be prepared and implemented effectively.**
- **Installation and configuration of an e-mail exchange server to enhance communication even when internet service is not available.**
- **Formulation of IT policies for the universities to enhance smooth deployment of IT resources in a cost-effective manner.**
- **Development of a realistic maintenance programme for effective maintenance of computer system and other IT resources.** The study revealed that remote access points for wireless connections within the main campus are powered via small inverters with small back-up batteries. I recommend regular inspection and voltage measurements in every two weeks. Computer maintenances should include regular software updates and defragmentation of the systems in every twelve weeks (3 months).
- **Use of inverters fitted with circuitries that can disconnect battery power after exceeding a minimum current reserve threshold.** This will avoid draining the batteries completely and destroying the cells.
- **Implementation of training programme for its staff to cope with the highly dynamic nature of ICT.**

- **Setting up of a functional computer-based testing centre is an essential component of a university ICT centre.**
- **Partnering with other corporate bodies in terms of service delivery and in terms of sponsorship.** IAUE is in very close proximity to a reasonable number of corporate institutions and can easily secure partnership.
- **Linking of the three campuses together through a microwave connection.** It is our recommendation that radios and other microwave-based equipments should be powered with solar power stations. The diagram below gives a graphical illustration of this recommendation.

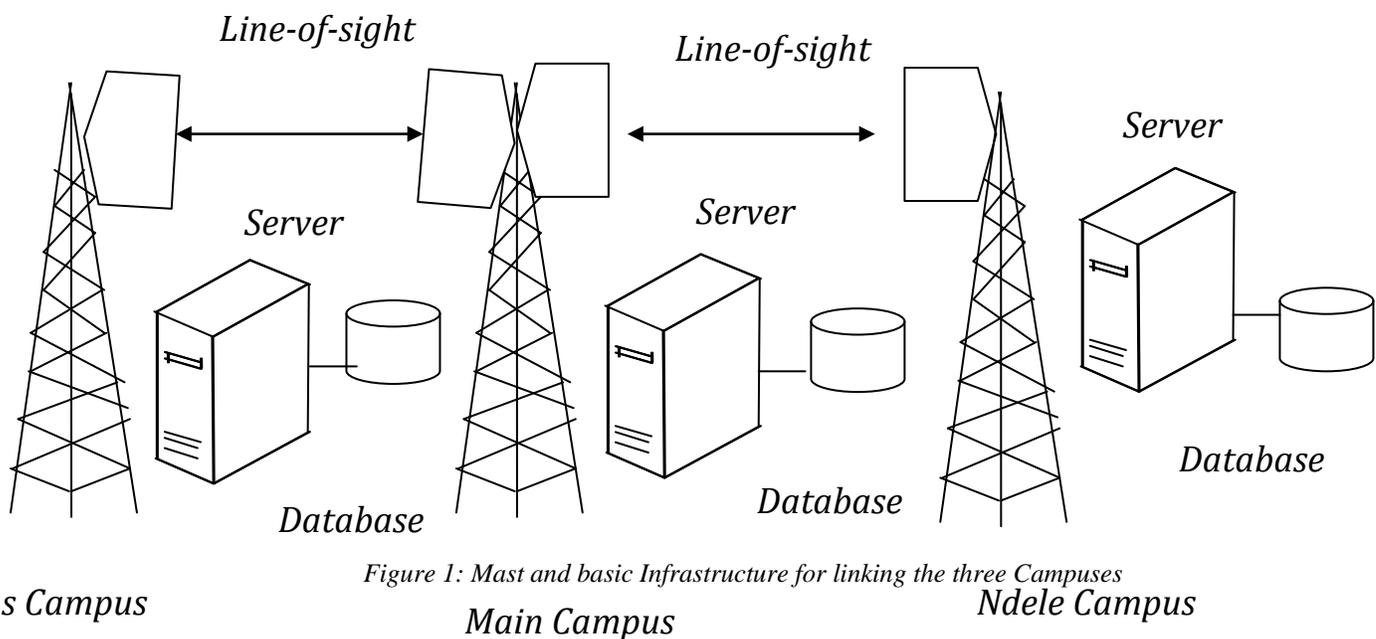


Figure 1: Mast and basic Infrastructure for linking the three Campuses

High quality radios from Teletronics or Cisco should be used. A voice service should be activated to enable inter-campus toll-free telephone communication. This will also enable video conferencing and computer-based security installations and controls.

- **An ICT centre that must remain strategic to the modern society must develop capabilities in computer security:** This is because the future war is a cyber war. An ICT centre must be capable of defending the university network and contributing same to national development. ICT personnel should be trained on advanced security and must acquire relevant certification in this field.

## Conclusion

Attractive opportunities exist for a sufficiently developed ICT centre. An effective University ICT centre can contribute immensely in placing the University on the global top list, if it is adequately equipped and properly managed. Its potential to determine the dynamics of life cannot be over-emphasized.

Nevertheless, the parallel, conflicting and duplicating financial control disorder observed in IAUE during the study, posed a serious threat to the development of ICT and academic activities. The practice where approval are only honoured if it has the imprimi potest of the bursary department has the potential of generating centrifugal and centripetal forces aggressive and asynchronous enough to cause serious developmental comatose and administrative chaos not only to the ICT centre but the entire university system. The Vice Chancellor is the chief executive of the University in the Nigerian University system and has the final approval to all requests. This should be observed and implemented in line with the principle of corporate administration.

The centre should acquire capacity to develop mobile applications. The author strongly recommend the use of J2ME or Java ME as this is a highly optimized JAVA runtime environment targeting a wide range of consumer products including pagers, cellular phones, printers, screen phones, Blu-ray Disc players, digital set-top boxes, embedded devices, M2M modules, car navigation systems and more. This is because there are wonderful and amazing opportunities in this area as reflected in study.

Advanced software and hardware laboratories should be established and properly equipped as they are essential resources to support academic activities in: Data communications, Microwave studies, Telecommunications, Microcontroller and Microprocessor-based studies, Systems engineering, Biotechnology, Computer Science and so on.

The cooperation between the department of computer science and the ICT centre should be encouraged and sustained. While the author recommends that funding must be based on annual budget; the ICT centre must intensify effort to run adequate fund-generating programmes and possibly become financially autonomous in the future.

The implementation of the strategic planning programme outlined in this study will no doubt produce a viable ICT centre with adequate capacity to support academic activities and immensely contribute to projecting the university on the top global list.

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**APPENDIX**

Dear Respondents, this document is intended to collect information that will assist in enhancing the capacity and service delivery of the Information and Communications Technology Centre (ICTC) of the Ignatius Ajuru University of Education Rumuolumeni, Port Harcourt, Nigeria. Please feel free to comment freely. The information is strictly for the purpose of research intended to achieve the above stated aim. Your responses will be treated in confidence, please.

Igenewari, L.S. and Micheal, C. P.  
Researchers

**Interview Questions**

- 1) What is your Rank/Job Description?.....  
.....
- 2) What is your last Qualification?.....
- 3) Do you have professional qualification.....
- 4) If you have professional Qualification write the qualification.....  
.....
- 5) How is the ICT centre funded.....  
.....  
.....  
.....  
.....
- 6) Do the ICT centre have training programmes for the University staff  
.....
- 7) If there are training programmes for the staff list them.....  
.....  
.....  
.....

- 8) What are training programmes (if any) available for other members of the society.....  
.....  
.....  
.....  
.....
- 9) Do you have a software laboratory?.....
- 10) Do you have a Network laboratory?.....
- 11) Do you have a Computer-Based Testing (CBT) resources designed and implemented by the centre for the University?.....
- 12) Do you have an intranet (LAN) covering each campus?.....  
.....
- 13) Are the three campuses of the University linked or connected together by a computer network by any means?.....
- 14) Can the Teaching staff upload results to the school Portal?.....
- 15) Can Students register their courses or access their results using the University portal?.....
- 16) Can the students pay their fees online using the portal?.....
- 17) Comment freely on the challenges and suggestions for improving the capacity and service delivery of the ICT centre.....  
.....

## Performance Analysis of Indian Life Insurance Companies using the Analytic Hierarchy Process

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DOI: 10.29322/IJSRP.8.8.2018.p8032

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8032>

### ABSTRACT

In this paper, both secondary and primary data is used for analysis of the performance of Indian Insurance Companies using the AHP technique. In order to solve the complex decision of choosing the insurance company, five criteria were taken into consideration and their pairwise comparison to calculate the AHP Scores of 15 such companies which are ruling the market currently. We could find out the significant positive relationship between the parameters and their composite scores depicting that these five criteria (premium, benefits, product diversity, customer service, distribution network) are mainly considered before the buying decision is made. However, the most stronger criterion among these was the premium and the associated benefits of the various insurance policies.

**Keywords:** Insurer, Market Share, Insurance Premium, Claims, Insurance Coverage, Term Assurance, Settlement.

### 1. Introduction

The life insurance industry in India is one of the biggest life insurance industries in the world, with over 360 million policies, and expected to grow at a rate of about 15% for the next five years, with increased life insurance penetration levels to at least 5% by 2020.<sup>1</sup> In 2013, India ranked eleventh among eighty-eight countries in the life insurance business, with a share of 2.1%, and ranked twenty-first in the global non-life insurance market with a share of 0.7%; it is the twentieth largest insurance market in the world in terms of premium volume.

The roots of the modern Indian life insurance industry originated with the incorporation of the Life Insurance Corporation (LIC) in 1956, consolidating together one hundred and fifty-six Indian and sixteen non-Indian insurers. The LIC was the sole player in the market until the late 1990s when the insurance sector was reopened to the private sector. There are currently twenty-four players in the Indian life insurance industry, the largest of which is the LIC, the only public sector life insurance company. Table 1 below presents all of the registered life insurance companies in India.

Table 1: registered life insurance companies in India

1	Bajaj Allianz Life	13	Sahara Life
2	Exide Life	14	Shriram Life
3	Reliance Life	15	Bharti Axa Life
4	SBI Life	16	Future Generali Life
5	Tata AIA Life	17	IDBI Federal Life
6	HDFC Standard Life	18	Canara HSBC OBC Life
7	ICICI Prudential Life	19	Aegon Life
8	Birla Sun Life	20	DHFL Pramerica Life
9	Aviva Life	21	Star Union Dai-Ichi Life
10	Kotak Mahindra Old Mutual Life	22	India First Life
11	Max Life	23	Edelweiss Tokio Life
12	PNB Met Life	24	Life Insurance Corporation

The Indian insurance industry can be categorized into two major market segments based on the purpose and service provided by them, viz. life insurance, catering to the needs regarding any incident of the death, and non-life insurance, which includes companies which provide insurance facilities against health, motor, fire, marine, and so on. Another segment is re-insurance, which has a sole operating player (GIC). Life insurance is a major segment of the insurance industry. The regulator of the industry is the Insurance Regulatory and Development Authority (IRDA), which was constituted following the recommendations of the Malhotra Committee report under the IRDA Act in 1999, as an autonomous body responsible for regulating, promoting, and ensuring orderly growth of the insurance industry, and was incorporated as a statutory body in April 2000.

Other stakeholders in the Indian insurance market include agents (individual and corporate), brokers, surveyors and third party administrators servicing insurance claims.

The Indian insurance market is a huge business opportunity waiting to be harnessed. India currently accounts for less than 1.5% of the world's total insurance premiums and about 2.1% of the world's life insurance premiums despite being the second most populous nation. It has tremendous growth potential in the coming years.

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[1 http://www.ibef.org/industry/insurance-sector-india.aspx](http://www.ibef.org/industry/insurance-sector-india.aspx)

## Market Structure & Competition

The major players in the life insurance sector are presented in Table 2 below, arranged according to descending market share.

**Table 2: major players in the Indian life insurance market**

	market share
<b>Life Insurance Corporation</b>	75%
<b>ICICI Prudential Life</b>	4%
<b>HDFC Standard Life</b>	4%
<b>SBI Life</b>	3%
<b>Max Life</b>	2%
<b>Bajaj Allianz Life</b>	2%
<b>Birla Sun Life</b>	2%
<b>Others</b>	8%

Source: IRDA Annual Report 2013-14

The HHI - Herfindahl-Hirschman Index, computed from the above market shares is 0.5742, and the six-firm concentration ratio is 90%, both of which indicate that Indian life insurance industry is highly concentrated, with LIC with a market share of 75% being the market leader. However, estimates indicate that LIC's market share has declined to 73% in 2015, and may further decline to 70% in 2016. This reflects a state of intense competition in the industry.

Though the industry is highly concentrated, regulations have been eased by IRDA to enable financial companies to readily enter the industry. Several banks have entered the industry, introducing the concept of bancassurance. Also, with the loosening of FDI restrictions, several global players are expected to enter. Thus, the threat of new entrants is moderate/high. The bargaining power of buyers is moderate/high, as products/services offered by different providers are relatively undifferentiated, and the switching costs are relatively low. The threat of substitutes is also moderate/high, as many more lucrative investment instruments have become available, and, further, banks and financial institutions are developing products that have insurance-like features. The bargaining power of suppliers is also moderate/high, as there is a single regulator (the IRDA), a single reinsurer (GIC), and provision of finance is highly regulated by the RBI. Thus, overall, Porter's five force model suggests that there is very high competitive rivalry in the Indian life insurance industry.

The intense competition in the life insurance segment is further reflected by recent trends in premium growth. Premium growth in the life insurance segment in India was negative in 2010-14, with year-on-year growth rates of -0.5%, -9.2%, -9.4%, -0.2%, and +1.0%, partly due to increased competition, and partly in order to stimulate demand in the recession; in comparison, in emerging markets in the same period, the corresponding growth rates were +11.0%, -5.2%, +4.5%, +3.6%, and +6.9%, and globally +3.0%, -3.0%, +2.0%, -1.8%, and +4.3%. On the other hand, premium growth in the non-life segment was positive, at +11.3%, +14.5%, +7.8%, +2.4%, and +4.8% in 2010-14; in comparison, in emerging markets in the same period, the corresponding growth rates were +9.9%, +8.1%, +9.1%, +8.6%, and +8.0%, and globally, +1.9%, +1.9%, +2.6%, +2.7%, and +2.9%.

## Growth Potential

The country's insurance market is expected to quadruple in size over the next ten years from its current size of US\$ 60 billion. During this period, the life insurance market is slated to cross US\$ 160 billion. The general insurance business in India is currently at US\$ 11.7 billion. Indian insurance market continues to be strong and is expected to rise and reach US\$ 280 billion by 2020. In the past few years, growth was the primary agenda across all competitive segments including public sector and private sector insurance players throughout the globe.

According to IRDA's Annual Report 2013-14, the insurance penetration in India was 3.9% against the world average of 6.3% in the year 2013. As compared with other BRICS countries, insurance penetration in India is moderate, at 5.0% in China, 1.3% in Russia, 4.0% in Brazil, and 15.4% in South Africa; but it is low as compared with some OECD countries: e.g. 8.0% in United States, 9.0% in France, 11.5% in United Kingdom, 11.1% in Japan, 6.7% in Germany, 6.9% in Canada, and 5.2% in Australia. More alarmingly, insurance penetration in India has been decreasing in the last five years; it had reached a peak of 5.2% in 2009, and has declined since, particularly due to a decline in life insurance penetration in the same period, whereas non-life penetration continues to increase.

Some of the main macro-environmental factors for Indian insurance industry are discussed in the following. The primary driving factors for growth of the life insurance market are demographic/social factors, including the growing young insurable population, improved living standards, life style changes, higher life expectancy, un-tapped market segments, better education levels and growing awareness of the need for protection and retirement planning. India's insurable population is anticipated to touch 750 million in 2020, with life expectancy reaching 74 years. Furthermore, life insurance is projected to comprise 35% of total savings by 2020, as against 26% in 2010.

There are several economic factors positively affecting demand for life insurance include growth of household savings, increased purchasing power, growth of the middle class, the increase in the working population, and the growth of the financial sector as a whole. On the other hand, some factors that negatively impact demand for life insurance include interest rates, alternative investments, unemployment, and inflation.

Among the political/legal factors affecting life insurance demand, the most critical are increased government promotion and support for the insurance industry. Insurance is promoted through income tax rebates given to individual tax payers, increased recently from INR 1 lakh (US\$ 1500) per head to the level of INR 1.5 lakh (US\$ 2250) per head. The following are some of the major recent government investments and developments in the Indian insurance sector.

The government has relaxed the FDI norms for the insurance sector from 26% to 49%, leading to a 152% growth in FDI year-on-year, reaching US\$ 341 million in March-September 2015. Several MNC insurance firms have responded, increasing their stake in joint ventures to 49%, e.g. AIA Group Ltd. in Tata AIA Life Insurance Co. Ltd, Sun Life Financial Inc. in Birla Sun Life Insurance Co. Ltd.; Nippon Life Insurance in Reliance Life Insurance; and BNP Paribas (up to 36%) in SBI Life Insurance. The government has launched a series of innovative special-purpose schemes, such as the unified scheme for farmers, the Bhartiya Keisha Bima Yojana, which includes various features like crop insurance, health cover, personal accident insurance, livestock insurance, insurance cover for agriculture implements like tractors and pump sets, student safety insurance, and life insurance, and its flagship insurance scheme Atal Pension Yojana, for which it has eased several norms, including more options for periodical contributions, voluntary and premature exits, and simplified penalty for payment delays, in order to increase the subscriber base and ensure wider reach. The government has also launched the Suraksha Bandhan Drive, comprising two schemes, the Pradhan Mantri Suraksha Bima Yojana, a personal accident insurance scheme, and the Pradhan Mantri Jeevan Jyoti Bima Yojana, a life insurance scheme, in order to promote insurance penetration and bank deposits.

The government has also launched the India Nuclear Insurance Pool of US\$ 226 million involving the GIC and eleven other non-life insurers under the Civil Liability for Nuclear Damage Act (CLND) in a bid to offset financial burden of foreign nuclear suppliers, to provide a risk transfer mechanism to the operators and suppliers under the CLND Act.

The IRDA has been introduced many regulatory changes in the insurance industry, promoting a higher degree of competition in the industry. The IRDA has recently reduced the mandatory investment norms for LIC in government securities from 75% to 50%, enabling it to diversify into more profitable investments. It has also stipulated that GIC and its subsidiaries should not hold more than 5% of its investments in any one security/company, thus reducing concentration risk

## Emerging Trends & Challenges

Some of the emerging trends in the life insurance industry are as follows. The industry has adopted multi-distribution channels, attempting to increase penetration through new modes of distribution such as the internet, direct marketing, and telemarketing. There has also been a proliferation of new products and product innovations, with increased levels of customization. Bancassurance, i.e. a partnership between a bank and an insurance company, using the bank sales channel in order to sell insurance products, is an example of product and distribution channel expansion, thereby increasing customer outreach. Customer service has also improved dramatically, with the introduction of technology, particularly claims management, i.e. the timely and efficient management of claims to prevent delays which can increase the claims cost. In fact, customer service has become a key differentiating factor between insurance companies, and this is strengthened by adequate support for CRM from the distribution network. Thus, most life insurance companies have been aggressively pursuing a combination of expansion strategies, expanding distribution channels, expanding product range, and developing innovative products, resulting in highly profitable growth. For example, Reliance Life Insurance Company (RLIC) is planning to expand its agency force by 20% to over 120,000 agents across India. Several prominent mergers/takeovers are expected in the insurance sector. For example, Bennett Coleman and Co. Ltd. is set to buy Religare Enterprises Ltd's entire 44% stake in life insurance joint venture Aegon Religare Life Insurance Co. Ltd., while the foreign partner Aegon is set to increase its stake from 26% to 49%.

An emerging/untapped area in the Indian insurance landscape is that of micro-insurance, which refers to insurance products which are designed to provide risk cover for low-income people. Growth in micro-insurance sector has been strongest in Asia, Latin America and Africa. Its growth in Asia, accounting for roughly 80% of the global micro-insurance market, is driven by large and dense populations, interest from public and private insurers, penetration of distribution channels and active government initiatives.

While India and China have been at the forefront, other Asian countries, such as Bangladesh, the Philippines and Indonesia are also witnessing rapid growth in micro-insurance. Latin America and Africa, which account for 15% and 5% of the global micro-insurance market, respectively, are other promising growth markets for the sector. In 2011, the estimated outreach of micro-insurance schemes (in terms of risks covered) was: 350-400 million in Asia, 45-50 million in Latin America, and 18-24 million in Africa.

The IRDA has formulated a draft regulation, IRDAI (Obligations of Insurers to Rural and Social Sectors) Regulations, 2015, in pursuance of the amendments brought about under section 32B of the Insurance Laws (Amendment) Act, 2015. These regulations impose obligations on insurers towards providing insurance cover to the rural and economically weaker sections of the population. It has also formed two committees to explore and suggest ways to promote e-commerce in the sector in order to increase insurance penetration and bring financial inclusion. This will provide insurance providers with an opportunity to unlock India's huge insurance potential.

However, the life insurance industry has recently witnessed a 10% decline in the first year premium collected, from INR 1,258 billion (US\$ 19.35 billion) in 2011 to INR 1,142 billion (US\$ 15.57 billion) in 2012. Also, despite strong improvement in penetration and density in the last 10 years, India largely remains an under-penetrated market. The market today is primarily dependent on push, tax incentives, and mandatory buying for sales. There is very little customer pull, which will come from growing financial awareness and increasing disposable income and savings.

## 1.1 Literature Review

Several studies have examined the factors affecting choice of life insurance policy and service provider. Some of the recent studies, particularly pertaining to the life insurance market in India, are reviewed in the following.

Berry (1995) observed that life insurance was characterized by high customer involvement due to the importance of customising to specific needs, the range of products available, the complexity of the policies/processes, and the involvement the customer in every aspect of transaction. Thus, sensitivity is needed in dealing with customers of insurance policies. This leads customers to form long-term relationships with their insurance agents and service providers in order to reduce uncertainties and risks.

Krishnamurthy et al (2005) discussed the growth of Indian insurance industry after liberalization and also presents future challenges and opportunities linked with the insurance. They argued that penetration of insurance was influenced by the availability of insurance products, insurance awareness, and quality of services. They also suggested that meeting customer expectations is the key to the growth of this sector, and that insurance providers need to educate Indian consumers to change their perceptions and make them aware of the insurable risks.

Devasenathipathi et.al (2007) compared the life insurance companies with respect to certain variables. They examined the effect of privatization, measured the customer perceptions, analysed purchase behaviour, and consumer awareness regarding the life insurance policies. They identified certain key success factors in the life insurance business such as the increasing use of IT tools, convenience, time savings, and money saving schemes. They found that customers expect multiple benefits from the life insurance policies, including higher returns from policies, lower premia, more awareness created by companies, a wider variety of policies, and advertisements.

Athma and Kumar (2007) identified various product and non-product related factors affecting life insurance purchase decision-making. They found that the urban market is more influenced by product-based factors such as risk coverage, tax benefits, return, and so on, while the rural market is influenced by non-product related factors such as credibility of agent, company's reputation, trust, and customer services.

Ray and Ali (2008) studied the gap between perceived and desired features in life insurance products/services, the relative importance of factors in the purchase decision of life insurance products, and customer preferences relating to after-sales services. They also found that customers seek not only risk coverage against death/accident, but also tax savings and meeting of post-retirement needs. Customers also desired continuous communication from their service providers, such as quarterly statements, information about premium payments, new products and switching of funds, preferably via SMS, e-mails, and/or phone calls.

Khurana (2008) studied customer preferences and satisfactions with respect to life insurance policies from different service providers. They found that most of their respondents faced problems in claims settlement, and most faced problems in obtaining information from service provider.

Eldhose and Kumar (2008) explained the importance of quality services and its significance in customer satisfaction. Their comparative study of public and private sectors helped in understanding the customer perception, satisfaction and awareness on various life insurance services.

Suneja and Sharma (2009) identified the various factors influencing choice of a life insurance company, including promotional activities, image of company, customer convenience, financial and non-financial facilities, and premium and procedural formalities.

Malik and Predham (2011) found that product features like tax rebate, investments, advertising and agents' knowledge, low premium are the key factors in determining selection of an insurance company. They suggested that proper training should be given to the agents in all aspects like product knowledge, behavioural aspects, communication, that greater focus should be given to advertisements to reach the customers, and that premium-setting should be done carefully, considering the target customers.

Singh (2011) also suggested that low premium, proper induction to agents, effective advertisement strategy, friendly policy, and easy accessibility to insurance company has motivated customers to acquire a policy.

Yadav and Tiwari (2012) examined the factors which influence customers' policy buying decision and also analyse the preferences of customers while life policy investment decision-making. They found that LIC is the most accepted and popular brand in life insurance, and that the market share of private insurers are gradually increasing with people trust and better services offered by them. They suggested that insurance companies should spread more awareness about life insurance, reduce premium amounts, and focus on need-based innovative products. Also, they found that demographic factors play a major role in deciding the purchase of life insurance policies.

Anuradha (2012) studied the factors influencing the customers to purchase the insurance products, including the type of insurance company and media as source of information. She also studied the age group which was more interested with life and health insurance policies, and whether the customer prefer public or private insurers.

Mathur and Tripathi (2014) identified nine factors affecting customers' choice of insurance company, of which the most important factors were computerization and online transactions, connectivity with bank, speed and efficiency in transactions, and clear communication.

Rajkumar and Kannan (2014) examined the factors influencing the selection of service provider for purchasing a life insurance policy. They found that product features, accessibility, low premium, advertising, proper redressal of complaints, and better claims settlement were some of the factors that significantly influence the choice of a service provider.

Kothari et al (2014) found that service benefits, awareness, risk and returns, and tax benefits were some of the factors influencing purchase of life insurance policies. The most important factor was found to be service benefits, which include prompt services, security and safety, and additional benefits.

Jothi and Sitaram (2014) identified five factors affecting the purchase of life insurance policies, viz. the core product factor, the promotional factor, customer expectation factor, risk–return factor, and service factor.

There are several potential factors affecting the choice of life insurance policies and service providers suggested in the literature. The current study considers some of these factors as the basis for comparison of life insurance service providers, using the Analytic Hierarchy Process.

## 2. Methodology

The study analyses the performance of life insurance service providers using the Analytic Hierarchy Process (AHP) methodology. AHP is a structured technique for organizing and analyzing complex decisions with multiple objectives, based on pairwise comparison and weighted averaging (Saaty, 2008). It is particularly applied in group decision making, and a wide variety of decision situations, including choice, i.e. the selection of one alternative from a given set of alternatives, usually where there are multiple decision criteria involved; ranking, i.e. putting a set of alternatives in order from most to least desirable; prioritization, i.e. determining the relative merit of members of a set of alternatives, as opposed to selecting a single one or merely ranking them; resource allocation, i.e. apportioning resources among a set of alternatives; benchmarking, i.e. comparing the processes in one's own organization with those of other best-of-breed organizations; quality management, i.e. dealing with the multidimensional aspects of quality and quality improvement; and conflict resolution, i.e. settling disputes between parties with apparently incompatible goals or positions.

AHP has four basic steps. The first step is to define the problem and state the goal or objective, define the criteria or factors that influence the goal, and identify the alternatives to be evaluated with respect to the criteria. The second step is to construct the paired comparison matrix between the criteria, using which the weights for each of the criteria are calculated. The third step is to construct the paired comparison matrices for the alternatives for each criterion, using which the ratings for each alternative under each criterion are calculated. The fourth step is to synthesise the ratings of each alternative by taking weighted averages, and to select the alternative with highest composite rating.

The scale used for the paired comparison matrix for criteria is an importance scale, ranging from 1 to 9, where "1" represents equal importance, "2" represents equal to moderately more important, "3" represents moderately more important, "4" represents moderately to strongly more important, "5" represents strongly more important, "6" represents strongly to very strongly more important, "7" represents very strongly more important, "8" represents very strongly to extremely more important, and "9" represents extremely more important. The scale used for the paired comparison matrix for alternatives under each criterion is a preference scale, ranging from 1 to 9, where "1" represents equally preferred, "2" represents equally to moderately more preferred, "3" represents moderately more preferred, "4" represents moderately to strongly more preferred, "5" represents strongly more preferred, "6" represents strongly to very strongly more preferred, "7" represents very strongly more preferred, "8" represents very strongly to extremely more preferred, and "9" represents extremely more preferred.

Several studies have applied AHP models in a related field, viz. to measure banking performance. Hunjak and Jakovcevic (2001) suggested the use of multi-criteria AHP, using both quantitative factors (viz. financial ratios) and qualitative factors (internal and external) in the evaluation process. Seçme et al (2009) proposed a fuzzy AHP model for the banking system using both financial and non-financial performance criteria. Stankeviciene and Mencaite (2012) used the AHP model to evaluate the performance of Lithuanian commercial banks.

For the AHP analysis of life insurance service providers, the attributes considered have substantial meaning in the buying decision of life insurance products from the wide range of products available, including: premium, benefits, product diversity, customer service, and distribution network.

**Premium** refers to the price of life insurance products that are offered by different service providers to differentiate their products on the bases of price prevailing among the rapid growing competition. The premium is usually a function of the type of life insurance policy, the benefits offered, and the demographic characteristics of the customer (i.e. gender, age, occupation, income, marital status, and so on). This criterion captures the pricing strategies of the life insurance service providers. In the present study, the analysis was performed for a term life policy with a coverage of Rs. 1 crore (US\$ 153,850) considering a specific segment, viz. male, 25 year-old, salaried employees, with an income in the range Rs. 5.0 - 7.5 lakh (US\$ 7,700 - 11,500) per annum. **Benefits** are the bundle of additional services that are provided along with the insurance instruments to provide greater overall coverage to the policy holder. These may include accident benefit, disability benefit, illness benefit, waiver of premium in certain circumstances, and so on. In the present study, the benefits provided by different service providers were compared for the term life policy detailed above. **Product diversity** refers to the range of products offered by the service provider. Service providers usually offer several policies of different types, including term life policies, whole life policies, endowment policies, money back policies, pension policies, and so on. In the present study, the number of policies in force of different types was used to compare the product diversity of different service providers.

**Customer service** refers to the responsiveness of service providers to customer service needs, including providing adequate and timely information about products, amicable and knowledgeable assistance in financial planning, appropriate and timely processing of claims, sensitive and timely handling of complaints/grievances, and so on. In fact, the IRDA has stipulated the maximum allowable service turnaround times (STAT) for various services that an insurance company has to render to the consumer. Many studies suggest that customer service is the most important parameter customers consider when selecting a life insurance service provider. In the present study, customer service was assessed by considering the claim settlement ratio (i.e. the percentage of claims paid in the stipulated period) and the grievance resolution ratio (i.e. the percentage of grievances addressed in the stipulated period).

**Distribution network** refers to the network of agents, branches, and insurance delivery system through which services are delivered to customers. This is perhaps as important as customer service in selecting a life insurance service provider, as it is the distribution network that provides the interface with customers and ensures delivery of the products and services to customers. In the present study, the distribution network was assessed by considering the number of agents for each service provider.

The analysis was performed for fifteen of the twenty-four registered life insurance service providers. The following nine service providers were eliminated from the analysis due to unavailability of data: Exide Life, Tata AIA Life, Kotak Mahindra Old Mutual Life, Sahara Life, Shriram Life, Canara HSBC OBC Life, DHFL Pramerica Life, Star Union Dai-Ichi Life, and IndiaFirst Life. The data for the service providers was obtained from the IRDA<sup>2</sup>, Life Insurance Council of India (LICI)<sup>3</sup>, and various insurance product comparison websites<sup>45</sup>.

## 2.1 Analysis & Interpretation

The pairwise comparison matrix for the criteria is given in Table 3 below, with x1 referring to premium, x2 referring to benefits, x3 referring to product diversity, x4 to customer service, and x5 to distribution network.

**Table 3: pairwise comparison matrix for criteria**

	X1	X2	X3	X4	X5	weightage
X1	1	1/5	1/3	1/7	1/7	<b>0.0358</b>
X2	5	1	3	1/5	1/5	<b>0.1216</b>
X3	3	1/3	1	1/7	1	<b>0.1141</b>
X4	7	5	7	1	1	<b>0.3642</b>
X5	7	5	7	1	1	<b>0.3642</b>

The resulting weights in Table 3 indicate that customer service and distribution network are jointly assumed to be the most important criteria in ranking the life insurance service providers. Benefits was the next important criterion, followed by product diversity; and premium was the least important criterion.

The pairwise comparison matrices for the life insurance service providers under each of the criteria are given in Tables 4 - 8 below, with y1 referring to Bajaj Allianz Life, y2 referring to Reliance Life, y3 to SBI Life, y4 to HDFC Standard Life, y5 to ICICI Prudential Life, y6 to Birla Sun Life, y7 to Aviva Life, y8 to Max Life, y9 to PNB Met Life, y10 to Bharti Axa Life, y11 to Future Generali Life, y12 to IDBI Federal Life, y13 to Aegon Life, y14 to Edelweiss Tokio Life, and y15 to Life Insurance Corporation. The summary of the AHP scores is presented in Table 9.

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- 2 <https://www.irdai.gov.in/>
  - 3 <http://www.lifeinscouncil.org/>
  - 4 <http://www.policybazaar.com/>
  - 5 <https://buy.insuranzone.com/>

**Table 4: pairwise comparison matrix for premium price**

	y1	y2	y3	y4	y5	y6	y7	y8	y9	y10	y11	y12	y13	y14	y15
y1	1	1/7	1/2	1/5	2/9	1/6	1/3	1/5	1/6	1/6	2/5	1/6	1/3	1/6	7
y2	7	1	6	3.5	3.5	3	4	3.5	3	2	4.4	2	4	3	9
y3	2	1/6	1	1/3	2/5	1/4	1/2	1/3	2/9	1/5	2/3	1/5	1/2	2/7	8
y4	5	2/7	3	1	1.5	1/2	3	1	2/5	1/3	2.5	1/3	2	2/3	8.5
y5	4.5	2/7	2.5	2/3	1	1/2	2.5	2/3	1/3	2/7	2	2/7	1	1/2	8.5
y6	6	1/3	4	2	2	1	3.5	1.5	2/3	2/3	4	2/3	3.5	1	9
y7	3	1/4	2	1/3	2/5	2/7	1	1/3	1/4	2/9	1	2/9	1	1/3	8
y8	5.5	2/7	3	1	1.5	2/3	3	1	2/5	1/3	2.5	1/3	2	2/3	8.5
y9	6	1/3	4.5	2.5	3	1.5	4	2.5	1	1/2	4.5	2/3	4	1.5	9
y10	6.5	1/2	5	3	3.5	1.5	4.5	3	2	1	4.5	1	4	2	9
y11	2.5	2/9	1.5	2/5	1/2	1/4	1	2/5	2/9	2/9	1	2/9	1/2	1/2	7.5
y12	6.5	1/2	5	3	3.5	1.5	4.5	3	1.5	1	4.5	1	4	1.5	9
y13	3	1/4	2	1/2	1	2/7	1	1/2	1/4	1/4	2	1/4	1	1/3	7.5
y14	6	1/3	3.5	1.5	2	1	3	1.5	2/3	1/2	2	2/3	3	1	8.5
y15	1/7	1/9	1/8	1/8	1/8	1/9	1/8	1/8	1/9	1/9	1/7	1/9	1/7	1/8	1

**Table 5: pairwise comparison matrix for benefits**

	y1	y2	y3	y4	y5	y6	y7	y8	y9	y10	y11	y12	y13	y14	y15
y1	1	2/3	1	1/4	1/6	1	2/3	2/5	1/5	2/5	2/7	1	1/8	1/7	2.5
y2	1.5	1	2/3	2/5	1/4	1.5	1	2/5	1/5	2/3	2/5	1.5	1/7	1/6	3
y3	1	1.5	1	2/5	1/5	2	1.5	1/2	2/9	2/3	1/2	2	1/6	1/6	3
y4	4	2.5	2.5	1	1/2	4	2.5	2	2/3	1.5	1.5	3	1/3	2/5	5
y5	6	4	5	2	1	6	4	2.5	1.5	3	2.5	3	2/3	2/3	6
y6	1	2/3	1/2	1/4	1/6	1	2/3	2/5	1/5	2/5	2/7	1	1/8	1/7	2.5
y7	1.5	1	2/3	2/5	1/4	1.5	1	2/5	1/5	2/3	2/5	1.5	1/7	1/6	3
y8	2.5	2.5	2	1/2	2/5	2.5	2.5	1	2/9	1.5	2/3	3	1/4	2/7	3.5
y9	5	5	4.5	1.5	2/3	5	5	4.5	1	2	1.5	2.5	1/3	2/5	5
y10	2.5	1.5	1.5	2/3	1/3	2.5	1.5	2/3	1/2	1	2/3	1.5	1/6	1/6	3.5
y11	3.5	2.5	2	2/3	2/5	3.5	2.5	1.5	2/3	1.5	1	2	1/4	2/7	4
y12	1	2/3	1/2	1/3	1/3	1	2/3	1/3	2/5	2/3	1/2	1	1/3	2/5	2.5
y13	8	7	6.5	3	1.5	8	7	4	3	6.5	4	3	1	1.5	7
y14	7	6.5	6	2.5	1.5	7	6.5	3.5	2.5	6	3.5	2.5	2/3	1	6.5
y15	2/5	1/3	1/3	1/5	1/6	2/5	1/3	2/7	1/5	2/7	1/4	2/5	1/7	1/6	1

**Table 6: pairwise comparison matrix for product diversity**

	y1	y2	y3	y4	y5	y6	y7	y8	y9	y10	y11	y12	y13	y14	y15
y1	1	1/3	1/3	1/3	1	2/5	1/2	3	1.5	1.5	1.5	4	1	1	1
y2	3	1	1	1	2.5	1	1	5	4	5	5	6	3	2	1.5
y3	3	1	1	1	2.5	1	1	5	4	5	5	6	3	2	1.5
y4	3	1	1	1	2 1/2	1	1	5	4	5	5	6	3	2	1.5
y5	1	2/5	2/5	2/5	1	2/5	1/2	1.5	1.5	1.5	1	2	1	1	1/2
y6	2.5	1	1	1	2.5	1	1	3.5	3	3.5	3.5	4.5	2.5	2	1
y7	2	1	1	1	2	1	1	3	3	4	4	5	1.5	2	2/5
y8	1/3	1/5	1/5	1/5	2/3	2/7	1/3	1	1	1	1	1	1/2	2/5	1/3
y9	2/3	1/4	1/4	1/4	2/3	1/3	1/3	1	1	1	1	1	1/2	2/5	1/3
y10	2/3	1/5	1/5	1/5	2/3	2/7	1/4	1	1	1	1	1	1/2	2/5	1/3
y11	2/3	1/5	1/5	1/5	1	2/7	1/4	1	1	1	1	1	1/2	2/5	1/3
y12	1/4	1/6	1/6	1/6	1/2	2/9	1/5	1	1	1	1	1	2/5	1/3	1/3
y13	1	1/3	1/3	1/3	1	2/5	2/3	2	2	2	2	2.5	1	1	2/3
y14	1	1/2	1/2	1/2	1	1/2	1/2	2.5	2.5	2.5	2.5	3	1	1	2/3
y15	1	2/3	2/3	2/3	2	1	2.5	3	3	3	3	3	1.5	1.5	1

**Table 7: pairwise comparison matrix for customer service**

	y1	y2	y3	y4	y5	y6	y7	y8	y9	y10	y11	y12	y13	y14	y15
y1	1	3	2/3	2/7	2/7	1.5	2.5	1/3	1	1.5	7	1	2	9	1/7
y2	1/3	1	1/4	1/6	1/6	1/3	1/2	1/6	1/3	2/5	4	2/5	1	8	1/8
y3	1.5	4	1	2/5	2/5	2	4	1/2	1	2.5	5	1.5	4	8	1/5
y4	3.5	6	2.5	1	1	4	5	1	2.5	4.5	8	2	6	9	1/3
y5	3.5	6	2.5	1	1	4	5	1	2.5	4.5	8	2	6	9	1/3
y6	2/3	3	1/2	1/4	1/4	1	2	1/4	1/3	1	4	1/3	3.5	8	1/8
y7	2/5	2	1/4	1/5	1/5	1/2	1	1/4	1/4	1/3	3	1/4	2	8	1/8
y8	3	6	2	1	1	4	4	1	2.5	4.5	8	2	6	9	1/3
y9	1	3	1	2/5	2/5	3	4	2/5	1	1.5	7	1	2	9	1/7
y10	2/3	2.5	2/5	2/9	2/9	1	3	2/9	2/3	1	6	2/3	3	8	1/7
y11	1/7	1/4	1/5	1/8	1/8	1/4	1/3	1/8	1/7	1/6	1	1/5	1/4	8	1/8
y12	1	2.5	2/3	1/2	1/2	3	4	1/2	1	1.5	5	1	2	8	1/9
y13	1/2	1	1/4	1/6	1/6	2/7	1/2	1/6	1/2	1/3	4	1/2	1	8	1/8
y14	1/9	1/8	1/8	1/9	1/9	1/8	1/8	1/9	1/9	1/8	1/8	1/8	1/8	1	1/9
y15	7	8	5	3	3	8	8	3	7	7	8	9	8	9	1

**Table 8: pairwise comparison matrix for distribution network**

	y1	y2	y3	y4	y5	y6	y7	y8	y9	y10	y11	y12	y13	y14	y15
y1	1	2/3	3	5	2/5	2.5	9	7	8	7.5	7.5	8	8	8	1/9
y2	1.5	1	3.5	5.5	1/2	3	9	7.5	8.5	8	8	8	8	8	1/9
y3	1/3	2/7	1	2	1/5	1/3	8 1/2	3	7	6.5	6.5	7	7	6.5	1/9
y4	1/5	1/5	1/2	1	1/5	2/7	7	3	5	4.5	4.5	7	7	6	1/9
y5	2.5	2	5	5.5	1	3	9	8	9	9	9	9	9	9	1/9
y6	2/5	1/3	3	3.5	1/3	1	9	7	9	9	9	9	9	9	1/9
y7	1/9	1/9	1/8	1/7	1/9	1/9	1	1/6	2/7	2/9	2/9	1	1	2/5	1/9
y8	1/7	1/7	1/3	1/3	1/8	1/7	6	1	2.5	2	2	6	6	4.5	1/9
y9	1/8	1/8	1/7	1/5	1/9	1/9	3.5	2/5	1	1/3	1/2	1.5	1.5	2/3	1/9
y10	1/7	1/8	1/6	2/9	1/9	1/9	4.5	1/2	3	1	1.5	4	4	3	1/9
y11	1/7	1/8	1/6	2/9	1/9	1/9	4.5	1/2	2	2/3	1	3.5	3.5	2	1/9
y12	1/8	1/8	1/7	1/7	1/9	1/9	1	1/6	2/3	1/4	2/7	1	1	1/2	1/9
y13	1/8	1/8	1/7	1/7	1/9	1/9	1	1/6	2/3	1/4	4/7	1	1	1/2	1/9
y14	1/8	1/8	1/6	1/6	1/9	1/9	2.5	2/9	1.5	1/3	1/2	2	2	1	1/9
y15	9	9	9	9	9	9	9	9	9	9	9	9	9	9	1

**Table 9: summary of AHP scores**

weightage	Premium	Benefits	Product diversity	Customer service	Distribution network	AHP score
	0.0358	0.1216	0.1141	0.3642	0.3642	
Bajaj Allianz Life	0.0169	0.0227	0.0523	0.0491	0.1017	0.0642
Reliance Life	0.1745	0.0293	0.1236	0.0233	0.1121	0.0732
SBI Life	0.0243	0.0335	0.1236	0.0647	0.0653	0.0664
HDFC Standard Life	0.0576	0.0750	0.1236	0.1162	0.0526	0.0868
ICICI Prudential Life	0.0467	0.1223	0.0447	0.1162	0.1335	0.1126
Birla Sun Life	0.0859	0.0217	0.1055	0.0381	0.0963	0.0667
Aviva Life	0.0316	0.0293	0.0973	0.0268	0.0094	0.0289
Max Life	0.0590	0.0538	0.0258	0.1114	0.0347	0.0648
PNB Met Life	0.1031	0.1039	0.0284	0.0579	0.0142	0.0458
Bharti Axa Life	0.1277	0.0427	0.0264	0.0413	0.0257	0.0372
Future Generali Life	0.0298	0.0610	0.0274	0.0148	0.0220	0.0250
IDBI Federal Life	0.1223	0.0316	0.0224	0.0553	0.0101	0.0346
Aegon Life	0.0364	0.1930	0.0503	0.0243	0.0104	0.0432
Edelweiss Tokio Life	0.0761	0.1657	0.0584	0.0079	0.0148	0.0378
Life Insurance Corporation	0.0080	0.0147	0.0903	0.2525	0.2973	0.2126

Reliance Life was found to be the most competitive with respect to premium, followed by Bharti Axa Life and IDBI Federal Life. However, Aegon Life, followed by Edelweiss Tokio Life and ICICI Prudential Life offered better benefits. In terms of product diversity, HDFC Standard Life, SBI Life, and Reliance Life had the best range of offerings. From the product point of view, LIC was last-ranked in terms of premium and benefits, followed by Bajaj Allianz Life and Aviva Life. On the other hand, LIC was found to dominate its competitors in terms of customer service and distribution network; HDFC Standard Life and ICICI Prudential Life were joint second-ranked with respect to customer service, and ICICI Prudential Life and Reliance Life were second- and third-ranked, respectively, with respect to distribution network. Overall, LIC was identified as the best performer, followed by ICICI Prudential Life and HDFC Standard Life, and followed Reliance Life and Birla Sun Life.

### 3. Discussion

The Indian insurance industry is still in a growing stage, as India's twin demographic dynamics of a growing working population and increasing disposable income are driving continued growth. Further, government initiatives continue to promote insurance penetration and reach. The Indian insurance industry is on a path of sustainable growth and momentum, by increasing penetration and exploring the latent segments, particularly the rural segment, through micro-insurance. This latter market may require more flexible policies and regulation. There is also a need to spread awareness and information about insurance for Indian consumers in general, requiring more careful advertising and promotional campaigns, particularly informing consumers about new products and their features. Distribution networks will play a vital role in this, so service providers must build a wider and deeper network, with a focus to improve awareness and customer service.

The results of the analysis of the life insurance service providers using AHP are relatively consistent with their market position. However, the analysis indicates good potential for Reliance Life to improve its market position. In fact, if the AHP analysis is carried out with equally-weighted criteria, Reliance Life displaces HDFC Standard Life and comes third among the life insurance providers considered. Aegon Life and Edelweiss Tokio Life also have attractive offerings in terms of benefits, but may need to reconsider their pricing if they are to make an impact on the market.

Several service providers were found to be lacking in terms of customer service and distribution network, including Edelweiss Tokio Life, Aviva Life, and Aegon Life. In fact, as the distribution network may be the driving force of the life insurance industry, it is necessary to examine its impact on performance more carefully, from the point of view of productivity and efficiency.

There are several limitations inherent in the present study. There were several difficulties with the operational definitions of the parameters considered. Firstly, not all insurance service providers had comparable policies catering to all customer segments, across different coverage ranges and maturities. For simplicity, in the present study, a fixed segment was selected, and insurance providers that offered comparable products for this segment were selected. Secondly, premium and benefits are generally interlinked: policies with more benefits tend to be priced higher. In the present study, the most basic policy for each service provider was considered. Thus, there could be some element of adverse overlapping between the definition of premium and benefits in the present study. As an extension of the present study, different segments need to be analyzed and collated to get a complete picture for the industry. This could also capture product diversity to some extent, in the sense of the different segments the service provider caters to. Also, it is necessary to separate the assessment of premium and benefits; i.e. to compare the prices of the most basic life insurance policies, without any additional benefits, and to compare the additional benefits offered at a fixed price. Alternatively, premium and benefits could be combined into a single criterion.

Another limitation arose from obtaining reliable data relating to the parameters considered. Customer service and satisfaction data was unavailable with both the IRDA and LIC, though there are prescribed service turnaround times for different services. Primary data from customers should be taken from panels of customers by a third party (preferably the regulator) and be made available for analysis, and used for improving customer service. The use of customer feedback on different product comparison websites may be insightful to some extent, but suffers from selection bias.

There are several avenues for further research suggested by the present study. As discussed above, the study can be extended to different segments. Further, the relationship between premium and benefits, as well as the relationship between distribution network and customer service, need to be further examined. Also, the critical determinants of productivity and efficiency of life insurance service providers need to be identified. Finally, the study can be extended by considering other criteria for comparison of life insurance service providers, e.g. equity, costs/expenses, investments, efficiency, solvency, returns/risk, valuation, and so on.

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## Annexure

**Table 10: data for the paired comparisons**

	premium*	max. maturity	benefits	products in force	agents	claim settlement	grievance resolution
<b>Bajaj Allianz Life</b>	9824	50		29	115920	91.29%	98.60%
<b>Reliance Life</b>	4626	55		34	117359	81.97%	98.02%
<b>SBI Life</b>	7465	50	A	35	87866	91.06%	99.88%
<b>HDFC Standard Life</b>	6529	60	B	38	77970	94.01%	93.01%
<b>ICICI Prudential Life</b>	6775	60	A, C, D, E	26	131619	94.01%	99.50%
<b>Birla Sun Life</b>	6297	50		34	105859	87.76%	99.95%
<b>Aviva Life</b>	6958	55		31	9305	84.00%	100.00%
<b>Max Life</b>	6526	55	A	19	40351	93.86%	99.98%
<b>PNB Met Life</b>	5743	60	A, B, C	22	12150	90.24%	99.85%
<b>Bharti Axa Life</b>	5125	65		20	18311	88.13%	93.80%
<b>Future Generali Life</b>	7112	70		22	16573	74.88%	93.06%
<b>IDBI Federal Life</b>	5222	45	A	17	10069	90.34%	100.00%
<b>Aegon Life</b>	6840	70		25	10159	81.00%	94.68%
<b>Edelweiss Tokio Life</b>	6412	70	A, B, C, E	28	13828	60.00%	93.58%
<b>Life Insurance Corporation</b>	13396	50		31	1076835	98.14%	100.00%

\*assuming a term life policy for a male, aged 25 years, salaried employee, in the income group Rs. 5.0-7.5 lakh, for a coverage of Rs. 1 crore.

- A: accidental death
- B: accidental disability
- C: critical illness
- D: terminal illness
- E: waiver of premium

# Camera Captured based Myanmar Character Recognition Using Dynamic Blocking and Chain Code Normalization

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DOI: 10.29322/IJSRP.8.8.2018.p8033

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8033>

*Abstract-* This paper presents a system for Myanmar text extraction and recognition from warning signboard images taken by a mobile phone camera. Camera captured natural images have numerous difficulties compared to the traditional scanned documents. Common problems for camera captured text extraction are variations in font style, size, color orientation, illumination condition as well as the complex background. In this system, color enhancement process is performed to distinguish the foreground text and background color. Color enhanced images are converted into binary images using color threshold range. The detected non-text objects are removed as clearly as possible using width, high, aspect ratio and object region area threshold. In the segmentation process, horizontal projection profile, vertical projection profile and bounding box are used for line segmentation and character segmentation. To recognize the above segmented Myanmar characters, blocking based pixel count and eight-direction chain codes features are proposed. In this system, characters are classified by feature based approach of template matching method by using the proposed features. In this paper, dynamic blocking based pixel count, eight-direction chain codes features and geographic features are used to correctly recognize Myanmar characters.

*Index Terms-* dynamic blocking, chain codes, Myanmar signboard, text extraction.

## I. INTRODUCTION

Character recognition is an important process in the understanding of warning text images by a foreigner or visually impaired person. In the optical character recognition (OCR) system, camera captured images have numerous difficulties compared to the traditional scanned documents. Common problems for camera captured text images are variations in font style, size, color, orientation, illumination condition as well as the complex background. This research presents the Myanmar text recognition system for warning signboard images which are captured by a camera. In this system, color enhancement process is performed to distinguish the foreground text and background color. Color enhanced images are converted into binary images using color threshold range.

The detected non-text objects are removed as clearly as possible using width, high, aspect ratio and object region area threshold. Recently, many researchers presented the text extraction and recognition systems for the various languages such as English [2], Chinese, Japanese, Korea, Kannada, Arabic, etc. Myanmar text extraction and recognition in real signboard images remain surprisingly challenging in Computer Vision. The text on the signboard is written in various styles, various fonts, various size and various colors. In our country, warning text papers or signboards may be anywhere and are printed or handwritten. To understand that warning text on the signboard by a foreigner or impaired person it is need to recognize and translate that warning text on the signboard. Myanmar script is considered as a complex script by software developers, as it originated from Indic scripts like Thai or Khmar. And then, Myanmar characters can be divided into two types: basic characters and extended character. The basic characters (consonants) may stand as single character or may be combined with one or more extended characters. The extended characters may be at left or right or top or bottom of the basic character. In Myanmar script language, there exist isolated characters and compound words but, there are no spaces and words as in English language. The remaining Related Works are presented in Section II. Dataset and Nature of Myanmar Script is presented in Section III. Propose Methods is presented in Section IV, Experimental Results are described in Section V. Error Analysis is described in Section VI and Section VII concludes System of the research.

## II. RELATED WORKS

Most of the algorithms for detecting text in the literature can be divided into methods based on space-based and connectivity (CC). The regional approach uses a sliding window scheme, which is basically a powerful method. The second way is to localize individual symbols using local parameters of the image (intensity, area, color, gradient, etc.). The selection of a function also plays a decisive role in the image positioning process. The main goal of object extraction is to maximize recognition speed. Many researchers have made research related to this but no technique is almost perfect and they found need to improve the work in more areas at different instants and techniques. Most of the work is found on Machine Printed document Images and



Figure 1: Myanmar basic symbols

#### IV. PROPOSED SYSTEM

In this proposed system, the following four main modules are mainly performed:

##### A. Text Information Extraction

Text extraction is critical and essential step since the efficiency of the OCR depends upon the accuracy of the text extraction system. In the text extraction step, RGB color enhancement is firstly processed by finding new RGB values using (1, 2 and 3).

$$\text{New\_R} = \text{OR} + \text{round}(\text{Old\_R} * 0.8) \quad (1)$$

$$\text{New\_G} = \text{OG} + \text{round}(\text{Old\_G} * 0.8) \quad (2)$$

$$\text{New\_B} = \text{OB} + \text{round}(\text{Old\_B} * 0.8) \quad (3)$$

Where, NR= new red value, NG=new green value, NB=new blue value, OR = original red value, OG= original green value and OB= original blue value.

After color enhancement, RGB image is converted into binary image by filling '1' in the places where all RGB values are greater than color threshold value 215 and filling '0' in other places. The connected components (CCs) in the binary image may be too large and/or too small connected components. Since these components, obviously, are not text, they are required to be deleted. In this system, the features such as height, width and aspect ratio of detected object are used to filter non-text CCs. And then, the non-text objects around the signboard boundary are removed by finding center location of the signboard image. The remaining too small non-text CCs of this stage are further filtered based on the object region area threshold. The CCs less than object region area threshold values are discard and CCs greater than region area threshold values are dilated for grouping text. After grouping text regions, the remaining non-text regions are removed based on region area threshold of grouping text region. The implementations of various text extraction are shown in Figure 2.



Figure 2 : Step by step text extraction

##### B. Segmentation

In this system, horizontal projection profile is used for line segmentation and vertical projection profile is used for vertically connected characters. The generated characters from vertical projection profile may have 1 to 5 characters which may be or may not be touching. Therefore, bounding box method is also used to segment non-touching character resulted in previous vertical projection profile until achieving individual character.

The segmentation steps of the horizontal projection profile are as follows:

- 1) Count the black pixel in each row of the image.
- 2) Find the rows containing no white pixel.
- 3) Crop each text-line.
- 4) Input the cropping text-line image to vertical projection profile step.

The character segmentation steps of vertical projection profile and bounding box method are as follow:

- 1) Count the black pixel in each column of the image.
- 2) Find the columns that containing no white pixel.
- 3) Crop each vertically connected character
- 4) Extract the individual connected character from the resulted character of step 3 by using connected component labeling with bounding box method.

##### C. Feature Extraction

The feature extraction is described about the characteristics of an image. It is one of the most important steps for any recognition system, since the classification/recognition accuracy is depending on the features. Before any other extraction of features, the segmented input character is preprocessed by resizing and thinning. In the feature extraction phase, normalization eight direction chain code features and pixel count features are extracted from the blocking image. Eight direction chain codes is one of the shape representations which are used to represent a boundary by a connected sequence of straight line segments.

The direction of each segment is coded by using a numbering scheme as shown in Figure 3. Chain codes based from this scheme are known as Freeman chain codes.

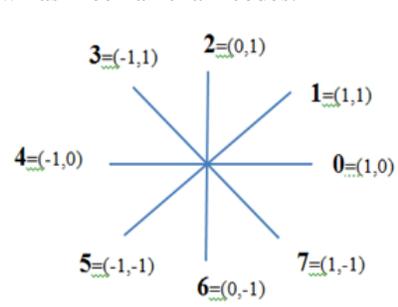


Figure 3 : Eight-direction chain code illustration

The chain code can be generated by following the object boundary clockwise and assigning a direction to the line segment connecting each pair of pixels. The chain code method select the topmost value in the leftmost column as starting pixel of the character object boundary shown in right side of Figure 4. The goal is to find the next pixel on the boundary image. Depending

on what it is, a numeric code from 0 to 7 is assigned as chain code. Repeat the process of positioning the next border pixel and assign the code until there is no remaining unvisited pixel and we return to the initial border pixel. Therefore, almost boundary pixels are visited twice to reach initial starting point.

Proposed feature extraction steps are described as follow:

Step 1: Frequency features of chain code directions are extracted on the input character as shown in left side of Figure 4.

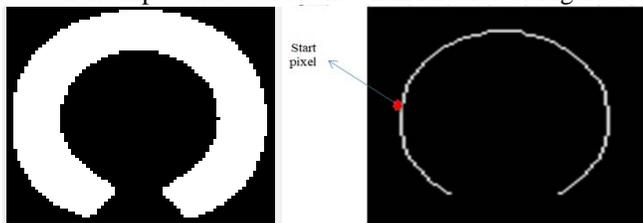


Figure 4 : Original character (left) and preprocessed character (right) of "o" 'gange"

The traversing of chain code directions on the input character is shown in figure 5.

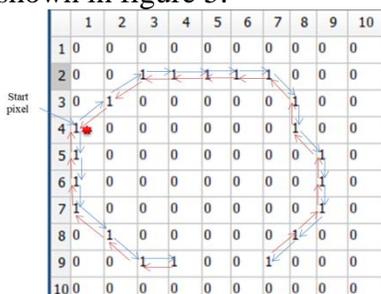


Figure 5 : 10 Traversing example of 10x10 character 'gange' image with binary values

In the above figure 5, blue arrow is first time traversing direction and red arrow is second time traversing direction. According to Figure. 10, row\_no and column\_no of visited pixels are described as follow:

row\_no=[4,3,2,2,2,2,3,4,5,6,7,8,9,8,7,6,5,4,3,2,2,2,2,3,4,5,6,7,8,9,9,8,7,6,5,4]

column\_no=[1,2,3,4,5,6,7,8,8,9,9,9,8,7,8,9,9,8,8,7,6,5,4,3,2,1,1,1,1,1,2,3,4,3,2,1,1,1,1]

In this example, the start pixel exist at row\_no = 4 and column\_no = 1 and second visited pixel is at row\_no = 3 and column\_no = 2, third visited pixel is row\_no = 2 and column\_no = 3, and so on.

Based on these row\_no and column\_no of visited pixels, x value and y value are generated as follow:

$x = \text{column\_no}(\text{next\_pixel}) - \text{column\_no}(\text{previous\_pixel})$

$y = \text{row\_no}(\text{previous\_pixel}) - \text{row\_no}(\text{next\_pixel})$

Chain code direction numbers are assigned based on the following x and y conditions:

```

if x==1&y==0
    Code = 0;
elseif x==1 &y==1
    Code = 1;
elseif x==0&y==1
    Code = 2;
elseif x==-1&y==1
    Code = 3;
elseif x==-1&y==0
    Code = 4;
elseif x==-1&y==-1
    Code = 5;
elseif x==0&y==-1
    Code = 6;
elseif x==1&y==-1
    Code = 7;
end
    
```

```

Code = 3;
elseif x==-1&y==0
    Code = 4;
elseif x==-1&y==-1
    Code = 5;
elseif x==0&y==-1
    Code = 6;
elseif x==1&y==-1
    Code = 7;
end
    
```

The following chain codes are extracted according to the x values and y values of this example and the frequencies of chain code direction results are shown in TABLE I.

Code = [1 1 0 0 0 0 7 6 7 6 6 5 5  
1 1 2 2 3 2 3 4 4 4 4 5 5 6  
6 6 7 7 0 4 3 3 2 2 2]

Table I. Frequency of eight chain code directions

Direction	0	1	2	3	4	5	6	7
Frequency	5	4	6	4	5	4	6	4

Step 2: The input character image is divided into N x N blocks (this paper presents 4x4 blocks) shown in Figure 6.

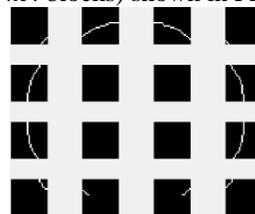


Figure 6 : 4x4 blocks character image

- Frequency features of 8 chain code directions [3] on each of 4x4 blocks character by performing as the processes of first step and therefore 8xNxN (N=4) features are extracted.
- The total number of visited directions on each of NxN blocks is extracted by using (4) and therefore 16 features are extracted.

$$B_n = \sum_{i=0}^7 F(i) \tag{4}$$

Note that,  $B_n$  = Total frequency of eight directions on Block n of character, where n= 1, 2, 3, ..., N x N (In this paper N is assigned 4).

- White pixel (binary value 1) density features on each of above 4x4 blocks image are extracted using equation (5). In this step, 16 features are extracted from 16 blocks.

$$W_n = \sum_{r=1}^{100/N} \sum_{c=1}^{100/N} x_{r,c} \tag{5}$$

Where,  $W_n$  be sum of pixel values in block n, n=1, 2, 3, ..., 16 (if N=4).

$x_{r,c}$  be pixel value in row r, column c of block n.

Step 3: the input character is divided into Nx1 blocks character image and 1xN blocks character image shown in Figure 7(a) and (b) using (6 and 7).

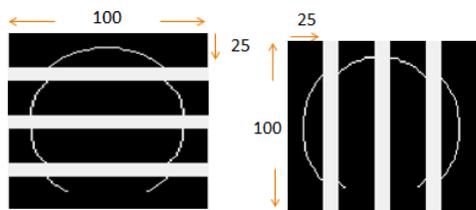


Figure 7 : (a) 4x1 blocks character image and (b) 1x4 blocks character image

$$R_i = \sum_{r=1}^{100/N} \sum_{c=1}^{100} x_{r,c} \quad (6)$$

$$C_i = \sum_{r=1}^{100} \sum_{c=1}^{100/N} x_{r,c} \quad (7)$$

Where,  $R_i$  be the sum of pixel values in horizontal block  $i$ .  
 $C_i$  be the sum of pixel values in vertical block  $i$   $x_{r,c}$  be the pixel value in row  $r$  and column  $c$ .

Step 4: Number of segments in upper block and lower block are extracted by dividing the character image into horizontally 2 x 1 blocks shown in Figure 8.

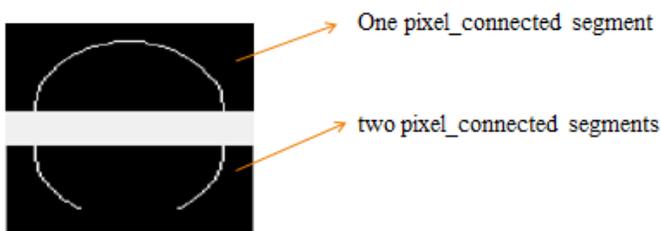


Figure 8 : 2x1 blocks character image

According to the above feature extraction steps, six feature sets are identified and analysis the recognition accuracy resulted from using each feature set for  $N \times N$  blocks ( $N = 4$ ).

- Feature\_Set\_1 includes features from step 1, 2(c), 3, 4 and aspect ratio.
- Feature\_Set\_2 includes features from step 1, 2(b, c), 3, 4 and aspect ratio.
- Feature\_Set\_3 includes features from step 1 and 2(a).
- Feature\_Set\_4 includes features from step 1 and 2(a, b).
- Feature\_Set\_5 includes features from step 1, 2(a, c), 3, 4 and aspect ratio.
- Feature\_Set\_6 includes features from step 1, 2, 3, 4 and aspect ratio.

Number of features included in the feature sets is different according to the divided number of  $N \times N$  blocks as shown in TABLE II.

Table II. Different number of features according to different numbers of blocking

Feature_Set Type	No of features on 3x3 blocks	No of features on 4x4 blocks	No of features on 5x5 blocks
Feature_Set_1	26 features	38features	46 features
Feature_Set_2	35features	51features	71features
Feature_Set_3	83features	139features	211features
Feature_Set_4	92features	155features	236features

Feature_Set_5	98features	163features	246features
Feature_Set_6	107features	<b>179 features</b>	271features

#### D. Classification

Characters are recognized by matching the features of input character with the features of all 343 characters that are already stored in the database. The distance values between tested character and the characters trained in the clustered group are calculated using Euclidean distance equation (8). The minimum distance value is selected and returns the position of that value.

$$dist((x,y), (a,b)) = \sqrt{(x-a)^2 + (y-b)^2} \quad (8)$$

#### V. EXPERIMENTAL RESULTS

In currently experiment, 343 Myanmar Zawgyi-One font characters that contain isolated characters and 2 to 5 connected component characters are trained. In this system, 3283 objects are extracted from 150 warning text signboards in current time. This system is investigated by KNN classifier, SVM classifier and feature based approach of template matching method using various blocking and various features on 3283 objects. The character classification performances are shown in TABLE III and VI.

Table III. Recognition accuracy of various types of feature sets on various blocking

Number of extracted objects	Feature_Set_Type	Recognition accuracy on 3 x 3 blocks	Recognition accuracy on 4 x 4 blocks	Recognition accuracy on 5 x 5 blocks
3283	Feature_Set_1	(66.16%)	(72.55%)	(72.46%)
3283	Feature_Set_2	(66.07%)	(74.66%)	(72.74%)
3283	Feature_Set_3	(66.28%)	(69.08%)	(64.88%)
3283	Feature_Set_4	(67.10%)	(79.89%)	(68.96%)
3283	Feature_Set_5	<b>(73.44%)</b>	(75.60%)	<b>(73.8%)</b>
3283	Feature_Set_6	(71.06%)	<b>(75.63%)</b>	(72.89%)

Table IV. Character classification performances using various classification methods 100x100 resized image, 4 x 4 blocking and feature\_set\_6

No of Image	Total Extracted objects	Fine KNN	Medium SVM	Area based matching	Features based matching
150	3283	(67.1%)	67.1%	64.31%	75.63%

#### VI. ERROR ANALYSIS

There are a few limitations in this system such as:

1. Since Myanmar characters on the natural warning signboard images are various styles and various size, the connected characters or words can not be segmented into individual characters. Therefore, we have to consider the connected word samples in the training

character dataset for classifying the connected words from the warning text images.

- The Myanmar compound characters on the warning signboard images may be often touching or non-touching and they are handwritten styles. Therefore, if the basic character and extended characters in the compound word were touching as shown in Figure 9, the character segmentation system will not further segment that compound word and if not, the system will further segment that compound word as shown in Figure 10. Therefore, this system identifies the number of final segmented characters as the number of characters.



Figure 9 : Touching formation of basic character and extended character (connected compound characters)

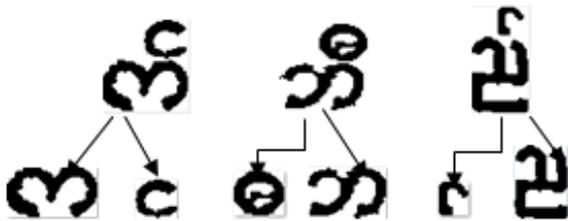


Figure 10 : Non-touching formation of basic character and extended character (non-connected compound characters)

## VII. CONCLUSION

The proposed system is investigated with dynamic blocking features, normalization chain code features and various classification methods. Among them, features based approach of template matching method is the most suitable method for this system and achieves 75.63% on 3283 extracted objects of 150 warning signboard images. Since the proposed features are based on pixels, this system can also be used in the character recognition system of any scripts.

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# The Arrangement of Universal Design Implementation in The Indonesia Disability Regulation and International Documents

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DOI: 10.29322/IJSRP.8.8.2018.p8034

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8034>

**Abstract-** The concept of universal design has been known in the engineering environment, especially Department of Architecture. It is an fundamental element to provide an accessible design for all including persons with disabilities. Therefore, necessary for us to review it in both of the national legislation, and international documents.

Through the literature study, it was found that the concept of Universal Design has not been regulated in Indonesian legislation yet, although international documents such as the Convention on the rights of Persons with Disabilities and several other countries have listed it. Finally, this paper recommends that the government should add the concept in disability regulation under the Indonesian disability legislation in order to provide guidance on accessibility for persons with disabilities.

**Index Terms-** Accessibility, disability legislation, Persons with Disabilities, and Universal Design.

## I. INTRODUCTION

Since 2015, the author was invited by the Department of Architecture, Faculty of Engineering, Diponegoro University as visiting lecturer concerning Universal Design Subject. The background of these activities were the awareness of the lecturers within the Faculty of Engineering, especially the Department of Architecture that so far they do not understand yet regarding the persons with disabilities needs as users of their designing. Consequently, their estimation of persons with disabilities needs are very different with the reality.

As a disability organizer and activist, the writer was expected to inform regarding the Indonesian marginal citizen and their needs to access to the building and its environment. It is very valuable in order to offer the accessible design of buildings and environments for various backgrounds.

In order to realize the accessibility, it is necessary to provide designing in the form of building design and environment based on the concept of universal design. Nowadays, the concept was reviewed by engineering scholars especially the Department of Architecture, Faculty of Engineering, Diponegoro University from a technical point of view. Certainly, it is made accessible design for various society. This is reinforced after searching in e-journal.undip.ac.id. There were two journals, that both of them review the universal design based on technical point of view. The two journals are, "*Penerapan Penyelesaian Universal Design Pada Renovasi Bangunan Gedung Spesifik (Ruang Terapi Ablasi) Studi Kasus RSUP Dr. Kariadi Semarang*" by Sri Hartuti Wahyuningrum and Bharoto and "A Review of Universal Design on Eldery House Design Development -Case South Korea" by Bangun Harsritanto.

Nowadays, universal design to animating engineering knowledge especially design, but also education. One of article on universal design in the education field, was written by Kenneth Lloyd Reimer, Ph.D., a lecturer Faculty of Education, University of Winnipeg, Canada. In one of his books which was published on May 31, 2017, entitled Universal Design and the Novel Study, says, "Although Universal Design (UD) was initially an architectural construct, the term is now used in a wide range of disciplines including education. Proponents believe that teachers trained in UD will be better equipped to meet the needs of the broadest range of learners through flexible curricular materials and activities".

Thus there has been no studying universal design in terms of government regulations of it. Because the author is a disability activist and has education background on Law, therefore interest in to review the concept from a legal point of view, especially its regulation on disability Indonesia regulation and international documents

## II. RESEARCH ELABORATION

This article was written through literacy study, because researcher read several literatures to find the essential legislation for universal design to be added in disability regulation

## III. RESULT

### A. Definition of Persons with Disabilities and Universal Design

Based on the Indonesian Dictionary on line, the notion of the word Person is "a person who bears (suffers) something". While the word Disability is, first, "circumstances (such as illness or injury) that damage or limit one's mental and physical ability" and secondly, "circumstances are incapable of doing things in the usual way". However, there is no meaning of the combined word of persons with disabilities in the Dictionary.

According to Dr. Didi Tarsidi, the term "Disability" is a substitute for the term handicap. In his own blog, he said that, on 29 March to 1 April 2010 the Ministry of Social Affairs held a meeting for composing the ratification of the Convention on Rights of Persons with Disabilities. The meeting was attended by 30 participants representing various agencies / organizations including the Ministry of Foreign Affairs, the Ministry of Justice and Human Rights, the Ministry of Women Empowerment and Child Protection, the Ministry of Manpower, the Ministry of Social Affairs, the National Commission of Human Rights, Disability Organizations, and Disability Awareness NGOs. The participants agreed to change the term of Persons with handicap to Persons with Disabilities. Their reasons were , first, term "persons with handicap" tentatively has a negative meaning, so it has a very wide impact, especially in public policy substance which marginalize them; secondly, the term Persons with handicap in Indonesian perspective has negative meaning and is not in line with the main principles of human rights as well as contrary to the noble values of our nation that uphold the dignity of human beings; third, the term persons with disabilities has a broader meaning and contains inclusive values in accordance with the spirit of legal reform in Indonesia, and in line with the substance of the Convention on the Rights of Persons with Disabilities (CRPD). Although it has been agreed to use the term persons with disabilities, in Indonesia there are other terms. These terms include persons with special needs, difable (different ability), and disabled persons. Based on the reasons for compliance with applicable laws and regulations, the authors will use the term Persons with Disabilities, as contained in Law No. 8 of 2016 concerning Persons with disabilities.

Article 2 United Nations Convention on the Rights of Persons with Disabilities states that persons with disabilities is "Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others". Next, it was adopted by Article 1.1 Law No. 8 of 2016 on Persons with Disabilities. It states in Indonesian, that "*Penyandang Disabilitas adalah setiap orang yang menyandang keterbatasan fisik, intelektual, mental, dan/atau sensorik dalam jangka waktu lama yang dalam berinteraksi dengan lingkungan dapat mengalami hambatan dan kesulitan untuk berpartisipasi secara penuh dan efektif dengan warga negara lainnya berdasarkan kesamaan hak*". Or in English is "persons with disabilities is "Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others". Based on the definition, we can form it into several elements. These elements are: first, impairments on mental, intellectual or sensory; second, in interaction with various barriers may hinder their full and effective participation in society; finally, on an equal basis.

Constraints or obstacles when accessing the environment are further reduced by means of designs that are accessible to persons with disabilities or not. The concept of such design is known as Universal Design, for example, the building provides a ramp ramp besides the ladder so that wheelchair users can access, fire alarm sign has warning sign besides noise also lights and vibration so that the disabled can understand the existence of danger, and mobile phones and computers provide a visual to speech converter application so that people with disabilities can also use it.

According to the dictionary, the meaning of universal design is "A style of architecture and design whose object is to make buildings and facilities easy to access and use by all people, including the young, the old, and the disabled". On 1997, several architectures from North Carolina State University, USA define Universal Design as "The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design". Then the United Nations Convention on, the Rights of Persons with Disability (UNCRPD), as international convention for persons with disabilities, in the Article 2 defines Universal Design as "Universal Design" means the design of products, environments, programs and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design".

Both of the definition North Carolina State University and United nations, are similar, they declare Universal Design as a design that everyone can be access without specialized design. The difference is the definition from United Nations more widely than other,

because including the design of products, environments, programs and services, whereas, definition North Carolina State University just covered the design of products and environments.

Based on the definition above, we know that, the universal design does not only for disable persons. Instead, its result will more useful, because its gives positive impact to disabilities and non-disabilities. It is similar with the statement of Joan M. McGuire, Sally S. Scott, and Stan F. Shaw, that, "A common observation about universally designed products and environments is that they result in a more functional environment or product for everyone".

In order to standardize the designs based on universal design, several scientists from North Carolina State University USA who consist of Bettye Rose Connell, Mike Jones, Ron Mace, Jim Mueller, Abir Mullick, Elaine Ostroff, Jon Sanford, Ed Steinfeld, Molly Story, and Gregg Vanderheiden formulated the general principals of Universal Design. The principals consist of 7 principals as indicator for design products have comply with universal design or not. Previously, universal design was limited for products and environment, but nowadays it can be implemented on programs and services.

First, "Equitable Use", that the design results should be useful and can be utilized by people with different background abilities. Second, "Flexibility in Use", that the results of the design can be exploited by various methods or ways. Third, "Simple and Intuitive Use", that the design is easy to understand even by the educated and experienced minimal. Fourth, "Perceptible Information", that those who have weak sensory abilities can capture and understand the information conveyed through the product of the design. Fifth, "Tolerance for Error", that the resulting design is able to minimize the damage and losses that may arise as a result of undesirable actions. Sixth, "Low Physical Effort", that for users of the design does not need to use excessive effort in utilizing it. Seventh, "Size and Space for Approach and Use", that user with various postures can use the results of the design.

Beside Universal Design, "inclusive design" is used by researchers from Cristian Petra University, Surabaya. They consisted of Joyce Marcella Laurens and Gunawan Tanuwidjaja. "inclusive design is defined as "the design of products mainstream and/or services which can be accessed by as much as possible, without distinguish based on age and ability, naturally, and without special design". The other terms that similar with universal design are non handicapping environment, design for all, accessible design, respect on human design, and design for diversity. Based on the terminology used by the United nations convention on the rights of Persons with Disabilities, hence the author prefer to use universal design.

#### B. The Arrangement of Universal Design on National Disability Law

If accessibility is manifested properly, then the potential of people with disabilities will be well channeled. On the other hand, the lack of accessibility will affect people with disability to the community burden. This is in accordance with the words of Monthian Bunthan, a member of the Committee on the Rights of Persons with Disabilities at the meeting of The 3rd AICHR (ASEAN Intergovernmental Commission on Human Rights) June 19-21, 2017 in Thailand. On the occasion, he underlined, "The participants highlighted," The participants were notified of the UNCRPD. However, social stigma surrounding persons with disabilities adds barriers to the realization of their right. Moreover, the lack of access to infrastructure, information and transportation hinders persons with disabilities from being contributing members of the economy through entrepreneurship".

The concept of universal design is a tool that means a lot to realize accessibility. The reason, the condition that has hampered the role of people with disabilities in social life, will be accessible through the concept of universal design thinking. This is because the entire design of products, environments, programs and services will be made accessible to everyone including disability. An entity called DO-IT, University of Washington and aims to empower disability to convey that, "When designers apply universal design principles, their products and services meet the needs of potential users with a variety of characteristics."

Because of the tremendous benefits for people with disabilities, it is natural that designers of products, environments, programs and services are encouraged to produce designs that meet Universal Design concepts that can be used by everyone. Such encouragement can be various things, including the existence of policies and regulations that guide the design criteria that fit the concept.

However, the laws and regulations on disability in Indonesia do not arrange regarding universal design yet. Law No. 8 of 2016 on Persons with Disabilities does not cover it. As for things that have been arranged yet. The law just provides accessibility and reasonable accommodation. Article 18 of Law Number 8 of 2016 provides guarantees on the fulfillment of accessibility rights for persons with disabilities that include the right to accessibility in order to utilize public facilities and the right to obtain adequate accommodation as a form of accessibility for individuals. According to the law, the definition of reasonable Accommodation in Article 1.9, is "appropriate modification and adjustment and is necessary to ensure the enjoyment or implementation of all human rights and fundamental freedoms for Persons with Disabilities based on equality" and Accessibility in Article 1.8 is "the ease provided to Persons with Disabilities in order to realize the Equal Opportunity".

### C. Arrangement the Concept of Universal Design in International Documents

Then, we should refer to The United Nations Convention on the Rights of Persons with Disability (CRPD) as reference for globe regulations relating to disability.

Article 2 CRPD declares that, reasonable accommodation is “necessary and appropriate modification and adjustments not imposing a disproportionate or undue burden, where needed in a particular case, to ensure to persons with disabilities the enjoyment or exercise on an equal basis with others of all human rights and fundamental freedoms”. On the other side, Universal Design is “the design of products, environments, programs and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design”. Then, accessibility is arrange in Article 9.1 that mandates “to enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems, and to other facilities and services open or provided to the public, both in urban and in rural areas “.

The Convention has been ratified by the Government of the Republic of Indonesia through Act No. 19 of 2011. Since the ratification, our country have been definitively bound to the United Nations Convention on the Rights of Persons with Disabilities. However, when Law No. 19 of 2011 was implemented through Law No. 8 of 2016 on Persons with Disabilities, the arrangement of Universal Design is not included, although Universal Design is an essential element of accessibility.

The arrangement of universal design is the step of positioning the "law as a tool or means of conducting social engineering (as a tool of social engineering). Unlucky, the Indonesian regulations that arrange the concept of universal design is the Minister of Public Works and People's Housing No. 14 / PRT / M / 2017 on Building Ease Requirements. Thus, the universal design is limited just for building and environment, whereas Convention on the Rights of Persons with disabilities mandats to obtain accessibility for disabilities on products, environment, services, and programs.

### IV. CONCLUSION

Based on the above description, it was revealed that the universal design has not been included in the regulations of Indonesian disability legislation. Law No. 8 of 2016 on persons with disabilities as currently law to regulate the protection and fulfillment of the rights of persons with disabilities has not included the subject. This condition has the potential border to provide accessibility as one of the rights of persons with disabilities.

Finally, author suggest to add the concept of universal design into regulation under the law of disability as guiding to provide accessibility for persons with disability.

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# Backpropagation Neural Network Experiment on Human Face Recognition

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DOI: 10.29322/IJSRP.8.8.2018.p8035

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8035>

**Abstract-** In Artificial Neural Network (ANN) experiments, the system of face recognition consists of image preprocessing, image segmentation, detection and feature extraction, localization and normalization and ANN. First, the process of preprocessing for human face is an improvement of the image data and image segmentation is the first step of image analysis that seeks to simplify an image to its basic component elements or objects. Then, the detection and feature extraction is the process of local feature and global feature for human face to extract features in localization and normalization. Finally, a back-propagation ANN is used and trained to recognize the actual human face images.

**Index Terms-** image preprocessing, image segmentation, detection and feature extraction, backpropagation ANN

## I. INTRODUCTION

The human face recognition is solved by using many methods. The images of human faces are made for many orientations and positions due to human faces position and the camera. Due to light source, the background and the appearance of human faces are dependent on the camera. There are important characteristics in the human faces and they are skin color, eye, mouth, nose, hair and other things. In the process of preprocessing, the human face images are preprocessed with standard algorithms to improve the overall brightness and contrast in the face images from lighting or camera to reduce variation. The image segmentation is the first step of image analysis that seeks to approach for edge detection, thresholding and feature extraction. In detection and feature extraction, the local feature is the information of eye, nose, and mouth that easily affected by irrelevant information and the global feature is to extract feature, such as face, from the whole image. In this research, the global feature extraction is used for human face.

## III. SURVEY OF RESEARCH

Now it is the time to articulate the research work with ideas gathered in above steps by adopting any of below suitable approaches:

### A. Main Method

First, the face view is seen from preprocessing and the face pixel view is performed from image segmentation. Then, the face pixel feature from feature extraction and localization is extracted.

For localization and normalization, the local view method for eigenface (use of a machine learning) approaches to deal with scaling variation. The image processing and computer vision have investigated the number of issues related to face recognition by human beings and machines. Face recognition is the identification of individuals from images of human faces by using a stored database of faces labeled with people's identities. This task is complex and is decomposed into the smaller steps of detection of faces in a cluttered background, localization of human faces followed by extraction of features from the face regions and finally recognition and verification is used by neural network.

Neural network is a parallel processing structure that has general large number of processors and many interconnections between them. The main characteristics of neural networks are to learn complex nonlinear input-output relationships, use sequential training procedures, and adapt themselves to the data. The research on human face recognition is important due to its application for security, information and observation.

## II. SURVEY OF RESEARCH ON HUMAN FACE

The algorithm in human face recognition mainly consists of five procedures and they are (i) capture the image of human face from camera, (ii) preprocessing of human face for face view, (iii) segmentation of human face for face pixel view, (iv) feature extraction and localization of human face for face pixel feature and face feature location, and (v) ANN for target face classification.

Finally, the sample information from face feature location is trained for target face classification at neural network.

### B. Systems for human face recognition

The general work for human face recognition is to implement face image recognition system. For pattern recognition techniques, there are three methods to perform the human face recognition. These methods are the principal component analysis,

the back-propagation neural network and counter propagation neural network. In this research, the back-propagation neural network is used for human face recognition

#### IV. FACE IMAGE PREPROCESSING AND SEGMENTATION

The image preprocessing stage is the most important part of the recognition system. This means that the remainder of recognition task is straightforward when the preprocessing is successfully performed. For face image preprocessing, human face photos are taken from CCD or digital camera and the shape of human face is scaled so that it has the same areas. The human face shapes must also be aligned for area of overlap to a significant metric.

The image segmentation is the process of the face image to subdivide an face image into its constituent regions or objects. For face image, segmentation algorithms are generally based on one of two basic properties of image intensity values. These two basic properties are discontinuity and similarity where the first category is to partition an image based on abrupt changes in intensity such as edges in an image and the second category is based on partitioning an image into regions that are similar according to a set predefined criterion. In this research, the first category is used for edges.

##### A. Lighting compensation and skin tone color

In face image preprocessing, the appearance of the skin tone color from CCD or digital camera can change due to different lighting conditions and the lighting compensation technique uses “reference white” to normalize the color appearance. The Figure (1) shows the background and human face and Figure (2) is shown to capture the face image by camera.



Figure (1) the background and human faces



Figure (2) the capture of human face

##### B. Color models

The color is represented by the following three components: (1) a component that measures the grayscale, or luminance, from to white, (2) a component that measures a “red to green” component and (3) a component that measures a “yellow to blue” component. However, there are other color spaces whose use in some applications. These colors include the NTSC, YCbCr, HSV, CMY, CMYK, and HIS color spaces. The conversion functions provide from RGB to the NTSC, YCbCr, HSV and CMY color spaces, and back. Several color models have been defined for the purpose of measuring or reproducing color.

##### C. Color transformation for human face

The color image processing of human face has three principal areas. They are color transformations, spatial processing of individual color planes and color vector processing. The color transformations techniques deals with processing the pixels of each color plane based strictly on their values and not on their spatial coordinates.

The techniques are based on processing the color components of a color image or intensity component of a monochrome image within the context of a single color model. For color images, the transformations of the form is

$$s_i = T_i(r_i), i = 1, 2, \dots, n$$

where  $r_i$  and  $s_i$  are the color components of the input and output images,  $n$  is the dimension of the color space of  $r_i$  and the  $T_i$  are referred to as full-color transformation (or mapping) functions.

The gray scale transformations of the human face from color image are independent of the gray level content of the image being transformed. In Figure (3) is shown as the gray scale transformation of face image.

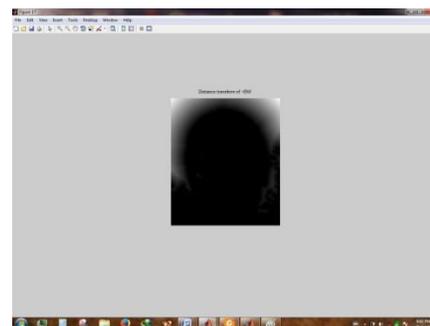


Figure (3) the gray scale transformation of face image

##### D. Human Face Segmentation

Face segmentation is the process of partitioning a face into meaningful regions, in simple term it is to isolate a face from its background. The general approaches for segmentation are edge detection, thresholding, and relaxation. The morphological system is used to segment the human face. Morphology relates to the structure or form of face. The two principal morphological operations are dilation and erosion. These operations are customized for an application by the proper selection of the structuring element, which determines exactly how the face will be dilated or eroded.

Dilation allows objects to expand, thus potentially filling in small holes and connecting disjoint objects. The dilation process is

performed by laying the structuring element on the image and sliding it across the image in a manner similar to convolution. The difference is performed in the operation of a sequence steps. In dilation process, there is no change and move to the next pixel when the origin of the structuring element coincides with a "0" in the image. But, it performs the "OR" logic operation on all pixels within the structuring element when the origin of the structuring element coincides with a "1" in the image. In Figure (4) is shown as the dilation of face image.

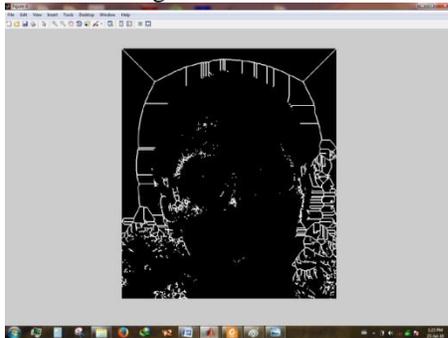


Figure (4) the dilation of face image

Erosion shrinks faces by etching away (eroding) its boundaries. The erosion process is similar to dilation, but the structuring or moving element turns to "0" rather to '1". As before, slide the structuring element across the image and then follow two steps. In first step, there is no change and move to the next pixel if the origin of the structuring element coincides with a "0" in the image. In second step, it changes the "1" pixel in the image to "0" if the origin of the structuring element coincides with a "1" in the image and any of the "1" pixels in the structuring element extend beyond the face ("1" pixels) in the image. In Figure (5) is shown as the erosion of face image.

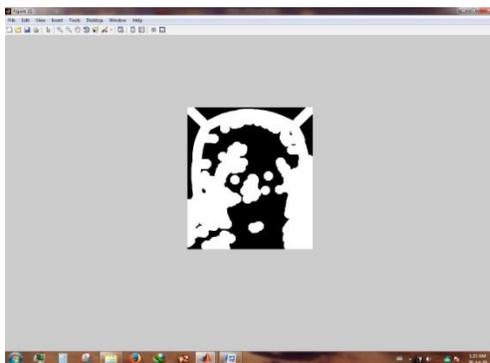


Figure (5) the erosion of face image

## V. PATTERN CLASSIFICATION TECHNIQUES

There are many attempts proposed for recognition of human face and others objects in different areas and different techniques. There are three basic approaches. These approaches are (1) statistical pattern classification, (2) syntactic pattern classification and (3) artificial neural networks. The statistical approach depends on defining a set of decision rules based on standard statistical theory and the syntactic approach is to decompose a complex image pattern into a hierarchy of interrelated sub-patterns. But the neural network approach seeks

to use artificial neurons that constructed from electronic devices, to form large interconnected networks. The main characteristics of neural networks are that have the ability to learn complex nonlinear input-output relationships, use sequential training procedures and adapt themselves to the data. However, the backpropagation neural networks are the useful technique for face recognition. The various architectures have been used with respect on the number of hidden layers and the number of neurons.

### A. Backpropagation neural network

Backpropagation is the generalization of the Widrow-Hoff learning rule to multiple-layer networks and nonlinear differentiable transfer functions. Input vectors and the corresponding target vectors are used to train a network until it approximates a function, associate input vectors with specific output vectors, or classify input vectors in an appropriate way as defined by the face image. Networks with biases, a sigmoid layer, and a linear output layer are capable of approximating any function with a finite number of discontinuities.

There are many variations of the backpropagation algorithm. The simplest implementation of backpropagation learning updates the network weights and biases in the direction in which the performance function decreases most rapidly, the negative of the gradient. One iteration of this algorithm can be written

$$x_{k+1} = x_k - \alpha_k g_k$$

where  $x_k$  is a vector weights and biases,  $g_k$  is the current gradient, and  $\alpha_k$  is the learning rate.

The structure of the backpropagation network has multiple layers of neurons with nonlinear transfer functions allow the network to learn nonlinear and relationships between input and output vectors are defined by log-sigmoid equation. Figure (6), Figure (7) and Figure (8) are shown to design the backpropagation network.

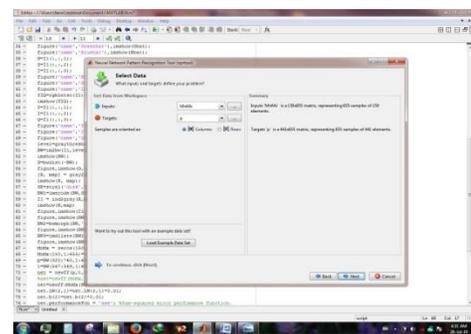


Figure (6) the selection of data

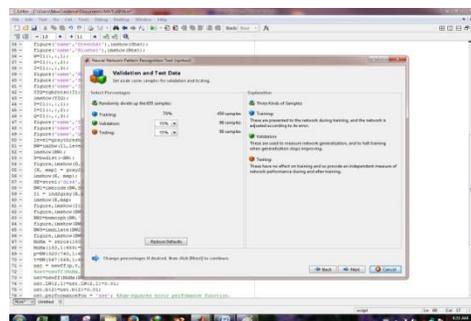


Figure (7) validation and test data

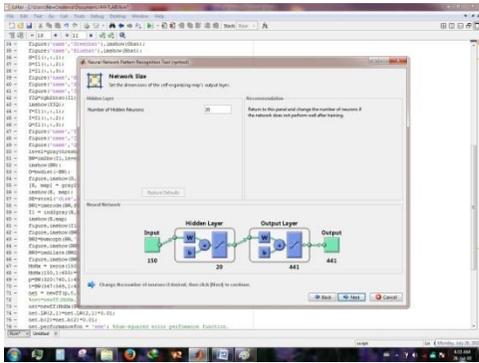


Figure (8) the neural network

Once the network weights and biases are initialized, the network is ready for training. The network can be trained for function approximation (nonlinear regression), pattern association, or pattern classification. The training process requires a set of examples of proper network behavior--network inputs  $p$  and target outputs  $t$ . During training the weights and biases of the network are iteratively adjusted to minimize the network performance function `net.performFcn`. The default performance function for feedforward networks is mean square error `mse`--the average squared error between the network outputs  $a$  and the target outputs  $t$ . Figure (9) is shown as the training network and Figure (10) is the results of network.

face recognition that determine the maturity of face recognition algorithms and have an independent means of comparing algorithms. And moreover, it is to recognize a person from an image containing the person's face, provided that another image of the same person exist in the system database. It is to apply an application area where computer vision research is being utilized in both military and commercial products. Some of the application areas include building security systems, verification of person identification documents, crowd surveillance systems, criminal purposes, and human computer interaction.

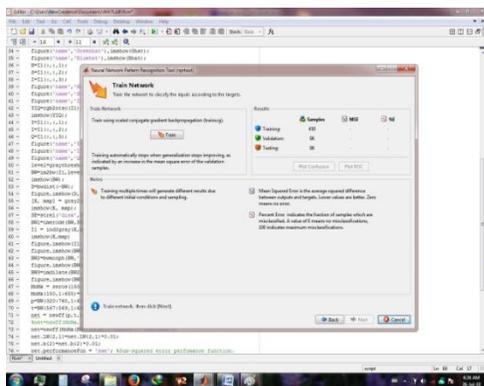


Figure (9) the training network

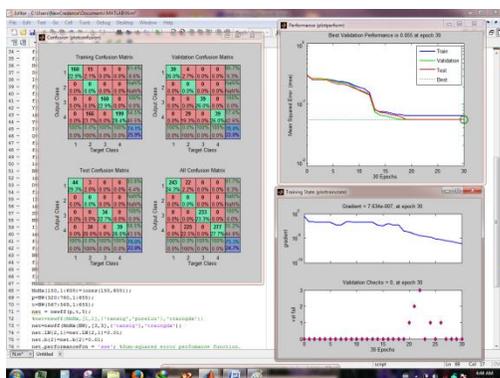


Figure (10) the results of network

## VI. CONCLUSION

The purpose of the research is to measure overall progress in

APPENDIX

```
CLEAR ALL;

CLOSE ALL;

I = IMREAD('C:\USERS\NEWCRENCE\DESKTOP\N.JPG');

IMSHOW(I);

I1=IMCROP(I,[1671.5 639.5 654 762]);

IMSHOW(I1);

[X, MAP] = GRAY2IND(I, 16);

IMSHOW(X, MAP);

H_IM = IMSHOW(I1);

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528.678100263852 564.915567282322]);

BW = CREATEMASK(E,H_IM);

I2=IMCROP(BW,[83.1846965699204 150.923482849604
528.678100263852 564.915567282322]);

IMSHOW(I2);

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IMSHOW(I1);

T=EYE(1);

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G=I(:,2);

B=I(:,3);

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FIGURE('NAME','GREEN'),IMSHOW(G);

FIGURE('NAME','BLUE'),IMSHOW(B);

YCbCr=RGB2YCbCr(I1);

IMSHOW(YCbCr);

Y=I1(:,1);

CB=I1(:,2);

CR=I1(:,3);

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FIGURE('NAME','Cb'),IMSHOW(Cb);

FIGURE('NAME','Cr'),IMSHOW(Cr);

RHAT=MEDFILT2(R,[5 5]);

GHAT=MEDFILT2(G,[5 5]);

BHAT=MEDFILT2(B,[5 5]);

FIGURE('NAME','REDHAT'),IMSHOW(RHAT);

FIGURE('NAME','GREENHAT'),IMSHOW(GHAT);

FIGURE('NAME','BLUEHAT'),IMSHOW(BHAT);

H=I1(:,1);

S=I1(:,2);

I=I1(:,3);

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FIGURE('NAME','SATURATION'),IMSHOW(S);

FIGURE('NAME','INTENSITY'),IMSHOW(I);

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IMSHOW(YIQ);

Y=I1(:,1);

I=I1(:,2);

Q=I1(:,3);

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FIGURE('NAME','I'),IMSHOW(I);

FIGURE('NAME','Q'),IMSHOW(Q);

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BW=IM2BW(I1,LEVEL);

IMSHOW(BW);

D=BWDIST(~BW);

FIGURE,IMSHOW(D,[]),TITLE('DISTANCE TRANSFORM OF ~BW');

SE=STREL('DISK',25);
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BW1=IMERODE(BW,SE);

FIGURE,IMSHOW(BW1);

BW2=BWMORPH(BW,'SKEL',INF);

FIGURE,IMSHOW(BW2);

BW3=IMDILATE(BW2,SE);

FIGURE,IMSHOW(BW3);

MNMX = ZEROS(150,655);

MNMX(150,1:655)=(ONES(150,655));

P=BW(320:760,1:655);

T=BW(567:569,1:655);

#### ACKNOWLEDGMENT

I wish to thank my partners for their encouragements and my family for their supports. And I also wish to thank to my former teachers for their helpful suggestion and constructive advice. I

would like to express deeply grateful to my partners at Department of Avionics, Myanmar Aerospace Engineering University, who helped directly or indirectly towards the completion of this work.

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# Conformity Analysis of Commercial Space Utilization as The Tourism-Supporting Activities: A Case Study at Sosrowijayan, Yogyakarta

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DOI: 10.29322/IJSRP.8.8.2018.p8036

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8036>

**Abstract-** Yogyakarta city is known for its tourist attraction as it also becomes the second tourism destination in Indonesia. One of the tourism development centre in Yogyakarta is Sosrowijayan Tourist Village. Sosrowijayan became a tourist attraction in Yogyakarta City, especially Malioboro and there are also many other accommodation and tourism-supporting activities found in Sosrowijayan roadside. The development of accommodation and tourism-supporting activities in Sosrowijayan led to a change in the utilization of space which was originally a settlement turned into commercial breakouts. This research aims to study the utilization of commercial space in Sosrowijayan as tourism-supporting activities and to understand the conformity of space utilization based on the perception of tourists. This study uses descriptive quantitative approach. Obtained data will be processed qualitatively by using quantitative descriptive analysis techniques, spatial analysis (overlay) and using qualitative variation index (IVK). The results of the analysis showed a comprehensive depiction of the commercial space utilization in Sosrowijayan and found that out of 14 indicators, there are 6 indicators that are met: strategic location, distance from city centre, travel time, accommodation, facilities and incurred costs with the final percentage of 43%. That means Sosrowijayan has not yet been functioned as a tourism-supporting area in Yogyakarta City.

**Keywords-** *Conformity, Space Utilization, Commercial Activities, Tourism-Supportings*

## I. INTRODUCTION

City is a non-agrarian spatial structure in a limited urban land area and serves as a centre of economic, social, cultural and governance activities (Sadyohutomo, 2009). As time goes by the city develops as a result of increased population growth, socioeconomic and cultural change. Physically the development of a city can be characterized by the increasingly dense land and complete urban facilities that support social and economic activities. In addition, the development of a city occurs because of the growth centres in the surrounding area.

Tourism is one of the catalysts that causes a city to grow. The impact of tourism on the city development is that it can accelerate economic growth, job creation, higher income, increase living standards and accelerate economic development (Suharso, 2009). Tourism is also one of the industries that is increasingly considered the fastest growth in the world (Ma, Hong, & Zhang, 2015). This led to the growth of tourism business in order to accommodate and support tourism needs (Pertiwi, 2013). According to Karyono in Suharso (2009), tourism is an activity undertaken by individuals or groups using the facilities, services and supporting factors provided by the government, private and local communities. This causes tourism to become one of the priority sectors in many developing countries (Mulyana, 2010). Tourism development could bring a positive and negative impact (Rivera, Croes, & Lee, 2016). The positive impact of tourism is on the social and economic enhancement of local communities (Damayanti, Scott, & Ruhanen, 2017). Whereas, the negative impacts of space utilization shifts are the emergence of new spaces for tourism activities (Boavida-Portugal, Rocha, & Ferreira, 2016).

One of the tourism development centres in Indonesia is located at Yogyakarta City (Utami & Haryanto, 2012). Yogyakarta city is part of the Yogyakarta Special Region which widely known for its cultural and educational centre and therefore become the second tourism destination in Indonesia. Yogyakarta city is not only visited by local tourists but also many foreign ones who seem to be attracted by distinctive culture lies within. Therefore, tourism is one of the potential sectors for Yogyakarta Special Region (Utami & Haryanto, 2012). One of the tourism areas in Yogyakarta that is experiencing rapid development is Sosrowijayan Area.

The Sosrowijayan area is strategically located near the centre of Yogyakarta City, close to Malioboro shopping mall and some other tourist attractions that make Sosrowijayan Area one of the tourism-supporting areas in town. Sosrowijayan area initially has the function of settlement but as time goes by it transforms into the centre of commercial activities. Residential area which shifted into the

commercial zone is a particularly frequent event that is supported by high market demand (Dinda Anditya Puteri & Haryanto, 2018). Commercial activity is a form of trading that includes retail trade activities and local scale services, regional scale shopping centres and entertainment areas, located not always in the downtown perimeter but have an enormous impact on the city's economic activity (Murti & Wijaya, 2013). The development of commercial activities in the Sosrowijayan Region cannot be separated from the history of Yogyakarta and the growth of commercial activity which starts from Kraton area, Malioboro Street to surrounding area such as Sosrowijayan (Haryanto, Soetomo, & Buchori, 2016). Also, Sosrowijayan developments occurred due to the high demand for certain goods and services needed to support the main activities of tourism. Commercial activities found in the Sosrowijayan are accommodation or lodging, food and beverage business, grocery store, bookstore and other tourism support such as vehicle rental, tours and travel, money changer and others related to tourism as it can be seen in Figure I.1.



Source: Field Observation and Google Streetview, 2018

**FIGURE 1.1**  
**COMMERCIAL ACTIVITIES IN SOSROWIJAYAN**

Based on the background and description above, the purpose of this research is to study the commercial space utilization as tourism-supporting activities and its conformity based on the perception of tourists. The research question is: **"Does the Functionality of Sosrowijayan Commercial Zone Already Suitable for Tourism-Supporting Activities, and Why?"**

## II. RESEARCH METHOD AND DATA

This study uses quantitative approaches. According to Sugiyono (2012), quantitative approaches are based on theories and are used to examine specific populations or samples, data collection using research instruments, quantitative/statistical data analysis with the purpose of testing the hypotheses set. Then, in the research process, the researchers are looking for facts related to the commercial space utilization as tourism-supporting activities. The variables to be used in this research are the utilization of commercial space (type of space utilization, number of available buildings, building functions, building density, commercial forms, commercial types, total commercial activities, distribution and commercial activity pattern), carrying capacity of the area, and commercial criteria as tourism-supporting activities (accessibility, amenities/infrastructure, and attractiveness). The sampling method used to collect data and information needed is purposive sampling, accidental sampling and proportionate stratified sampling.

The initial stage is purposive sampling to determine the sample of each identified population according to the purpose of commercial activity in Sosrowijayan. Furthermore, in determining the sample to be used is calculated using the Slovin formula Sugiyono (2012) as follows:

$$n = \frac{N}{Nd^2 + 1}$$

Description:

n: Total Sample

N: Total Commercial Activity Population

d: Degree of Significance with 10% accuracy and 90% confidence level

Based on Slovin formula with confidence level of 90% and error tolerance limit of 10%, from total population of 154 commercial activity, the sample size has been obtained equal to 60,6 which is rounded to 61 samples which will set to be the total respondent needed, followed by the Probability Sampling technique with proportionate stratified sampling. Sampling distributions will be provided as follows:

**Tabel II. 1**  
**Sampling Distributions**

No.	Commercial Types	Amount	Sample
1.	Hotel	16	6
2.	Inns	53	21
3.	Homestay	14	6
4.	Cafe	7	3
5.	Restaurants	12	5
6.	Travel Agents dan Vehicle Rentals	7	3
7.	Money Changer	2	1
8.	Stalls	35	14
9.	Salon/ Spa/ Massage	4	2
10.	Laundry	4	2
<b>TOTAL</b>		<b>154</b>	<b>61</b>

Source: Research Analysis, 2018

Furthermore, the number of tourists available in Sosrowijayan Area is not the same between weekdays, weekends or holidays. Therefore, an accidental sampling technique is needed with the respondents of whoever tourist presents or be available at that time. Then, after obtaining data regarding the commercial space utilization, it will be processed using quantitative descriptive analysis techniques in the form of figures, diagrams, tables and supporting explanations. Whereas, for data related to commercial criteria as tourism-supporting activities will be processed using qualitative variation index (IVK).

Qualitative variance index analysis (IVK) is used to determine the conformity level of commercial space utilization of each variable indicator obtained from the tourists' questionnaire. Then, the questionnaire data is measured by the value of each variable mode. The mode is the most frequent value derived from the perceptions of tourists because in the qualitative variation index (IVK) it should consider the number of variations observed significantly in a value distribution of the maximum variation that can occur in the distribution (Healey, 2012).

$$IVK = \frac{k [(\sum fi)^2 - \sum fi^2]}{(\sum fi)^2(k-1)}$$

Description:

fi: classified frequency of "i"

k: total classification

After obtaining the IVK value from those three criteria, follow up calculation needs to be made to understand conformity percentage of the commercial space as tourism-supporting activities. According to Jones in Hariz (2013), the checklist method aims to assist researchers in using knowledge about predetermined requirements to be relevant in similar situations. This method is also used to assess the fulfillment of indicators of suitability of the spatial utilization function based on criteria and variables fulfilled. Conformity percentage can be calculated using the following formula:

$$\% \text{ Conformity Levels} = \frac{\text{Fulfilled Indicators} \times 100\%}{\text{Total Indicators}}$$

Then, after obtaining the conformity level, it will be categorized as follows:

- If all of the variable indicators are met, then Sosrowijayan is in line with its commercial function as a tourism-supporting activity.
- If the percentage of conformity level more than or equal to 50% of fulfilled indicators, then Sosrowijayan is sufficiently suited to its commercial function as a tourism-supporting activity.
- If the percentage of conformity level is less than 50% of fulfilled indicators, then Sosrowijayan has not yet functioned as a commercial tourism-supporting activity.

### III. RESULT AND ANALYSIS

#### 3.1 Analysis of Commercial Space Utilization in Sosrowijayan

##### 3.1.1 General Identification of Spatial Utilization in Sosrowijayan

Sosrowijayan area was formerly known as Pasar Kembang [Flower Markets] which is a profound place of prostitution in Yogyakarta City. However, as the term goes on it has begun to fade. According to the Yogyakarta City Regulation No 1 year 2015 on the Detailed Spatial Plan of Yogyakarta 2015 – 2035, Sosrowijayan which is part of Sosromenduran Village is entered into Sub BWP B block B1 with the function as an important strategic area as well as its peer, Malioboro. Malioboro is a region which is planned to be developed

as a cultural heritage zone, trade and services centre that implies a cultural image. As Sosrowijayan regrouped with the Malioboro Zone, a commonplace for tourist to shop over, the development of commercial activities in the area has been increased simultaneously so that the space utilization has also been shifted from settlement areas into commercial ones to meet the existing demand.

### 3.1.2 Identification of Existing and Planned Land Use in Sosrowijayan

The identification of land use plan and existing land suitability is useful to determine whether the existing land use is in line with government guidelines.



Source: Yogyakarta Regional Planning and Development Council, 2018

**Figure IV. 1**  
**Land Use Planning Map of Sosrowijayan**



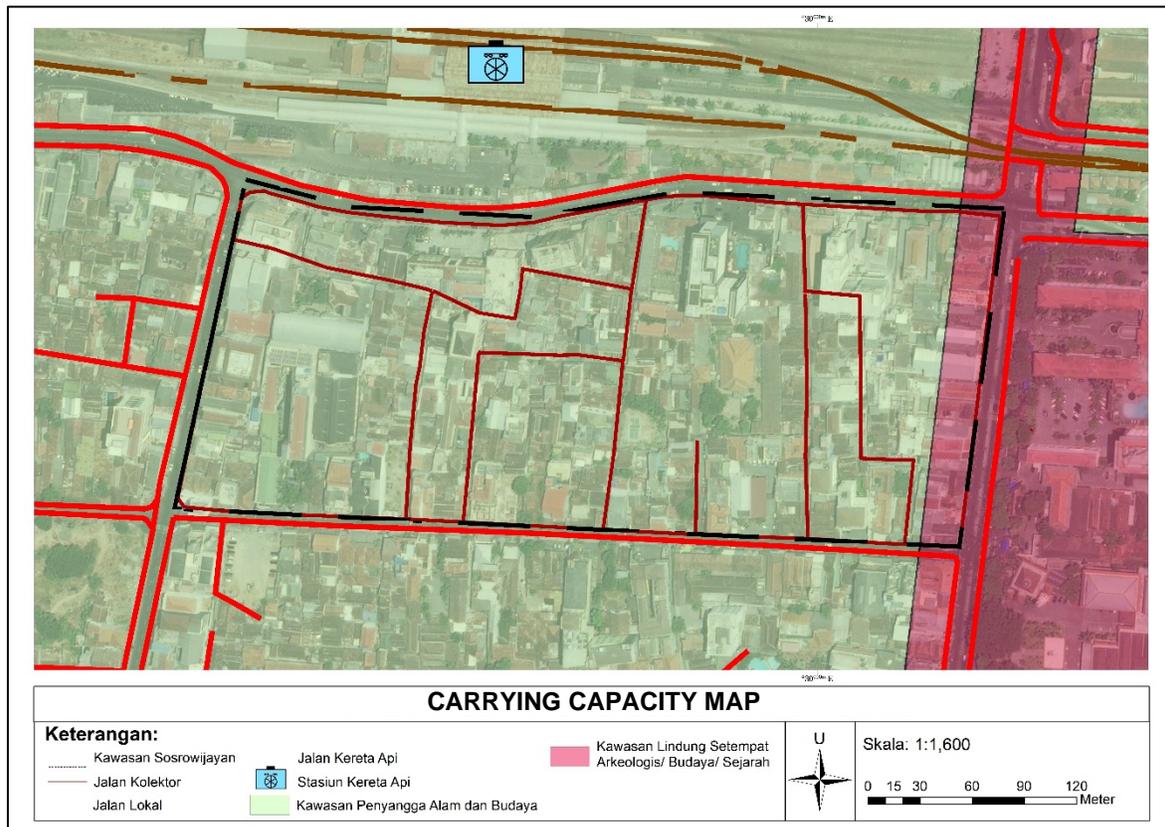
Source: Research Analysis, 2018

**Figure III. 2**  
**Existing Land Use Map of Sosrowijayan**

As shown on the existing land use map above, most are in accordance with the land use plan of trade and service area which has been previously specified by the government. However, there is a different land use plan with the existing ones in Sosrowijayan which there is a domination of pure residential use located in RW 3 or Sosrowijayan Kulon. This is because prostitution took charge of this area so there are not many commercial activities available.

### 3.1.3 Carrying Capacity Analysis of Sosrowijayan

Carrying capacity analysis is derived from the scoring of certain variables such as rainfall, the slope of land and soil type. These three variables have scores, the number of scores will reflect the ability of space. After the variables were obtained, the analysis will be done using spatial analysis or overlay.



Source: Research Analysis, 2018

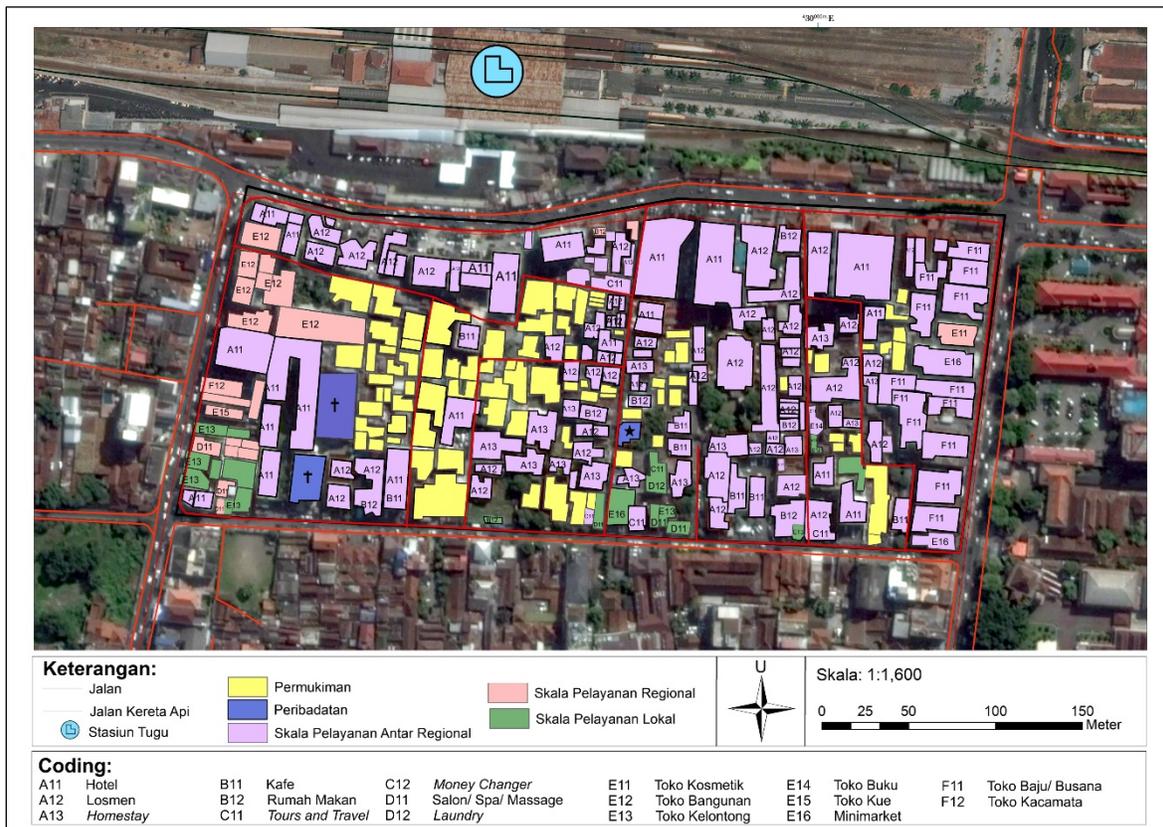
**Figure IV. 3**

### **Carrying Capacity Map of Sosrowijayan**

The Sosrowijayan area is dominated by natural and cultural buffer areas and some of the local areas are the protected archaeological/cultural/historical sites located on Malioboro shopping centre. This is done to protect the nation's cultural richness because Malioboro is a historical heritage, a form of high cultural value building, and has the high benefits that can be useful for the development of science. Then, if seen on the carrying capacity map, Sosrowijayan has no vulnerability to landslides and natural disasters. With that, the Sosrowijayan area is just suitable for trading and service activities.

#### **3.1.4 Analysis of Commercial Pattern and Scale of Services in Sosrowijayan**

Analysis of this commercial activity pattern is aimed to know the pattern of commercial activities in Sosrowijayan and to reveal its distribution within the perimeter. Existing data indicate that the distribution of commercial activities shaped by a pattern of specialized areas, commercial activities with certain commodities that are interconnected. The pattern of specialized areas is a pattern of unplanned economic activity arises because of the same interest. The specialized area pattern requires complex architecture, strong integration and requires good accessibility as this pattern attracts consumers from outside the region. Sosrowijayan area has the integration that is moving as a tourist accommodation in the form of lodging, food and beverage business and other supporting tourism services. Commercial activity in the area appears unplanned as the development of Malioboro shopping centre and other Yogyakarta tourism spots. Then with the scale of commercial activity service, the range of service will be revealed as later belongs into local, regional, or inter-regional scale.



Source: Research Analysis, 2018

**Figure IV. 4**  
**Commercial Service Scale Map of Sosrowijayan**

Commercial activity in this area is dominated by inter-regional scale services. That is because the commercial activities can serve overseas. Goods traded at this inter-regional service scale are accommodation or lodging services as well as fashion stores whose customers are not only the people of Yogyakarta City but also foreign parties. With tourists as their customer target, Sosrowijayan becomes increasingly dense and crowded because of many customers passing by. Then for the regional service scale of goods traded in the form of building materials and supplies, cake shop, optical shop and also a cosmetics store. Most of these commercial activities have customers who are not only domiciled in Sosrowijayan but also from the outer region.

**3.1.5 Analysis of Space Utilization Characteristics in Sosrowijayan**

After conducting several analyzes related to the commercial space activities, the characteristics can be seen in Table 3.1 as follows:

**Table 3.1 Space Utilization Characteristics**

Commercial Characteristics	Space Utilization	Tourism Effects
The types of commercial activities in Sosrowijayan include lodging, restaurants, tour travel, laundry, fashion store and so on with 24 hours of daily operation. Ownership of 71% commercial activities is mostly personal property and the building which is used as a place of business is 64% personal property and 31% lease/contract. In addition, many businessmen who set up businesses here mainly because of it close to the city centre, many tourist attractions, or it has been long established there.	Some of the building functions in Sosrowijayan have a commercial function, but there are several buildings with mixed functions. The mix functions include homestay, grocery store, laundry.  Before the establishment of the commercial activities, Sosrowijayan was dominated by buildings with residential functionalities.	Tourism activities have an impact on the emergence of the commercial centre in Sosrowijayan. Business owners then saw the chance of developing business activities as many tourists came through, backed by tourists as its customer target.  In addition, commercial activity in Sosrowijayan Region has been established for more than 10 years, it is known that the commercial activities in the Regions began in 1970.

Source: Research Analysis, 2018

### 3.2 Conformity Analysis of Commercial Space as Tourism-Supporting Activities based on Tourists Perception

Conformity analysis of commercial space as tourism-supporting activities will be analyzed based on the questionnaire results. The questionnaire consists of 14 questions used for the analysis of each suitability criteria. Then data obtained from the questionnaire will be processed using qualitative variation index (IVK) to measure conformity variable of commercial space as tourism-supporting activities in Sosrowijayan.

#### 3.2.1 Characteristic Analysis of Accessibility in Sosrowijayan

Accessibility is an important factor that must exist to support tourists in order to enhance tourism activities. Evaluation indicators on accessibility are seen from accessibility characteristics of strategic location, transportation, road condition, distance from city centre and travel time as follows:

**Table 3.2 Conformity Indicators of Accessibility**

Indicators		Frequencies	Modes	IVK < 0,5	Indicator Fulfillments
Strategic Location	Not Accessible	2	Accessible	0,5	Fulfilled
	Quite Accessible	5			
	Accessible	27			
<b>Total Respondents</b>		<b>34</b>			
Distance from City Center	Far	0	Very Close	0,5	Fulfilled
	Averagely Close	8			
	Very Close	26			
<b>Total Respondents</b>		<b>34</b>			
Travel Time	2 – 3 Hours	0	< 1 Hour	0,4	Fulfilled
	1 – 2 Hours	6			
	< 1 Hour	28			
<b>Total Respondents</b>		<b>34</b>			
Transportation	Bad	3	Good	0,9	Not Fulfilled
	Averagely Good	14			
	Good	17			
<b>Total Respondents</b>		<b>34</b>			
Road Condition	Bad	1	Averagely Good	0,7	Not Fulfilled
	Averagely Good	21			
	Good	12			
<b>Total Respondents</b>		<b>34</b>			

Source: Research Analysis, 2018

Based on the results of the questionnaire on 34 respondents using accessibility criteria, there are three indicators suitable to measure the conformity level of commercial space utilization as tourism-supporting activities, amongst them are a strategic location, distance from city centre and travel time.

#### 3.2.2 Characteristic Analysis of Amenities in Sosrowijayan

In tourism, amenity is an important thing. Amongst them is accommodation, food and beverage business, infrastructure and tourist information. Accommodation is a part of an industry which means a component of the tour itself, accommodation can be a place or room where people or visitors or tourists can rest or stay to sleep, bathe, eat and drink and enjoy the available services and entertainment. Adequate facilities and infrastructures are needed to support tourism activities in accommodating tourists' mobility. Whereas, tourism information needs to be provided to support tourism activities so it is necessary to create as much information as possible.

**Table 3.3 Conformity Indicators of Amenities**

Indicators		Frequencies	Modes	IVK < 0,5	Indicator Fulfillments
Accommodations	Bad	0	Good	0,5	Fulfilled
	Average	8			
	Good	26			
<b>Total Respondents</b>		<b>34</b>			
Restaurants	Bad	0	Good	0,7	Not Fulfilled
	Average	15			
	Good	19			
<b>Total Respondents</b>		<b>34</b>			
Facilities	Bad	1	Average	0,5	Fulfilled

Indicators		Frequencies	Modes	IVK < 0,5	Indicator Fulfillments
	Average	27			
	Good	6			
<b>Total Respondents</b>		<b>34</b>			
Infrastructure	Bad	0	Average	0,6	Not Fulfilled
	Average	24			
	Good	10			
<b>Total Respondents</b>		<b>34</b>			
Tourism Information	Less Informative	2	Quite Informative	0,7	Not Fulfilled
	Quite Informative	22			
	Highly Informative	10			
<b>Total Respondents</b>		<b>34</b>			

Source: Research Analysis, 2018

Based on the results of the questionnaire on 34 respondents using amenity criteria, there are two indicators suitable to measure the conformity level of commercial space utilization as tourism-supporting activities, amongst them are accommodation and facilities.

### 3.2.3 Characteristic Analysis of Tourist Attractions

Comfortability is one of the most important indicators for commercial as the tourism-supporting activities. Convenient surrounding will trigger a comfortable sense in using the facility and doing particular activities. In addition, comfortability can also increase the aesthetic value of a region. A clean tourism area will provide a sense of comfort for visitors and make the aesthetic value of a region remains high. In addition, hygiene is also one of the health aspects for visitors which should be prioritized. Based on observation results, there are no scattering piles of trash around the perimeter. Affordability of prices affects the number of coming tourists as the affordable costs will attract more tourists to come over. Price compatibility with whatever is offered by a place affects its promotional campaigns.

**Table 3.4 Conformity Indicators of Tourism Attractions**

Indicators		Frequencies	Modes	IVK < 0,5	Indicator Fulfillments
Public Security	Not Safe	2	Averagely Safe	0,7	Not Fulfilled
	Averagely Safe	23			
	Already Safe	9			
<b>Total Respondents</b>		<b>34</b>			
Comfortability	Unpleasant	2	Quite Comfortable	0,8	Not Fulfilled
	Quite Comfortable	21			
	Already Comfortable	11			
<b>Total Respondents</b>		<b>34</b>			
Hygiene and Sanitary	Polluted	3	Already Clean	0,8	Not Fulfilled
	Quite Clean	12			
	Already Clean	19			
<b>Total Respondents</b>		<b>34</b>			
Incurred Costs	Less Affordable	0	Affordable	0,4	Fulfilled
	Affordable	28			
	Highly Affordable	6			
<b>Total Respondents</b>		<b>34</b>			

Source: Research Analysis, 2018

Based on the results of the questionnaire on 34 respondents using tourism attraction criteria, only the incurred cost indicators are suitable to measure the conformity level of commercial space utilization as tourism-supporting activities.

### 3.3 Formulation Factors Level of Conformity of Commercial Space Utilization as Tourism-Supporting Activities

Based on the three characteristic of commercial space utilization with 14 indicators, there are six factors that can be used in calculating its conformity level. These indicators include the strategic location, distance from the city centre, travel time, accommodation, facilities and incurred costs. Here the calculation as follows:

$$\begin{aligned}
 \% \text{ Conformity Levels} &= \frac{\text{Fulfilled Indicators}}{\text{Total Indicators}} \times 100\% \\
 &= \frac{6}{14} \times 100\%
 \end{aligned}$$

= 43%

From the calculation above, the result showed a conformity scale of 43%. This suggests that Sosrowijayan is not yet functionally suitable as a tourism-supporting area.

### 3.4 Research Findings

After doing some analysis related to the commercial space utilization as tourism-supporting activities, a particular set of facts and findings were obtained. Here as follows:

1. Sosrowijayan commercial space serves as tourism-supporting activities. Commercial activities found in the Sosrowijayan are accommodation or lodging, food and beverage business, grocery store, bookstore and other tourism support such as vehicle rental, tours and travel, money changer and others. In addition to general commercial businesses, there are other undefined commercial activities called prostitution located in RW 3 or widely-known as the "third alley".
2. The building functions of Sosrowijayan is highly dominated by commercial activities, ownership status is either own or personal. Then, reasons for establishing the venture are dominated by tourism effects of Malioboro, or merely as their side business. Furthermore, as it seen from the shape of the buildings, it indicates that many commercial activities there violate the building permits of residential. Though it's has been functioned otherwise.
3. Sosrowijayan area is located in a very strategic location so that the price of land in the area is high and available buildings are not sold but rented out.
4. There are eight indicators that are not met for the calculation of the suitability level of commercial space utilization function as supporting tourism in Sosrowijayan area. The eight indicators are road, transportation, restaurant or restaurant, infrastructure, tourist information, security, comfort and hygiene area.

## IV. CONCLUSION

Sosrowijayan is located in Sosromenduran, Gedongtengen, Yogyakarta. Based on the Detailed Spatial Plan of Yogyakarta 2015-2035, Sosrowijayan has its main function as trade and services zone. Overall, the Sosrowijayan land usage is already in line with the government's plans. Looking at the zonal development wise, Sosrowijayan has a specialized area pattern where commercial activities with certain commodities are interconnected as tourism-supporting activities. The service scale available in Sosrowijayan is dominated by regional scale. This is because almost all commercial activities are reachable by tourists coming from outside the Sosrowijayan and even dominated by foreign tourists. Most of the commercial activities have the function of space as a place of business along with the status of private properties, also, the commercial bustles are preceded by residential functions. Many businessmen who set up businesses here mainly because of it close to the city centre, many tourist attractions, or it has been long established there. Rapid tourism development in Yogyakarta as well as placing Sosrowijayan as one of the tourism centres has been attracting many tourists to come around so that the initial use for residential later being shifted into commercial to meet the needs of tourists.

Furthermore, from the different indicators of each criterion, the result is that out of fourteen (14) indicators there are only six (6) indicators that are fulfilled and have IVK smaller than 0.5 ie strategic location, distance from city centre, travel time, accommodation, facilities and incurred costs. From these six indicators, the conformity level result is 43% suggesting that Sosrowijayan is not yet functionally suitable as a tourism-supporting area because the level of conformity is less than 50% of the fulfilled variables. It's because the infrastructure condition of accessibilities and amenities are still averagely good, slightly below the expected standard of tourists, so that improvements should be targeted in a long run to elevate the local tourism services.

## ACKNOWLEDGMENT

This article is a follow-up to the Final Paper research for a Bachelor of Urban and Regional Planning degree. Thanks to Diponegoro University, especially the Department of Urban and Regional Planning which has provided the best educational approach as well as Ragil Haryanto who always provides guidance and supportive gestures in every possible way. Once again, thank you very much.

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# Flow Analysis of Turgo Impulse Turbine for Low Head Power Plant

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DOI: 10.29322/IJSRP.16.7.2018.p8037

<http://dx.doi.org/10.29322/IJSRP.8.7.2018.p8037>

**Abstract-** Hydro energy is widely used in the small and remote areas that require only a small amount of electricity. The Turgo turbine is used for pico hydro power generation. The initial cost of the turbine is low and is similar to Pelton wheel. The Turgo impulse turbine is known for its reliability and strength, and it can perform efficiently with the range of flows. The research was carried out in order to perform CFD analysis of Turgo turbine. The whole simulation was performed in ANSYS-CFX. The Computational Fluid Dynamics (CFD) method was used to determine the stream flow through the blade. The Turgo Turbine consists of the runner with 261.50 mm diameter and the diameter of the nozzle is 26.15 mm which inclination angle is 20 degree. The flow rate of this turbine is 436.9 liter /min, the head is 10 m and the total number of buckets are 20 buckets. The power and torque generated by the device is analyzed and compared with CFD simulation under the certain boundary conditions. The simulation uses the  $k-\epsilon$  turbulent flow model. The buckets are designed according to hydrodynamic theory. In this research the power and torque are compared between theoretical and numerical at various jet speeds for Turgo impulse turbine.

**Index Terms-** Flow, Jet velocity, Power, Torque, Turgo turbine

- Introduction

## T

he Turgo turbine is the impulse turbine. The Turgo turbine is similar to the Pelton but the jet strike the plane of the runner at an angle of typically from  $10^\circ$  to  $30^\circ$  so that the water enters the runner on one side and exits on the other. Therefore the flow rate is not limited by the discharged fluid interfering with the incoming jet (as is the case with Pelton turbines). As a consequence, a Turgo turbine can have a smaller diameter runner and it can rotate faster than a Pelton for an equivalent flow rate.

The Turgo turbines are used in medium head and high head of water between the head of 15 m to 300 m. Turgo turbine transforms kinetic energy of water jet to rotational energy with the help of a nozzle. The high speed of water jet directed on to the turbine blades and the turbine is rotated at high speed after striking the water to the turbine blades. Then the shaft is rotated and the electricity is generated in generator. Turgo turbine runner is same as Pelton runner but it is split in half. For the same power output the Turgo turbine runner is one half the diameters of the Pelton runner, and the specific speed is twice the Pelton runner.

The Turgo turbine can handle a greater water flow than the Pelton turbine because the exiting water doesn't interfere with buckets. If the number of jets are increased the specific speed of the turbine is also increased. This is widely used in pico hydro power plant because the cost of the turbine is low and it can easily manufacture in minimum cost. Turgo turbines are mostly used in rural areas electrification in pico hydro power plants.

The simulation is important before the actual operation of turbine as it helps to optimize the design according to the obtained values of flow velocities, pressure distribution and efficiency. The results obtained from CFD are of great interest since these findings can be used to minimize testing time and cost as well as to analyze failure conditions. The research was performed to calculate the power and torque by the computational method.

• METHODOLOGY

The power supplied by a water jet depends upon the head and the rate of water flow. Therefore the available hydraulic power can be written in terms of head and flow.

$$\text{power supplied by the jet, } P = \rho g Q H \quad (1)$$

Where  $\rho$  is the density of the fluid,  $H$  is hydraulic head and  $Q$  is the flow rate. The jet diameter  $d_j$  can be calculated using

$$d_j = 0.545 \sqrt{\frac{Q}{z_o \sqrt{H}}} \quad (2)$$

Therefore, the diameter of runner is

$$D = m d_j \quad (3)$$

The jet diameter plays an important role in the designing of the buckets of the Turgo turbine. The width of the bucket  $B$  is  $(1.68-2.34) d_j$  [9], the length of the bucket  $L$  is  $(2.4-3.4) d_j$  [9] and the depth of the bucket  $H$  is  $(0.3-0.585) d_j$  [9] respectively.

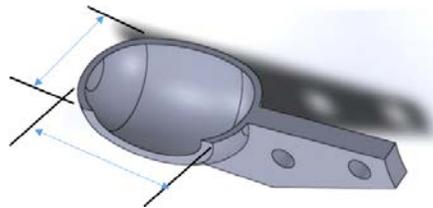


Figure 1. Bucket of Turgo turbine

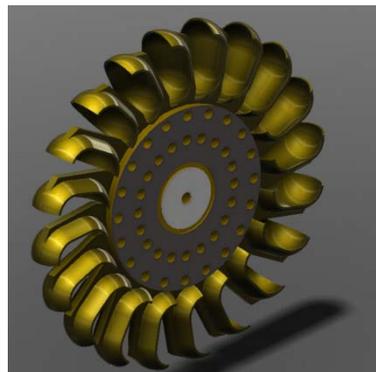


Figure 2. Buckets and runner of Turgo turbine

The jet velocity is determined from the net head as:

$$v_j = c_v \sqrt{2gH} \approx 0.98 \sqrt{2gH} \quad (4)$$

Where  $c_v$  is the efficiency of the nozzle and generally  $0.97 \sim 0.98$  [12]. At optimum efficiency, the circumference or tangential velocity of the runner is connected with the jet velocity as:

$$U \approx (0.46 - 0.47) v_j \quad (5)$$

The power is the product of the angular speed at maximum power and the torque.

$$P = T\omega = \eta\rho gQH$$

(6)

- NUMERICAL ANALYSIS

The CFD simulation involves numerical modelling and analysis of the flow in the Turgo runner, along with a preliminary design. To achieve this, the design of buckets and runner were initially designated according to the hydrodynamic theory. The CFD simulation starts with the creation of 3D study model. This study consists of the buckets, nozzle, casing, fluid part and rotating bodies. The materials considered in the CFD process are the fluid, solid, and rotating regions.

*A. Geometric Modeling and Meshing*

The flow domain is imported to Geometry sub-program by using the ANSYS Design Modeler. The flow domain consists of the fluid, the nozzle, the bucket, the casing and rotating region. The geometry of Turgo turbine is designed with the aid of the SolidWorks. The domains are separated into two parts such as the stationary components and rotating component respectively. 20 buckets were considered in this simulation and these buckets are taken as the rotating part. The nozzle and the casing are considered as the stationary parts.

The meshing was performed for both domains. The flow domain is meshed using the ANSYS Mesh sub-program ANSYS CFX Project. In the meshing, the size function is taken as curvature and the relevance center is considered as the medium. Figure 5 shows the meshed on buckets and nozzle and the numbers of nodes are 1045788 and the numbers of elements are 5393410. Figure 6 is the meshed detail on buckets. Figure 3 shows the geometry for rotating part and figure 4 describes the geometry for rotating and stationary part of the Turgo turbine.

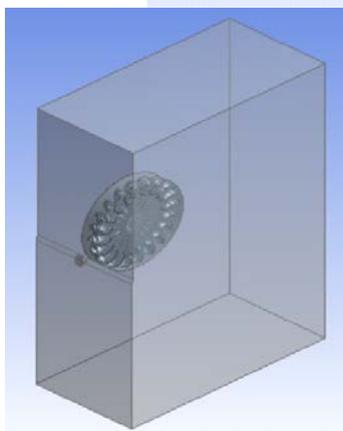
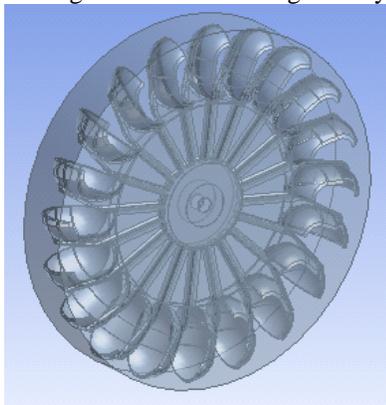


Figure 3. Geometry for rotating part and stationary part

Figure 4. Geometry for rotating

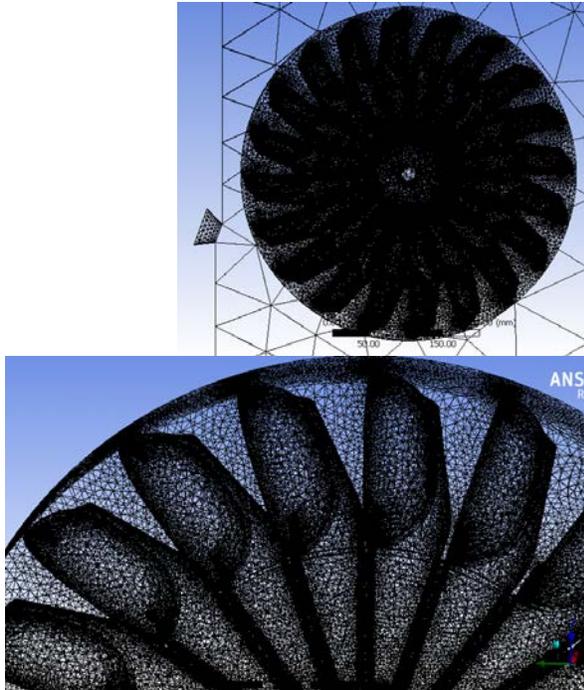


Figure 5. Meshed on buckets and nozzle  
buckets

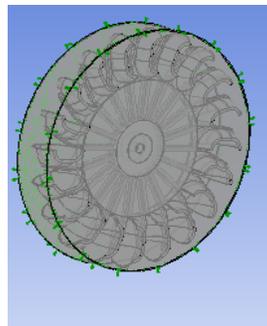
Figure 6. Meshed on

Meshing on buckets and nozzle can be seen from figure 5 and figure 6 shows the detail mesh on buckets.

### B. Boundary Conditions

The analysis was carried out at steady state. The reference pressure was kept to 1 atm for both domains and the fluid temperature is 25°C. The turbulence option is taken as  $k-\epsilon$  and domain type is fluid domain. The angular velocity for rotating part is 48.29 rad/s and the mass flow rate is 7.28 kg/s. Domain motion was set to stationary for the nozzle and casing while rotating for runner and bucket with appropriate speed. The motion of the rotating domain was set in clockwise direction along positive x-axis direction.

In the input boundary parts, the water stream from the nozzle is injected into the rotating region. The inlet boundary condition for nozzle was 13.73 m/s. All buckets were set to wall with no slip condition. The faces at the stationary domain except nozzle are taken as the opening with relative pressure 1atm. But the back surface set as the outlet whereas the pressure outlet show 1 atm respectively. Figure 7 (a) shows the domain interface of rotating turbine.



(a) Domain interface

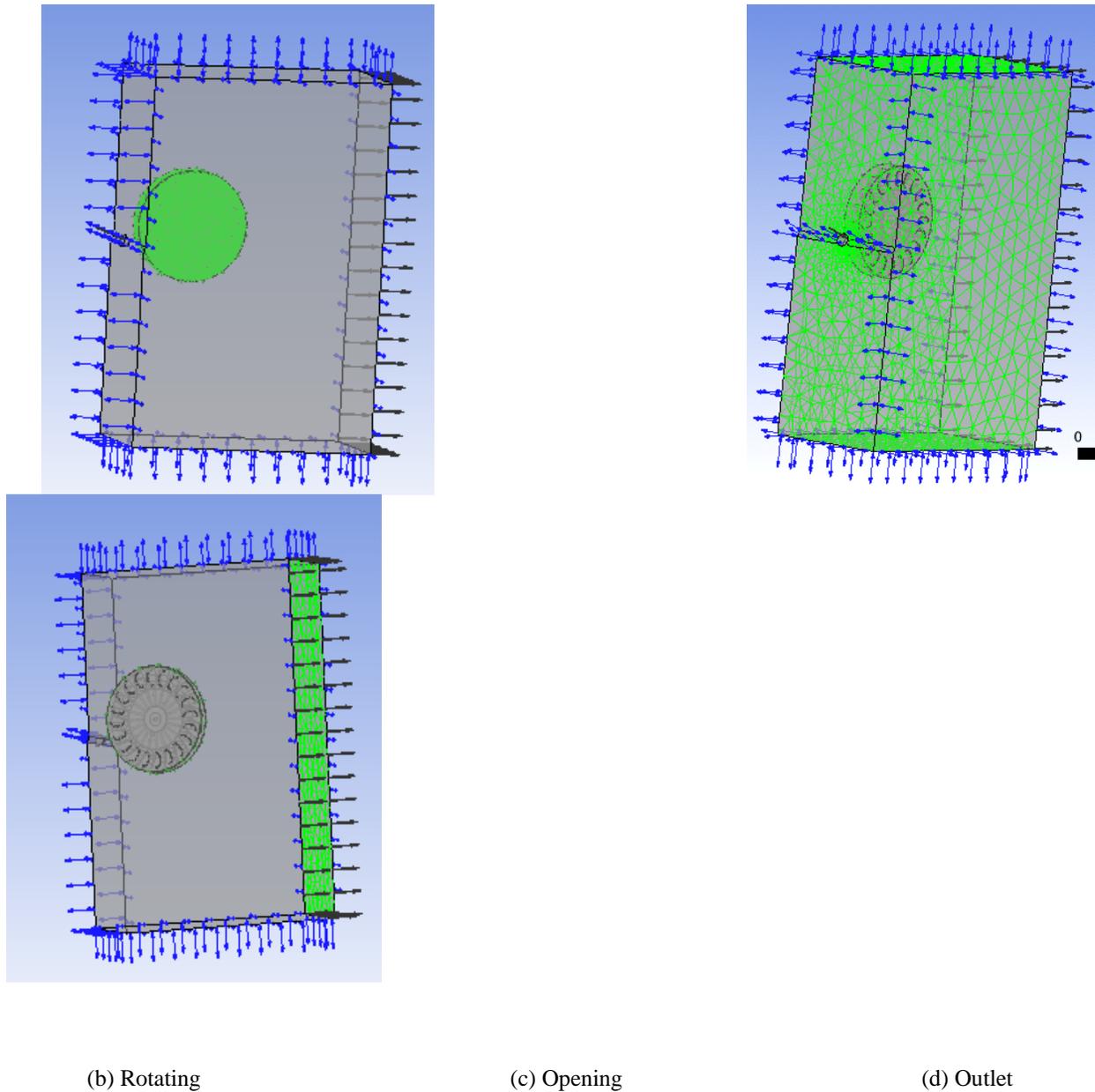


Figure 7. Boundary Conditions

Figure 7 (b) illustrates the rotating part of Turgo turbine. The places around the stationary part such as front surface, top and bottom surface and the sides surface are taken as opening. But the back surface is taken as the outlet. Figure 7 (c) shows the opening part and (d) shows the outlet of the turbine

### C. Simulation Domain

The pressure distribution, the velocity distribution and torque variation in the turbine bucket were analyzed after the simulation. The liquid flow in the rotating runner of an impulse turbine is complex and unsteady. The water emerges from the inlet nozzle and strikes the buckets. The inclination of jet angle is 20 degree. Figure 8 shows the streamlines of water jets discharged from the nozzles.

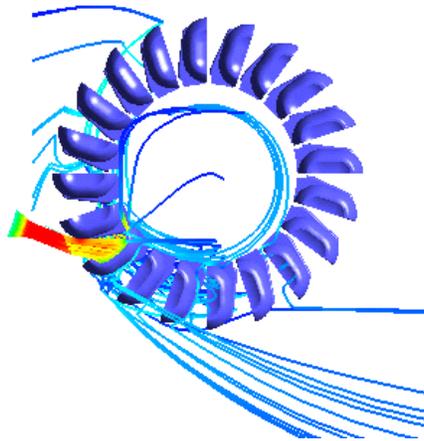


Figure 8. Streamline of water flow on the bucket

(i) Pressure distribution

The pressure distribution in the bucket was due to impact of high jet. The pressure is maximum at the place where the jet strike on the bucket with the value of 0.72 MPa.

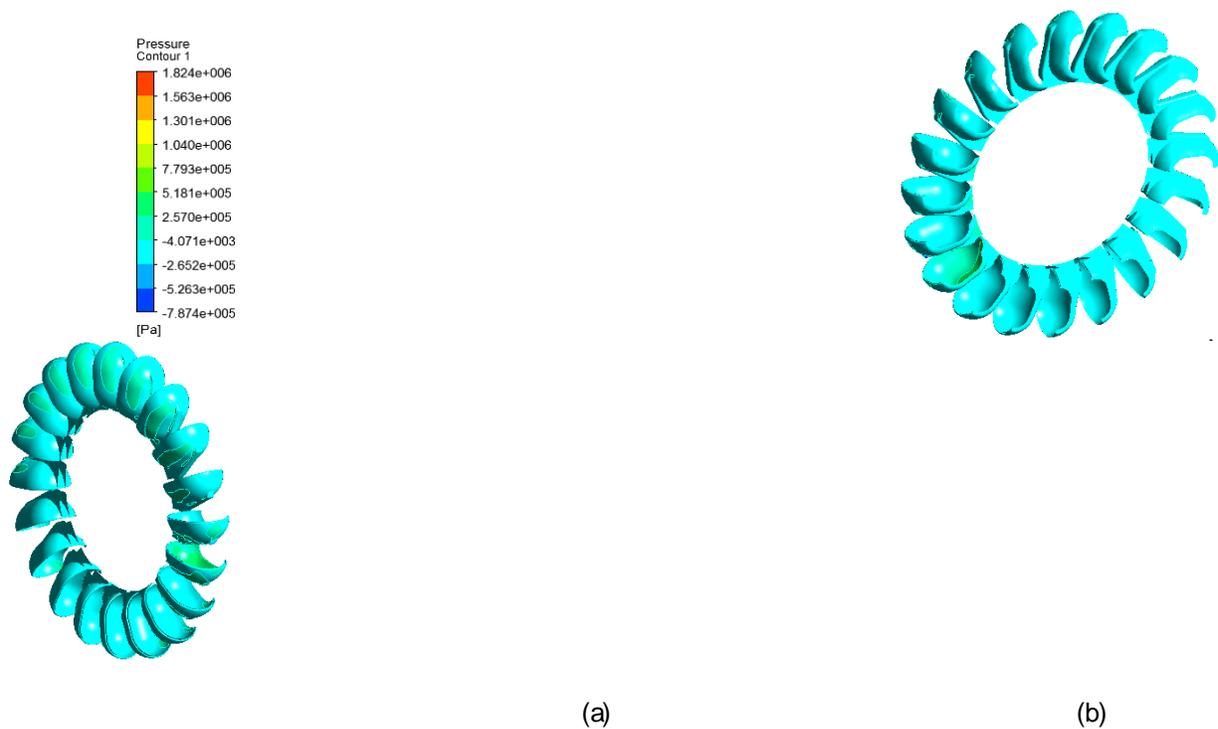


Figure 9. Pressure distribution on the buckets (a) front side (b) back side

Figure 9 (a) illustrates the pressure distribution on the buckets from the front side and figure 9 (b) also shows the pressure distribution on the back side of the buckets.

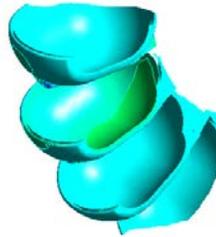


Figure 10. Pressure distribution on one bucket length

Figure 10 shows the pressure distribution along the bucket length where the jet strike. Since the inclination of the jet angle is 20, the pressure decrease at the tip of the bucket length and then it increase gradually. The maximum pressure occurs at the root of the bucket. From the simulation results, the pressure is maximum at the spot where the jet strikes the bucket, and then decreases towards the edges of the bucket. If the pressure increases, the force will increase proportionally and the bucket can be more failure.

(ii) Velocity distribution

Figure 11 shows the velocity distribution through the buckets. The velocity is maximum when the water emerge from the nozzle and then it will decrease when it strike the bucket.

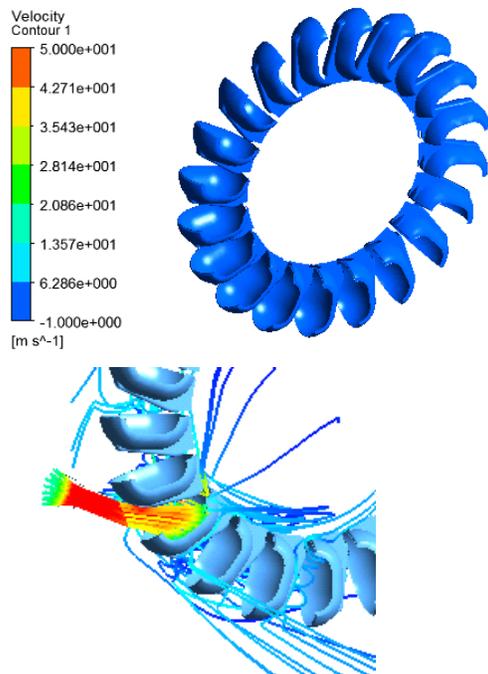


Figure 11. Velocity distribution on the buckets

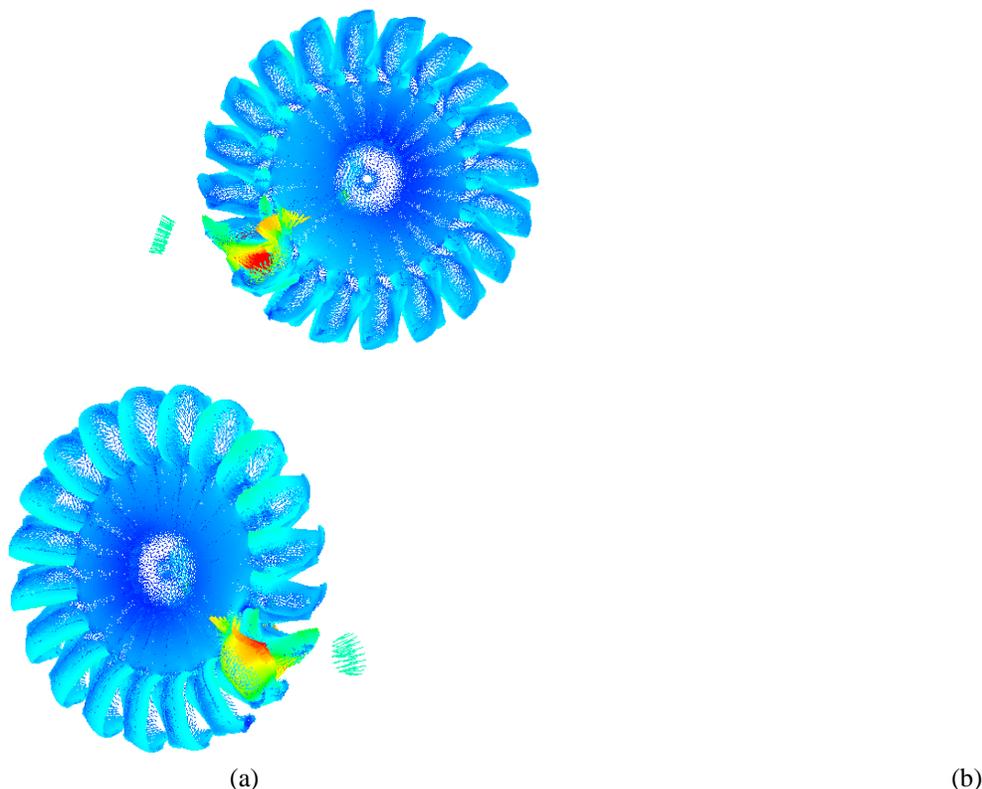


Figure. 12 Flow velocity vector on buckets and disc (a) front surface (b) back surface

Figure 12 (a) shows the flow velocity vector on buckets from the front surface and (b) shows the back surface of the buckets according to the flow velocity vector.

#### IV. RESULTS AND DISCUSSION

From the simulation results, the pressure is maximum at the spot where the jet strikes the bucket, and then decreases towards the edges of the bucket. If the pressure increases, the force will increase proportionally and the bucket can be more failure.

Moreover, from the CFD simulation, the torque (T) of the turbine can be produced and the theoretical torque (T) can be received from the equation  $T = Q D (v_j - U)$ . Therefore, the power (P) can be calculated using the formula  $P = T \omega$ . In addition, the CFD simulation results depict the streamlines, water velocity, and water velocity distribution on the bucket. The CFD simulations were validated with the theoretical results. Hence the power and torque are compared at various jet speed. From the theoretical results, the torque is 3.89 Nm if the jet velocity is 3.73 m/s and the torque will become 14.11 Nm when the jet velocity increase to 13.73 m/s. The torque is 24.39 Nm at 23.73 m/s of jet velocity. If the jet velocity increases, the torque of the turbine will increase gradually.

Figure 13. Comparison of torque between theoretical and Numerical results

Figure 13 compares the torque given by the theoretical calculations and CFD. The results show that the value of torque of the turbine varies when the jet velocity changes. If the jet velocity increases, the torque will increase proportionally. And then the power also varies accordingly because the power is directly proportional the torque of the turbine. Figure 14 shows the relationship between the jet velocity and power.

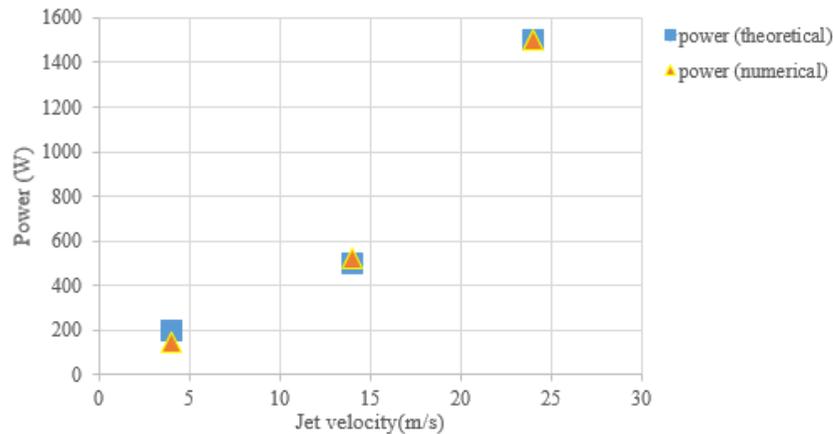


Figure 14. Comparison of power between theoretical and CFD

The power of the Turgo turbine is dependent on the flow rate, head and jet velocity. From figure 14, it can be seen clearly that the power will increase when the jet velocity increases. Therefore the jet velocity is the important point in the designing of Turgo turbine.

## V. CONCLUSION

The Turgo turbine is an impulse turbine and it is designated for medium to high head application. But in this research, the head of the turbine is 10 m and the flow rate is 436.9 liter /min. The simulation was performed in symmetrically for 20 buckets and the nozzle angle is 20°. The results obtained from the simulations were dependent on the accuracy in domain set up, quality of mesh, turbulence model and boundary conditions. Therefore, the results can be improved by increasing the mesh quality and the number of mesh nodes.

Moreover, in the designing of the Turgo turbine, the jet ratio and jet velocity play an important role. If the jet velocity increase, the torque of the turbine will also increase. Therefore, the jet velocity is very important in order to get more power. The theoretical power that is developed from the analytical calculation is 520 watts and the jet velocity is 13.70 m/s. Moreover, the simulation shows that the power is 145 watt when the jet velocity is decreased to 3.70 m/s and 1504 watt will be obtained when the jet velocity is increased to 23.70 m/s.

## Acknowledgement

The author wishes to express the deepest gratitude to her parents, for their moral support and encouragement. The author is grateful to Dr. Sint Soe, Rector, Mandalay Technological University. Great thanks to Dr. Htay Htay Win, Professor, Head of Mechanical Engineering Department, Mandalay Technological University.

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# Deceptive versus Informative Income Smoothing: Evidence from Audit Committee Attributes

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DOI: 10.29322/IJSRP.8.8.2018.p8038  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8038>

## **Abstract-**

The paper examines which income smoothing perspective (deceptive or informative) is more prevalent by focusing at four audit committee attributes namely audit committee size, the number of audit committee meeting, the proportion of non-executive, and the proportion of independent audit committee members. Using a sample comprises 604 public listed firms in Malaysia during the year 2008 to 2014, this study finds that firms with strong audit committee, which have large audit committee, more frequent meeting and high proportion of independent directors are associated with low extent of income smoothing. The findings provide evidence supporting the proponent for deceptive perspective in which income smoothing is viewed as an unacceptable act when reporting earnings. The results are robust even when using an alternative measure for income smoothing and including various control variables namely auditor size, firm size, leverage, profitability, growth and industry fixed effects.

**Index Terms-** Income smoothing, corporate governance, audit committee

## I. INTRODUCTION

Income smoothing is an act to reduce the fluctuations of corporation's earnings over time (Beattie et al., 1994). Income smoothing is carried out by managers using variety of means, ranging from taking advantage of discretions given to managers within acceptable financial accounting practices to conducting fraudulent corporate reporting. For example, income smoothing can be accomplished by shifting the timing of the firm's events, by either postponing or advancing the recognition of the expenses or transactions. The rescheduling of recognition of such expenses will show smooth effects on reported income variation over time (Ronen and Sadan, 1975). The loopholes of certain accounting standards also leave the managers with choices and options to manage firm's earnings through manipulation of certain accounting numbers.

Evidence of income smoothing was found in many previous studies. A recent study in Asia by Rusmin, Scully and Tower (2013) find that corporate managers manipulate their reported income downward during the global financial crisis period so that firms' poor results became even worse during the fiscal year,

as to easily manage and boost future years' income. On the other hand, Strobl (2013) posits that managers are more likely to engage in opportunistic behavior during an economic boom as opposed to a recession period. Despite the evidence that managers did perform opportunistic behavior to manage earnings, the pattern and motives of income smoothing are still subject to debate.

Prior literature has viewed income smoothing from two different perspectives. The first view is that income smoothing is considered as a deceptive act. Based on this perspective, managers are more likely commit an income smoothing act not for the provision of information, but merely as a deceptive tool to manipulate accounting information to satisfy their own self-interests such as maximizing bonuses and other incentives. It is contradictory to the principle of a good agency relationship explained by Eckel (1981), hence income smoothing can be considered as an unfavorable act to the shareholders. In this case, smoothing of income is regarded as unethical regardless of the reasons that motivate the managers to commit the act. The second perspective is known as informative smoothing, in which income smoothing is regarded as an acceptable act by some researchers due to its objectives of maximizing the benefits of the shareholders. Smoothed income stream reduces firm's overall tax liability and enhances the relationship between workers and managers (Hepworth, 1953). This is closely related to worker's motivation and morale through recognition of their contribution in the form of appreciation, maintaining or increase bonuses, increment, and other employees' benefits in kind as compensation will boost the motivation hence boosting the employee's productivity (Moses, 1987). Also, income smoothing could avoid debt covenant violation (Habib, 2005), reduce political cost (Godfrey & Jones, 1999), ensure higher earnings persistence (Silhan, 2014), and promote higher market valuation (Michelson et al., 2000).

The contradicting view of whether income smoothing is related to deceptive acts, or efforts to provide more information of company's financial performance are shown in empirical studies. Recent evidence, for example, Li and Richie (2016) find that firms with higher income smoothing rankings exhibit lower cost of debt, suggesting that the information signaling effect of income smoothing dominates the distorting effect. In addition, Gao and Zhang (2015)'s findings suggest that the market does

not reward smoothers, which is opposite to the finding of Hunt et al. (2000), as well as contrary to the anecdotal evidence, e.g., in Graham et al. (2005).

Thus, this paper seeks to verify whether income smoothing is related to deceptive or informative managerial acts, in an environment where corporate control is weak, which gave more opportunity for managers to conduct such act. This study concentrates on income smoothing in Malaysia. Using four corporate governance attributes namely audit committee size, the frequency of audit committee meeting, the proportion of non-executive director, and the proportion of independent director in audit committee, this study tests whether firms with strong audit committee attributes is linked to higher or lower propensity to smooth income. The positive association between audit committee attributes and income smoothing indicates support for informative perspective, while the negative association implies that firms with strong corporate governance perceive income smoothing as a deceptive tool. To achieve this objective, this study follows Tucker and Zarowin (2006) and Li and Richie (2016) in calculating income smoothing measure.

Our findings contribute to the existing literature in two main ways. First, we add new evidence to the scant literature pertaining to income smoothing, and second, to shed more light on emerging markets especially after serious corporate governance reforms.

## II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

In this study, we analyze how a firm with audit committee perceived income smoothing practices. If the informative perspective is dominant, the relationship between audit committee and income smoothing would be positive, and vice versa. In Malaysian context, Kamarudin, Wan Ismail, & Alwi (2014) find that audit committee play critical roles in preventing financial fraud.

From prior literature, we postulate that better corporate governance practices minimize excessive risk-taking activities which are determined by considering the tradeoff between risk and benefits. If the firm with strong corporate governance value income smoothing as beneficial to the shareholders, and subscribe to information perspectives school, the empirical result would document prevalent practices of income smoothing in strong corporate governance firm. If income smoothing is perceived as a deceptive tool to detriment the quality of financial reporting, which will lead to a greater risk to shareholders, the audit committee will object the practices. Hence the evidence of income smoothing would only appear in poorly governed firms. For example, Zagorchev and Gao (2015) find that better governance is negatively related to excessive risk-taking and positively related to the performance of the U.S. financial institutions. Specifically, sound overall and specific governance practices are associated with less total non-performing assets, less real estate on performing assets, and higher Tobin's Q. Second, Zagorchev and Gao (2015) show that better governance contributes to higher provisions and reserves for loan/asset losses of financial institutions, supporting the income smoothing

hypothesis. The finding is consistent with Beaver, Eger, Ryan, and Wolfson (1989), Wahlen (1994), Tucker and Zarowin (2006) and Yang, Tan, and Ding (2012) and supports the value relevant information related to the income smoothing hypothesis for financial institutions.

Considering the above arguments, this study tests the following alternate hypothesis:

*Ha: Ceteris paribus, firms with strong audit committees are associated with low extent of income smoothing.*

We employed four proxies for strong audit committee namely audit committee size (ACSIZE), the frequency of audit committee meeting (ACMEET), the proportion of non-executive director in audit committee (NONEX), and the proportion of independent director in audit committee (ACIND).

Our first proxy is the audit committee size (ACSIZE). The Malaysian Code on Corporate Governance and the Listing Requirement of Bursa Malaysia require public listed firms to establish audit committee with at least three directors. The larger audit committee size would lead to more effective monitoring and better financial performance. For example, Dalton et al. (1999) found a positive relation between size and the monitoring function of the board that results in higher performance. More members of the audit committee will have more diverse skills and knowledge to be employed by the committee to enhance monitoring of the managers.

The second proxy is the frequency of audit committee meeting (ACMEET). The Malaysian Code on Corporate Governance (MCCG) requires that the audit committee holds at least four meetings a year. Based on Song and Windram, (2004), the more frequent the meetings held by the audit committee would lead to a more effective decision. Similarly, Abbott, Parker, and Peters (2004) suggest that by holding a meeting at least four times a year, the audit committee enhances a low extent of income smoothing practices. Farber (2005) found out that the firm that is involved in fraudulent has a low frequency of audit committee meetings, thus has a weak governance. Prior studies (e.g. Chen et al., 2006 and Xie et al., 2003) found that the high frequency of board meetings will reduce the possibility of managers in manipulating income. In the context of fraudulent financial statements, and the number of audit committee meetings has a negative relationship with fraud (Owens-Jackson, Robinson and Shelton, 2009).

The third proxy is the proportion of non-executive director in audit committee (NONEX). The executive director is considered as an employee of the firm, thus may induce the conflict of interest between the agent and the owner. Jensen and Meckling, (1976) defined an agency relationship as the contract in which the principal or the owner engage another person or the agent to perform some service on their behalf by means of delegating some authority to make the decision to the agent. The basic principle between principles and the agent is, the agent will be compensated or remunerated to act diligently to manage the company wealth to maximize the wealth of the principle. However, if both parties' relationship is based on the utility

maximizers (Jensen and Meckling, 1976), the agency cost theory suggests that there will be strong reason to believe that the agent will not always act in the best of interest of the principle or in another word the agent might be motivated to manipulate the earnings to suit their interest. To prevent or minimize the unethical practices of income smoothing, good corporate governance is very important for the principal to secure their interest. Thus, the recommendation by MCCG 2012 that requires the board composition to have a balance composition between executive directors, non-executive directors, and independent non-executives motivated this study to test whether the large or small proportion of non-executive director (NONEX) have any correlation with the extent of income smoothing among the listed companies in Bursa Malaysia.

The fourth proxy is the proportion of independence director in audit committee (ACIND). Independent directors are the directors who have no connection with the firm thus have no conflict of interest in the company as they are not remunerated or provided by the company with an incentive except director's fee (Hermalin and Weisbach, 1988). Beasley (1996) and Uzun et. al. (2004) found out that firms that committed fraud have fewer gray directors and independent directors in the board composition as compared with firms that non-fraudulent. Thus, the independent directors in are regarded as an effective tool in strengthening the corporate governance in the firms as suggested by Fama and Jensen (1983). We assume that a firm with a higher proportion of independence directors and the smaller the size of boards would attenuate the likelihood of the firms presenting misrepresented or manipulated financial information.

### III. RESEARCH METHODOLOGY

#### A. Sampling and data collection

We draw the sample from all Malaysian publicly listed companies from the year 2008 to 2014 as the calculation for income smoothing score requires at least seven years financial data. The financial information was downloaded from OSIRIS database, while the corporate governance variables were manually extracted from corporate reports. Our final sample was determined after performing several procedures. First, we deleted firms with missing values for any of the dependent and independent variables included in the study. Second, we excluded all financial institutions (SIC code between 6000 and 6999), such as banks, life insurance firms, nonlife insurance firms, real estate investment and services, real estate investment trusts, suspended equities and financial services in general because of the atypical financial structure, similar with previous researches (e.g. Kamarudin, Wan Ismail, & Samsuddin, 2012). Third, we removed utility companies (Standard Industrial Classification [SIC] code between 4900 and 4999) because they are regulated and therefore are likely to differ from other companies with respect to operating decisions. Finally, to mitigate the influence of outliers, we drop observations that fell in the top and bottom 0.5% of the absolute value of discretionary accruals, and those with absolute value of studentized residuals greater than 3 (Wan Ismail, Kamarudin, & Sarman, 2015), leaving a final sample of 608 firm year observations.

#### B. Income Smoothing model

Gordon (1964) and Eckel (1981) are the earliest researchers that developed frameworks to classify smoother or non-smoother firms. The method has further advanced by examining the extent of income smoothing based on the use of discretionary accruals, measured using Jones' (1991) model and modified by Kothari, Leone, and Wasley (2005).

In this research, we followed Tucker and Zarowin (2006) which introduced the calculation of the correlation between the change in discretionary accrual proxy ( $\Delta DAP$ ) and the change in pre-discretionary income ( $\Delta PDI$ ). According to this measure, a more negative correlation between  $\Delta DAP$  and  $\Delta PDI$  indicates more income smoothing.

To calculate income smoothing measure, we first estimate discretionary accruals using the following model:

$$TACC_{it} = \beta_0(1/ASSETS_{it-1}) + \beta_1(\Delta REV_{it} - \Delta REC_{it})/ASSETS_{it-1} + \beta_2 PPE_{it}/ASSETS_{it-1} + \mu_{it} \quad (1)$$

where:  $TACC_{it}$  is the total accruals;  $ASSETS_{it}$  is total assets;  $\Delta REV_{it}$  is the change in revenue ( $\Delta REV_{it}$ );  $\Delta REC_{it}$  is the change in receivables;  $PPE_{it}$  is total net property plant and equipment; and  $ASSETS_{it-1}$  is the lagged of total assets.

The regression is performed for each year of observation to calculate the non-discretionary accrual (NDA) values for each firm from the year 2008 to 2014. Non-discretionary accruals proxy (NDAP) are the fitted values of regression (1) and the discretionary accruals proxy (DAP) for each firm are the difference between total accruals (TACC) and non-discretionary accruals proxy (NDAP). The pre-discretionary income (PDI) is calculated as net income (NI) minus discretionary accruals proxy (DAP).

We then calculate the extent of income smoothing, measured as the correlation between the change in discretionary accruals and the change in pre-discretionary income,  $CORR(\Delta DAP, \Delta PDI)$  using the current year (2014) and past six years' observations. Following Tucker and Zarowin (2006) and Li and Richie (2016), income smoothing measure (IS) is calculated by converting the correlations into reverse fractional rankings by industry groups. The highest income smoothers (most negative correlations) having high rankings and lowest income smoothers (less negative correlations) having low rankings. Firms with lowest correlations are firms with higher income smoothing, whereas firms with higher correlations are firms with lower income smoothing. For ease of interpretation, we multiplied the correlation value with negative one.

### IV. REGRESSION MODEL

The following regression model tests the association between the extent of income smoothing practices and audit committee attributes namely audit committee size (ACSIZE), audit committee meeting (ACMEET), the proportion of non-executive (NONEX), and the proportion independent audit committee in

audit committee (ACIND). The regression model also incorporates several control variables, namely auditor size (BIG4), firm size (FSIZE), leverage (LEV), growth (GROWTH), profitability (PROFIT), and industry effect (Industry-effects) as control variables.

$$IS_i = \beta_0 + \beta_1 ACSIZE_i + \beta_2 ACMEET_i + \beta_3 NONEX_i + \beta_4 ACIND_i + \beta_5 BIG4_i + \beta_6 FSIZE_i + \beta_7 LEV_i + \beta_8 GROWTH_i + \beta_9 PROFIT_i + \beta_{10} Industry-effects + e_i \quad (2)$$

Where: IS is the correlation between the change in discretionary accruals and the change in pre-discretionary income CORR(ΔDAP, ΔPDI) multiplied by negative one; ACSIZE is the total numbers of directors in the audit committee; ACMEET is the total numbers of audit committee meeting held during the financial year; NONEX is the proportion of non-executive directors in the audit committee; ACIND is the proportion of independent directors to the total of audit committee size; BIG4 is a dummy variable that takes value 1 if the auditor is BIG 4 audit firm, 0 otherwise; SIZE is the natural log of total assets; LEV is the total debt divided by total assets; GROWTH is the change in sales deflated by prior year sales; PROFIT is the current earning per share (EPS) of firms; and Industry-effects are dummy variables for relevant industry, 0 otherwise.

## V. FINDINGS AND DISCUSSIONS

### A. Descriptive statistics

Table 1 presents the descriptive statistics for the independent and control variables. The extent of income smoothing practices (IS) has a minimum value of -1.000 and the maximum correlation is 1.000. The correlation's means is 0.837. The minimum number of the audit committee (ACSIZE) is two members while the maximum number of audit committee member in the sample is nine members. On average, the audit committee has three members. The minimum number of audit committee meeting is one time while the highest number of audit committee meeting is 15 times whereby the audit committee meets approximately five times a year in average. For the proportion of non-executive director (NONEX), the minimum value is 0.667 while the maximum number of non-executive directors in the samples is 1.000 which the average number of NONEX is 0.923. The proportion of independent directors in audit committee has an average value of 0.887 with a minimum value of 0.333 and maximum value of 1.000.

Table I: Descriptive Statistics

	Mean	Std. Dev	Min	Max
IS	0.837	0.316	-1.000	1.000
ACSIZE	3.318	0.670	2.000	9.000
ACMEET	4.983	1.219	1.000	15.000
NONEX	0.923	0.182	0.667	1.000
ACIND	0.887	0.157	0.333	1.000
SIZE	8.676	0.638	6.869	11.044
LEV	0.209	0.319	0.000	6.592
GROWTH	0.134	1.305	-1.000	30.765
PROFIT	0.103	0.281	-3.963	2.347

For the control variables, the firm size (SIZE) has the average value of 8.676 with minimum value of 6.869 and maximum value of 11.044. The firm leverage (LEV) have a minimum value of 0.000 while the maximum is 6.592 and the leverage mean of 0.209. For growth (GROWTH), the lowest value of -1.000 and the highest value of 30.765. The minimum value for profitability (PROFIT) of the firms is -3.963 while the maximum value is 2.347 while the mean value is 0.103.

### B. Empirical Results

Table 2 presents the main regression estimates for two models - with and without industry effects. The results from both models show that the coefficient for the audit committee size (ACSIZE) are significantly negative suggesting that larger audit committee size is associated with lower extent of income smoothing. This is consistent with Dalton et al. (1999) who argued that the audit committee size is strongly linked to the monitoring function of the board hence resulting in higher firm performance. We also find that firms with active audit committee particularly with more frequent meetings were associated with less income smoothing practices, showed by the negative coefficients for audit committee meeting (ACMEET) in both models. Our finding support prior results where firms involved in manipulating income have a weak governance particularly low frequency of audit committees meetings (Farber, 2005) and board meeting (Chen et al., 2006; Xie et al., 2003). The findings also report that the coefficients of audit committee independence (ACIND) in both models are positive and highly significant (p<0.001), implying that firms with high proportion of independent director in the audit committee would have a lower income smoothing, consistent with Beasley (1996) and Uzun et. al. (2004). For the proportion of non-executive director in audit committee (NONEX), the coefficients are insignificant, showing lack of influence on income smoothing practices.

Table II: Regression Summary Statistics with industry effect

Model	Model 1	Model 2
Intercept	1.446*** (7.273)	1.664*** (7.860)
ACSIZE	-0.041** (-1.969)	-0.044** (-2.120)
ACMEET	-0.026** (-2.072)	-0.025** (-2.030)
NONEX	0.021 (0.260)	0.011 (0.130)
ACIND	-0.429*** (-6.377)	-0.414*** (-6.130)
BIG4	-0.037 (-1.370)	-0.024 (-0.860)
SIZE	0.006 (0.266)	-0.012 (-0.520)
LEV	0.006 (0.230)	0.005 (0.160)
GROWTH	0.007** (2.215)	0.008** (2.560)
PROFIT	-0.144***	-0.144***

	(-2.721)	(-2.800)
<i>Industry-effects</i>	No	Yes
<i>N</i>	604	604
<i>F-stats</i>	5.47	3.89
<i>Adj. R<sup>2</sup></i>	0.0693	0.0693

The reported t-statistics are in parentheses and adjusted for heteroscedasticity (White, 1980). Asterisks denote statistical significance at the 1% (\*\*\*) level, 5% (\*\*), or 10% (\*) level, respectively.

The results for the control variables indicate that firm profitability (PROFIT) has significant negative coefficients ( $p < 0.001$ ) consistent with prior evidence that firms with high profit have lower propensity to smooth earnings (Tseng & Lai, 2007, and Wan Ismail, Kamarudin & Ibrahim, 2009). In addition, we find that high growth firms have higher extent of income smoothing, in which the coefficients for GROWTH are significantly positive for both models. However, we found no significant results for firm size (SIZE), leverage (LEV), and auditor (BIG4).

From the results in both models, we find that firms with strong audit committee have lower extent of income smoothing, hence supporting the deceptive view of income smoothing. This view perceived that managers manipulate earnings to satisfy their own benefits and self-interest at the expense of the shareholders probably to maximize bonuses, increment and other incentives. To accomplish the objectives managers may shift the timing of the firm's event's recognition, either postponing or recognized the expenses or transactions early where such recognition will shows smooth effects on reported income variation over time (Ronen and Sadan, 1975).

### C. Sensitivity Analysis

For robustness test, we re-estimate income smoothing using the coefficient of variation method as introduced by Eckel (1981). The Eckel's method has been extensively used in income-smoothing studies (Albrecht & Richardson, 1990; Michelson et al., 1995; Carlson & Bathala, 1997; Wan Ismail, Kamarudin, & Ibrahim, 2005) to distinguish between smoothing and non-smoothing firms. We determine smoothing firm when the coefficient of variation of sales is greater than the coefficient of variation of income. The firm is considered as an income smoother if the one period change in income is lower than the one period change in revenue. We use the logistic regression analysis and found that the results support our main results.

## VI. CONCLUSION

The aim of this paper is to examine which income smoothing perspective is more prevalent that is by considering four audit committee attributes. If the informative perspective is dominant, the relationship between audit committee and income smoothing would be positive, and vice versa. The findings show support for deceptive perspectives, where this study finds evidence of low income smoothing in firms with strong audit committee attributes, i.e. a large number of audit committee members, a high frequency of audit committee, and a high proportion of independence directors in the committee. Firms with strong audit

committees have a low extent of income smoothing, hence supporting the view of income smoothing as least informative or deceptive. The results show that strong audit committees curb income smoothing practices by managers.

A limitation of this study is that there is a possibility of classification bias in determining firms as non-smoother as the model requires long period of data. Factors such as economic and business restructuring might influence the smoothing trend. Hence, we attempt to address this problem by incorporating alternative measures for income smoothing. Going forward, the present study can be extended by examining other dimensions such as managers' bonus compensation and firms' political costs, ownership structure, audit committee effectiveness, and function of an internal auditor.

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# Analysis of Stakeholders on Participatory Trash Management Program in Realizing Trash Free Territory in Bandung City

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DOI: 10.29322/IJSRP.8.8.2018.p8039  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8039>

**Abstract:** The Trash problem becomes a major challenge faced by the entire community of Bandung city. The Government and the community began to actively seek a solution in realizing a free living conditions, problems of trash. It's therefore necessary the proper handling, especially in waste management involving various elements of society. This research aims to know the role of stakeholders in the management of waste. The approach used is the qualitative approach with case studies. Research conducted at the RW 09 Cigelereng Village Regol District Bandung City. The collection of data obtained through observation, interview techniques, the study of librarianship, documentation and study then analyzed using data reduction, the presentation of data and verification of data. The data obtained are then validated using the triangulation technique of the data. The research results showed that the role of stakeholders in waste management in RW 09 Cigelereng Village Regol District Bandung City has not been optimal. This is caused by a lack of coordination between stakeholders. There are two key players in the handling of trash is the Government and society. The role of the community is very dominant at this stage of the implementation of the waste management. Meanwhile, at the stage of planning and monitoring of dominant exercised by the Government which functions as a facilitator and regulator.

**Key words:** Roles, Stakeholders, Participatory, Trash management.

## 1. Introduction

Optimal waste management is a major challenge faced by society of Bandung city. Management and waste reduction efforts continue to be undertaken by various parties in an attempt to reduce the trash directly from the source. The increase in population has become one of the influence on the increase in the volume of trash in the city of Bandung. Whereas the higher the amount of trash generated by the community then it should be followed by optimal waste management so that the trash problem did not provide the impact worse for the environment.

Trash is one of the environmental problems that can endanger the living conditions of individuals and society in General. To make the society healthy living conditions and prosperous, it must be supported by a healthy settlement condition and clean. Based on Republic Indonesia Act No. 18 of the year 2008 About waste management, trash is the remains of the everyday activities of humans and/or natural processes that shaped solid. Waste is not managed properly will be a source of environmental pollution and disease that is very detrimental to human life.

The trash problem has an impact is bad for the environment has high urgency to immediately resolved, because the quality of the environment will have an impact on the viability of life as well as the welfare of the society. The various stakeholders in the environment or elements of society should work together to safeguard and preserve the environment, especially in fostering awareness in the citizens about waste management

## 2. Literature Review: The role of Stakeholders in waste management

Trash is environmental problems unresolved until this day. The growth of population has become an indicator of the high volume of trash each day continues to increase. This is a serious problem given the decline in environmental quality resulting from waste can cause a bad conditions one of which society would be vulnerable to illness. The role and need for encouragement of the Stakeholders to restore the environmental quality in order to return.

Stakeholders is a group or individual who can affect or is affected by a specific goal achievement. Freeman (in Solihin, 2010, p. 48). Such pointed views the term stakeholders not only answering who the stakeholders are, but more than that the views above look at the relationships, the issue, the views and the influence of the stakeholders in a given activity or the program.

In line with the views of Dill (in Solihin, 2010, p. 49) which stressed the importance of taking into account the role that stakeholders can do in affecting the decisions that will be made. In his view, Dill stated that during these often stakeholders considered or treated as factors that are outside of strategic planning. When it should stakeholders should be given an active role in

the making of decisions made by management or organization. First, at present we not only pay attention to the influence of the organization alone but also the participation of stakeholders. The wider community can influence the achievement of the objectives of an organization, so their presence to be reckoned with as the parties who have a interests against the operations of an organization.

Basically in the implementation of waste management, the responsibility about the waste problem is not just there on the Government as the State apparatus but the community also has an important role in the settlement of the problem of waste given the community as a major producer of trash. As well as in their implementation, the public and Government can't run each to fight the trash problem encountered, but should equally cooperated and supported also by other parties (stakeholders) so that can make in the achievement of objectives. The function and the role in its development can only experience the changes caused by the independence community in managing waste in the environment.

As well as in the issue of trash each day became a serious problem in the city of Bandung. Waste management activities involving various elements in society become very important. Stakeholders in the management of this waste will largely determine the success of the completion of the trash problem. Waste management program in this, the public should emerge as the main stakeholders, while the Government along with other parties who acted as the parties contributing to the passage of waste management activities. Stakeholders can play a role in influencing decision making or planning against the concerning what it will do in the future. Stakeholders will be interacting in accordance with its function and role to give influence on the success of a program or activity. According to Widyatmoko and Moerdjoko (in Faizah, 2008), to know the functions and roles of stakeholders in waste management stakeholders can be grouped as follows:

- a. Government: regulator, facilitator
- b. Community: waste management, beneficiaries of results and processes
- c. private: investor
- d. experts/academics: Planner
- e. NGO: companion, facilitators.

It is ideally community component will support each other in the implementation of waste management, such as in the strengthening of regulatory, mentoring, an increase in knowledge and technology, as well as institutional strengthening of institutional strengthening.

According to Reed et al. (in Oktaviani, 2015) stakeholders involved in a program or activity can be categorized into:

1. Context setter or keep satisfied, i.e. stakeholders that have a high influence but low interests.
2. Key player or manage closely, i.e. stakeholders actively since it has high power and influence on the development of the program.
3. Subjects or keep informed, that the stakeholders have high importance but low influence. But can be influential when stakeholders it formed an alliance with other stakeholders.
4. Crowd or monitor, i.e. stakeholders that have low interest and influence which is also low.

Classification of stakeholders to Reed above will help explain the role of each stakeholder that did waste management in Regol district. So in this analysis it will be known who the stakeholders are becoming the main implementers and stakeholders who have been carrying out its role in achieving the common goal.

### 3. Methodology

The methods used in this research is a case study with a qualitative approach. Research conducted at the RW 09 Cigelereng Village Regol District Bandung City. Informant research consists of the Chairman of the RT 02, Secretary/Treasurer in *KAKASIH* Group RT 03, *KAKASIH* community members, employees Cigelereng Village, employees BPLH of Bandung City, the NGOs, consultants of waste management, and Builder of the Foundation biomethagreen.

This study used a qualitative approach because of trying to understand the phenomenon of what is experienced by the subject of the research. Meanwhile the methods used namely case study which is a model that emphasizes on the exploration of a "limited systems" (bounded system) in one case or several cases in detail, along with data mining in depth involving various sources rich in context. According to Creswel, 2010, the results of the collection of data obtained through observation, interview techniques, the study of librarianship and documentation are then analyzed using data reduction, data presentation, and data verification (Milles and Huberman, 2007). Data successfully retrieved then validated using the technique of triangulation of the data.

### 4. Discussion

This study aims to reveal the role of stakeholders in the RW 09 Cigelereng Village Regol District Bandung City in waste management. In order to obtain the optimal data then research focused into three phases i.e. the planning stages, implementation stage and monitoring and evaluation stages. While to acquire enough information of this research involves the stakeholders include: 1) the Government which in this case the environmental agency of the Bandung City and the village of Cigelereng; 2)

private parties that in this case the Corporate Social Responsibility (CSR) of Bank Jabar Contact Indonesia Foundation (YKI) and Biomethagreen Foundation; and 3) community which in this case include local community institution named *KAKASIH* (our Community Area clean).

### **Stages of Planning**

In the planning stages, there are four activities undertaken by the society include the preparation of a plan of activities, socializing or extension of the concept of waste management, survey and build partnerships. The planning process undertaken include draft licensing, provision of infrastructure and community involvement plan on the planning of this Government and society into a key player.

On planning activities for this community serves as the main implementers and users of the results of the process as well as waste management. The community has the most prominent role because it is engaged in any activity conducted with forces that owned that is the power and availability of time. Meanwhile, the Government has a high influence on the development of waste management activities with the authority and policy. In the planning stages of this, private parties and NGOS have not been involved in the planning. Private parties which in this case includes CSR of Bank Jabar less role because more precise technical planning is managed by communities and local government. While the private companies are more focused on the awarding of the grant to support the implementation of the program. The NGO parties which include Contact Indonesia Foundation (YKI) and Biomethagreen Foundation as an escort community and facilitator at this stage are included in the category of crowd or the monitor where the NGO parties at this stage have not been running the role with a maximum activities conducted in the community at the stage of planning.

### **Stages of Implementation**

In the stage of implementation of some activities conducted in these waste management including waste management training and infrastructure setup. At this stage of the implementation of the party's most instrumental and have power and influence high enough on program development (key player) is a society and the Government. The active role of the community as a result of users and processes very influential towards the sustainability of waste management activities, where these activities are in dire need of community participation to achieve the goal. The community in the process of transportation, sorting and processing of trash with the supervision of the Government. One of the flagship programs of the waste management program in Regol District is rubbish Calendar. On Monday and Thursday of society doing the separation of organic waste. The bins are minced and marinated, after that organic waste into fuel biodigester capacity 15 kg fertilizer into liquid and gas for the stove. Meanwhile Tuesday and Friday was chosen to separate trash is inorganic. Some residents there that sells paper or plastic bags themselves. While on Wednesdays and Saturdays are the time to transport the trash pick up litter residue. This schedule is created and kept by the citizens

In the implementation of waste management, the Government included in the category of key players but the Government has not run its role optimally. That is because at the time the waste management training activities the Government only facilitate some training but not carried out continuously or sustainable. In addition the training given to any society tends to follow a program of the City Government are being implemented not as a special training for the regions targeted Junk-free program (KBS). First BPLH of Bandung City has been commissioned to the NGOS as the parties who collaborate with BPLH to accompany the Bandung area. While the stakeholder categories include crowd or monitor is the NGO parties. The NGO community as an escort party has yet to run its full potential because of the role of NGOS is not involved at the time the infrastructure setup is done in the planning stages. *Kakasih* NGO parties during the execution of the program helped in the implementation of technical training and also provide the motivation of people who are involved in implementing the program.

### **Stage of Monitoring and Evaluation**

In the stage of monitoring and evaluation there are two activities conducted in the course of monitoring, namely waste management activities (monitoring) and the preparation of the report. In the implementation of monitoring and evaluation that are included in the category of key player is the NGO and private parties since both of these same stakeholders who have power and influence in the development of programs in both activities performed at this stage. Given the activity monitoring or monitoring and evaluation will be very influential towards the sustainability of the communities in the future. Whereas the community which belong to the category of crowd or the monitor. Not many community parties play a role at this stage due to the role of the community as beneficiaries or target Junk-free program (KBS) 2015 has been represented by NGOs and private parties in carrying out the activities that are in the stage of monitoring and evaluation that is the course of the monitoring activities and the preparation of the report. As for the involvement of the community in the activities of monitoring only involve sysop Community *KAKASIH* especially its leader. Whereas at the stage of making the community report is not at all involved, and that becomes a weakness at this stage is that the parties who perform monitoring and assessment report results do not convey the result to the community.

In carrying out its role, there are barriers experienced by the stakeholders involved in waste management in the RW 09 Cigelereng Village Regol District Bandung City. These barriers usually appeared when the community comes from the difficulty of adjusting the time in the community to undertake activities in waste management given the flurry of each community vary. In addition the amount of training that was provided to the Government is very limited. In line with the opinion of the Dil (in Solihin, 2010, p. 49) that "the importance of taking into account the role that can be undertaken by stakeholders in influencing the decisions to be made". If this still left then the sustainability of waste management activities will be a little threatened, and annoying as well as implementation of the role of other stakeholders.

## 5. Conclusion

The role of stakeholders in waste management in the RW 09 Cigelereng Village Regol District Bandung City has not been optimal. This is caused by a lack of coordination between stakeholders. The role of key stakeholders (society) player was dominant at this stage of the implementation of the waste management. Meanwhile, at the stage of planning and monitoring of dominant exercised by the Government which functions as a facilitator and regulator. The roles have not been optimal waste management program is causing it to be difficult to survive, because the flow of waste management to deliver positive benefits in the form of an increase in the quality of the environment and increased revenue.

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# Assessment of Serum Lipid Profile in patients with chronic Hepatitis C

## Assessment of Serum Lipid Profile in patients with chronic Hepatitis C

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DOI: 10.29322/IJSRP.8.8.2018.p8040

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8040>

**Abstract:** Chronic Hepatitis C is the most common cause of liver disease and liver cirrhosis and it is due to common spreading of HCV by liver transplantation in the United State (U.S) Australia and most of Europe. Approximately 170 million people are affected by HCV worldwide and 3% are in global population. HCV is the most common chronic blood born infection in the U.S and its involved 40% in chronic cases of liver disorders (Wasley & Alter, 2000)). HCV was first time isolated from a person who has not affected with hepatitis A and hepatitis B in 1989 (QL, et al., 1989). Shortly after the cloning of HCV this new-found virus was discovered to be the cause of approximately 90% of non-A and non-B hepatitis in the U.S. (Lauer & Bruce, 2001)

**Objectives:** To investigate the serum lipid profile in patients with chronic Hepatitis C. To explore the variation in lipid profile due to Hepatitis C.

**Methodology:** Fasting blood samples was collected from patients that are already diagnosed with Hepatitis C virus infection in a cold Lithium heparin anticoagulant and immediately centrifuged at 8000xg 4°C for 5 minutes. To minimize the losses of lipid metabolism the sample was stored at -80°C and examined the all parameter of lipid profile on Hitachi 912 (routine chemistry analyzer).

**Results:** In this study 100 subjects were taken in this 59 (59%) were male and 41 (41%) were female. in this study HCV positive patients were included which were

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8040>

already diagnosed by using Bio Molecular technique PCR and then blood specimen of these 100 patients were examined for assessment of serum lipid levels. All the parameters (Cholesterol, Triglycerides, LDL Cholesterol, HDL Cholesterol, and VLDL Cholesterol) of lipid profile were performed on automatic Hitachi 912 (Instrument which is used for routine chemistry analysis). In these 63 % patients was normal, 3% of hyperlipidemic and 34% were hypolipidemic patients.

**Conclusion:** This study indicates that the advancement of Hepatitis C viral infection can lead to decrease level of lipid profile.

**Keywords.:** HCV (Hepatitis C Virus), HDL (High density lipoproteins), LDL (Low density lipoproteins), VLDL (Very low density lipoproteins), HBV (Hepatitis B Virus), RIBA (The Recombinant immunoblot Assay), PCR (Polymerase Chain Reaction), NHANES (National Health and Nutrition, Examination Survey).

**Introduction:** HCV infection is a public health problem. Approximately 170 million people worldwide and 200,000 in UK are infected with HCV (An RNA virus of the Flavivirus family up to 2% of people have been expressed to HCV with high rate in Asia and Africa)(Marks , Webster, & Baloom, 2002).Recent studies indicate that HCV accounts for 70% of all cases of chronic Hepatitis and is responsible for 30% of all liver transplants performed in developed countries. Persistent HCV infection triggers

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immune response resulting in intrahepatic inflammation.(Feng, et al., 2014).Chronic Hepatitis C is the most common Cause of liver disease and liver cirrhosis and it is due to common spreading of HCV by liver transplantation in the United State (U.S) Australia and most of Europe. Approximately 170 million people are affected by HCV worldwide and 3% are in global population. HCV is the most common blood borne infection in the U.S and it is involved 40% in chronic cases of liver disorder (Wasley & Alter, 2000).HCV was first time isolated from a person who has not affected with hepatitis **A and hepatitis B** in 1989.(QL, et al., 1989). Shortly after the cloning of HCV this newfound virus was discovered to be the cause of approximately 90% of non-A, non-B Hepatitis in the U.S. (Lauer & Bruce, 2001)

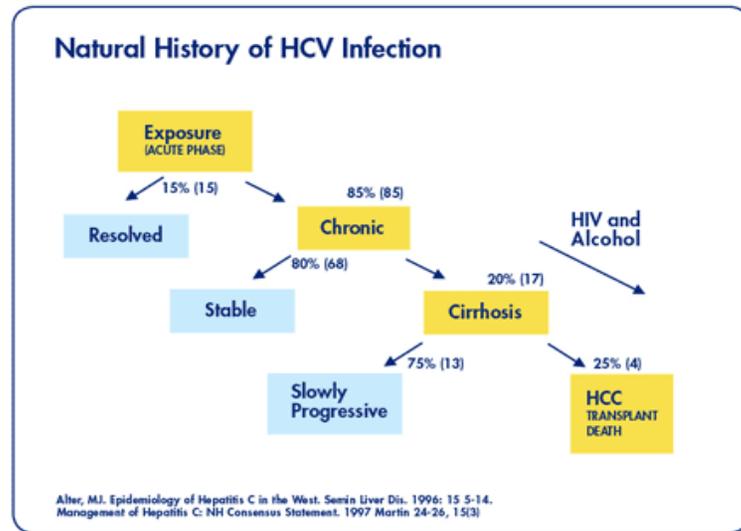


Figure 1  
Natural history of HCV in the form of diagram (Alter, 1997)

### What is hepatitis?

“Hepatitis” means inflammation of the liver. Toxins, certain drugs, some diseases, heavy alcohol use, bacterial and viral infections can all cause hepatitis. Hepatitis is also the name of a family of viral infections that affect the liver; the most common types are hepatitis A, hepatitis B, and hepatitis C.

### What is Hepatitis C?

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8040>

Hepatitis C is a contagious liver disease that range in severity from a mild illness lasting a few weeks to a serious, lifelong illness that attacked the liver. It results from infection with the Hepatitis C virus (HCV) which is spread primarily through contact with the blood of an infected person Hepatitis C can be either “acute” or “chronic”.

### HEPATITIS C VIRUS

**Important properties:** HCV is a member of Flavivirus family. HCV is an enveloped virion containing a genome of single standard positive polarity RNA. It has no virion polymerase. HCV replicates in the cytoplasm of hepatocytes but is not directly cytopathic.

**Replication Cycle:** The replication of HCV is not exactly known because it has not been grown in the cell culture. Other viruses which are related to the Flavivirus family replicate in the cytoplasm of hepatocytes and then translate the genome RNA into large polypeptides, from which functional proteins are cleaved by virion encoded protease. This protease is the main target to treat the HCV. This replication of HCV in the liver is enhanced by a liver specific micro-RNA. The principle of this micro-RNA is to increase the synthesis of mRNA. Micro-RNA is also known as to enhance the synthesis of mRNA in cells of the tissue (Levinson, 1989).

**Routes of Transmission:** Human is a primarily reservoir of HCV. Transmission of HCV is primarily via infected blood; risk of transmission includes blood transfusion before 1992. The other than transmission factors are

- Uses of intravenous drugs
- High risk sexual activity
- Solid organ transplantation from infected Donor
- Occupational exposure
- Haemodialysis
- Birth to an infected mother
- Intra nestle cocaine use

**Chronic hepatitis C infection:** Chronic hepatitis C is noticeable by the persistence of HCV polymer in infected patients for a minimum of 6 months after the exposure of acute infection. HCV is self-limiting in exactly 15%-25% of patients in whom HCV polymer within the blood serum becomes undetectable. Approximately 75%-85% of infected patients don't clear the virus in 6 months, and chronic infectious disease develops. The rate of chronic HCV infection is suffering from several factors, including the age at time of infection, gender, ethnicity, and the development of jaundice throughout the acute. (Stephen & Timothy, 2006)

Risk factors for developing chronic HCV infection

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**Risk factors:**

- Male gender
- Immunosuppression
- African American race
- Age at the time of infection >25 years
- HIV infection
- No jaundice for symptoms during acute infection

**Pathogenesis and immunity:** HCV taints liver cells (hepatocytes) fundamentally however there is no proof for an infection incited cytopathic consequences for liver cells. The demise of hepatocytes is presumably caused by resistant assault by cytotoxic T cells. HCV contamination unequivocally inclines to hepatocellular carcinoma however there is no confirmation for an oncogene in viral genome or for an inclusion of duplicate of viral genome into DNA of a tumor cells (Levinson, 1989). Higher admission of liquor enormously upgrades the hepatocellular carcinoma in HCV contaminated individual so we can state that the disease is caused by drawn out harm of liver and resulting strange development of liver cells (Levinson, 1989). Antibodies against HCV are made however around 75% of patients are incessantly tainted and keep on producing infection for no less than multi year. Unending carriage of HCV is higher than HBV. Perpetual dynamic hepatitis and cirrhosis happen around 10% of these patients. In once the disease clear then it isn't known precisely whether reinfection can happen or it is a long lasting invulnerability (Levinson, 1989)

**Clinical findings:** Clinically the acute infection of HCV is mild rather than infection HBV. Patients presents with these findings:

- Fever
- Anorexia
- Nausea
- Vomiting
- Jaundice

Dark urine, pale faces and elevated transaminase level are seen (Levinson, 1989). HCV infection also leads to significant autoimmune reactions including:

- Vasculitis
- Arthralgia
- Purpura
- Membranoproliferative glomerulonephritis.(Levinson, 1989)

**Laboratory diagnosis:** HCV infection can diagnose by detecting the antibodies against this virus by Elisa because false positive result can occur in an Elisa technique then we use RIBA (recombinant immunoblot assay) for confirmation, if the result of RIBA is positive then a PCR base test perform that detects the presence of viral RNA in the serum of infected individual.(Levinson, 1989)

Isolation of virus from the patients cannot do. A chronic HCV infection diagnose by elevated level of Transaminase. (Levinson, 1989)

**Lipids****What are lipids?**

Any classes of organic compounds that are fatty acids or their derivatives are insoluble in water but soluble in organic solvents. They include many natural oils, waxes and steroids are called lipids.

**What is lipid profile?**

Lipid profile or lipid panel is a panel of blood tests that serves as an initial board. Medical screening tool for abnormalities.

**Parameters of lipid profile test:**

- Cholesterol
- Triglycerides
- High density lipoproteins (HDL Cholesterol)
- Low density lipoproteins (LDL Cholesterol)
- Very low-density lipoproteins (VLDL)

**Lipid metabolism:** Liver plays a central role in lipid metabolism as several pathways are at least in part dependent to this site. Major metabolic processes take place at this level involving the production transportation and storage of apoproteins and lipoproteins as well as catabolism of various lipids and excretion of cholesterol and phospholipids and alteration in liver function resulting from cellular injury leads to change in the serum concentration of cholesterol and lipoproteins (Criston , Costin , Lilana S, & Ion, 2012).Infection with (HCV) leads to hepatic damage which in turn relates to change in alterations of lipid metabolism. Different mechanisms involved dependent on the stage of the liver disease and the metabolic state. Low levels of plasma cholesterol and lipoproteins as well as lower triglyceride (TG) values are usual in chronic liver disease. However, the number of studies which included patients with advanced cirrhosis remains low.(Criston , Costin , Lilana S, & Ion, 2012)

Replication of the hepatitis C virus (HCV) involves several important host lipid interactions. Hepatitis C virion complex with have lipoproteins to from Lipovirions in the host flow. Lipovirions may then utilize low thickness lipoprotein (LDL) receptors on hepatocytes as one component of cell section furthermore the HCV envelope glycoprotein E2 has been exhibited in vitro to bind to lipoprotein and lead to enhanced LDL receptor and CD81 binding. Once inside the hepatocytes, HCV replication requires geranylation of the host protein FBL2 a process dependent on the host cholesterol synthesis pathway. Interruption of this pathway results in dissolution of HCV replication complex. Further, HCV secretion appears to be tied to host apolipoprotein B secretion. Interaction between HCV and host lipids has been shown in clinical studies. Lower serum cholesterol and LDL levels are found in patients infected with hepatitis C when compared with compared with patients with hepatitis B or without infection, (Corey, et al., 2011)

### Methodology:

#### Technique for collecting Venous Blood:

The steps involved in this technique are described below:

1. The patient should sit in a chair. Position the patient and extend the patient's arm.
2. Apply the tourniquet 3-4 inches above the selected puncture site. Don't place too tightly or leave on more than 2 minutes (and no more than a minute to avoid increasing risk for haemo concentration). Wait 2 minutes before reapplying the tourniquet.
3. The patient should make a fist without pumping the hand.
4. Select the venepuncture site.
5. Prepare the patient's arm using alcohol swab. Cleanse in circular fashion, beginning at the site and work outward. Allow to air dry.
6. Grasp the patient's arm firmly using your thumb to draw the skin taut and anchor the Vein. The needle should form a 15 to 30-degree angle with the surface of the arm. Swiftly insert needle through the skin and into lumen of the vein. Avoid trauma and excessive probing.
7. When the last tube to be drawn is filling, remove the tourniquet.
8. Remove the needle from patient's arm using a swift backward motion.
9. Press down on the gauze once the needle is out of the arm, applying adequate pressure to avoid formation of hematoma.
10. Dispose of contaminated materials/supplies in designated containers.
11. Mix and label all appropriate tubes.

Fasting blood sample was collected from patients that are already diagnosed with Hepatitis C virus infection in a cold lithium heparin anticoagulant and immediately centrifuged at 8,000xg 4 °C for 5 minutes. To minimize the losses of lipid metabolism, the samples was stored at -80 °C.

**Polymerase chain Reaction (PCR):** Polymerase chain reaction is basic molecular technique which is used for amplification of the required gene in three steps.

1. Denaturation
2. Primers Annealing
3. Extension

**Qualitative PCR:** In this study HCV qualitative is performed on automatic Abbot Molecular m2000 real-time system (Abbot Molecular, Wiesbaden, Germany) for this purpose 800 ul of patient sample is loaded on to the instrument which quantifies the simple and gives results in international units per milliliter (IU/ml).

**Genotyping PCR:** HCV genotyping is performed using multiplex PCR containing different primers for different genotypes as described by Company kit for this purpose, HCV RNAs extracted using RNA extraction kit from Qiagen (Qiagen, Hidden, Germany). Extracted RNAs subjects to reverse transcription to make cDNA. This cDNA is amplified with type specific primers to get HCV genotypes.

New Hepatitis C virus (HCV) Genotypes System that Allows for identification of HCV genotypes 1a, 1b, 2a, 2b, 3a, 3b, 4, 5a, and 6a.

**Lipid profiling:** Lipid profile or lipid panel is a panel of blood tests that serves as an initial broad medical screening tool for abnormalities in lipids, such as cholesterol and triglycerides. All the parameter (Cholesterol, Triglycerides, HDL Cholesterol LDL Cholesterol, VLDL Cholesterol)

Of lipid profile were performed on automatic Hitachi 912 (Instrument which is used for routine Chemistry analysis) for this purpose 400 ul of patient sample is loaded on to the instrument which analyze the sample and give result in milligram per deciliter (mg/dl).

**Results:** In this study 100 subjects were taken, out of which 59 (59%) were male and 41 (41%) were female. In this study HCV positive patients were included which was already diagnosed by using. Bio Molecular technique PCR and then blood specimen of these one hundred patients were examined for assessment of Serum lipid level. All the parameters (Cholesterol, Triglycerides, HDL Cholesterol LDL Cholesterol, VLDL Cholesterol) of lipid profile were performed on automatic Hitachi 912 (Instrument which is used for routine Chemistry analysis). In these one hundred 63% patients were normal, 3% had raised level of lipid profile and 34% had low level of lipid profile.

**Table No 1.1:** Age of patients

	N	Minimum	Maximum	Mean	Std. deviation
<b>Patients age</b>	100	30	72	54.82	8.365

In these 100 subjects maximum age of patient is 72 year and minimum age is 30year

**Table No 1.2:** Gender distribution

Gender	Frequency	Percentage%
<b>Male</b>	<b>59</b>	<b>59.0%</b>
<b>Female</b>	<b>41</b>	<b>41.0%</b>
<b>Total</b>	<b>100</b>	<b>100.0%</b>

Out of 100 subjects 59 (59%) were male and 41 (41%) were females.

**Table No 1.3:** Frequency distribution of lipid profile results

Results	Frequency	Percentage%
<b>Normal</b>	<b>63</b>	<b>63%</b>
<b>Raised lipids</b>	<b>03</b>	<b>3.0%</b>
<b>Lowered lipids</b>	<b>34</b>	<b>34%</b>
<b>Total</b>	<b>100</b>	<b>100.0%</b>

Out of 100 patients 63 (63%) were normal 3 (3%) had high level of lipids and 34 (34%) low level of lipid profile.

**Discussion:** HCV infection is a public health problem. Approximately 170 million people worldwide and 200,000 in UK are infected with HCV (an RNA virus of the Flavivirus family up to 2% of people have been expressed to HCV with high rates is Asia and Africa (Marks , Webster, & Baloom, 2002).

Chronic hepatitis C is the most common cause of liver disease and liver cirrhosis and it is due to common spreading of HCV by liver transplantation in the United State (U.S), Australia and most of Europe. Approximately 170 million peoples are affected by HCV worldwide and 3% are in global population. HCV is the most common chronic blood borne infection in the U.S and it is involved 40% in chronic cases of liver disorders. (Wasley & Alter, 2000)

The spectrum of severity of chronic hepatitis C varies widely as done the rate of its progression to the cirrhotic stage. This heterogeneity largely depends on host and environmental factors, although the contributing role of viral features such as the HCV genotype has recently been revisited. Cofactors influencing hepatitis C severity and progression include age, gender, and excess alcohol consumption, co infection with other hepatotropic viruses and/or HIV and the metabolic syndrome. The role of the latter in the pathogenesis of hepatitis C has attracted considerable attention in recent years.

HCV virion circulate in serum bound to lipoproteins; lipids have been shown to modulate (and indeed are essential for) the HCV life cycle and an occasionally severe accumulation of triglycerides in hepatocytes is observed in a distinct subgroup of patients in the form of fatty liver. In summary lipid metabolism shows widespread alteration conferring an idiosyncratic profile to HCV infection. This review will discuss these aspects focusing on both their molecular mechanisms and their clinical consequences. ( (Criston , Costin , Lilana S, & Ion, 2012)

**Conclusion:** This study indicates that the advancement of Hepatitis C viral infection can lead to decrease level of lipid profile.

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# Acid producing bacteria Isolated from Brown Rice Vinegar

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DOI: 10.29322/IJSRP.8.8.2018.p8041

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8041>

**Abstract-** Organic brown rice was fermented under anaerobic condition to produce rice vinegar. Lactic acid bacteria which were grown in fermented rice vinegar (pH 4, total acidity 6%) were isolated. Totally six bacterial isolates were identified as *Lactobacillus* spp. by some biochemical characteristics. All isolates gave clear zone which were cultured on MRS agar supplemented with 0.3% CaCO<sub>3</sub>. The cell concentration of the strain BRV 4 was higher acid producing than any other probiotic tested when they were grown in MRS medium. Colonial morphologies of all isolates were convex and white-creamy. All isolates were gram positive and shape of rod. Among these isolates, BRV 4 gave catalase positive and the rest were negative and BRV2 gives methyl red negative. As for motility test, all strains showed negative results. Moreover, the carbohydrate fermentation test (glucose, sucrose, dextrose and lactose) were carried out, it has been found that, all isolates can ferment all carbohydrates.

- Fermented foods already have promoted as being healthful.
- Consumers are familiar with fermented products contain viable microorganisms.
- Probiotics organisms combine the positive images of both fermented food and fermentation organisms.
- The fermented food like products as healthful foods that is recommend for consumption of probiotics.

In addition, there is the important technologic reason for the use of fermented products as carriers of probiotics: many of these products have already been optimized to some extent for survival of the fermentation organisms. Thus, the existing technology can be relatively easily adapted to guarantee sufficient survival of the added probiotic bacteria. However, it must be pointed out that other fermented products (eg, raw sausages and sauerkraut) can serve as carriers of probiotic organisms, but few such products are already on the market.

**Index Terms-** Brown rice vinegar, Anaerobic Condition, Lactic Acid Bacteria, *Lactobacillus* spp.

## I. INTRODUCTION

Rice vinegar is made from fermented rice. Brown rice vinegar tastes better than other vinegar from the store, add the flavor to get more tasteful. BRV can also use for herbs and spices. Vinegar is a the fermented food or cleanser by bacteria. The BRV gives its tangy flavor and also the ingredient that makes useful for household cleaning.

### Definition of probiotic

The microbes in BRV that protects its host and prevents disease. The best-known probiotic in BRV is *Lactobacillus acidophilus* which is found in yogurt acidophilus milk and supplement. Probiotic counter the decimation of helpful industrial bacteria by antibiotic. Probiotic given in combination with antibiotic. It can promote the intestinal tract... Among the probiotic in BRV *L. acidophilus*, *Lactobacillus johnsonii*, *Lactobacillus casei*, *Lactobacillus rhamnosus*, *Lactobacillus gasseri*, and *Lactobacillus reuteri*. *Bifidobacterium* strains include *Bifidobacterium bifidum*, *Bifidobacterium longum*, and *Bifidobacterium infantis*. This probiotics provides dairy products specifically, yogurt like products that is probiotic products. The consequences of this quality with respect to consumer perception are that

Test	Result
Spore forming test	Negative
Catalase test	Negative
Methyl Red test	Positive
Voges Proskauer test	Negative
Citrate test	Negative
Starch hydrolysis	Negative
Glucose fermentation test	Positive(Acid and gas)
Tentative identification	<i>Lactobacillus</i> spp
Lactose fermentation test	Positive

### Objectives

- To study the traditional method of rice fermentation
- To isolate acid producing bacteria from fermented food.
- To assume the isolated bacteria are safe to consume.

The chemical composition of the BRV are acidic, available carbohydrate content, nitrogen sources, mineral content, water activity, and oxygen content, and possible interactions of the probiotics with the starter cultures (eg, bacteriocin production, antagonism, and synergism).

## II. MATERIAL AND METHODS

### Material

Brown rice, brown sugar and salt were collected from Ocean Super Market, Mandalay All glass wear, chemical and lab facilities were used in Department of Biotechnology, Technological University (Kyaukse).

**Methods**

Traditional fermentation methods, weight brown rice, brown sugar and salt were used to add together into distilled water. And released gas and shaken very well every day. After five days, brown rice vinegar was collected by sieving. Bacteria were incubated by plate culture methods on De Man, Rogosa and Sharpe agar (MRS). It is selective culture media for *Lactobaclli*. The Gram stain technique is a differential stain, a procedure that distinguishes between various microorganisms according to their ability to retain certain dyes. The Gram stain depends on the ability of some bacterial cells to resist decolorization longer than others. After another water rinse, you have created a differential stain with purple gram-positive bacteria and colorless gram-negatives. To see the gram-negative cells, it is helpful to add the pink counter stain, safranin.

Brown rice vinegar was measured pH by using pH paper star paper. Cn) Detecting of the acid content was made by titration methods. The present of catalase enzyme in the isolate is detected using hydrogen peroxide. If the bacteria possess catalase, when the amount of bacteria isolate is added to hydrogen peroxide, bubble of oxygen are observed. It is catalase positive. Bubble are not observer, negative. Methyl red broth is used for MR test. Inoculate tube containing Methyl red broth with a pure culture of the microorganism under investigation. Incubate at 35°C for up to 4days. After that add about of the methyl red indicator solution to the tubes. If the color of the

medium change to red, it is positive reaction. If the color change yellow negative medium.

**III. RESULT**

The brown rice were fermented by traditional method for rice vinegar. The air were released in the fermented bottle because the culture of anaerobic probiotic bacteria were needed. After five days, rice vinegar was measured pH-4, acid content were concerned by titration method (Table 4.1). So it was assume that bacteria in it acid producing bacteria. Probiotic bacteria were culture by plate culture method by using MRS media under anaerobic condition (Plate 4.1and Plate 4.2). All six isolated samples are gram positive (Plate 4.3) bacteria and five samples are catalase negative. Five samples are methyl red positive. Therefore, it was assumed that sample BRV<sub>1</sub>, BRV<sub>3</sub>, BRV<sub>5</sub> and BRV<sub>6</sub> may be *Lactobacillus spp.* (Table 4.2)

**Table 4.1 Physico chemical properties of FRV**

Sample	pH	Alcohol	Acid
Sample1	4	–	0.023
Sample2	4	–	0.03
Sample3	4	–	0.03

**Table 4.2 Morphology and Biochemical Properties of Isolated Bacteria**

Sub culture	Cony –Mor	Gram	Shape	Catalase	MR
BRV1	White-Creamy Convex	+	rod	–	+
BRV2	White-Creamy Convex	+	rod	–	–
BRV3	White-Creamy Convex	+	rod	–	+
BRV4	White-Creamy Convex	+	rod	–	+
BRV5	White-Creamy Convex	+	rod	+	+
BRV6	White-Creamy Convex	+	rod	–	+

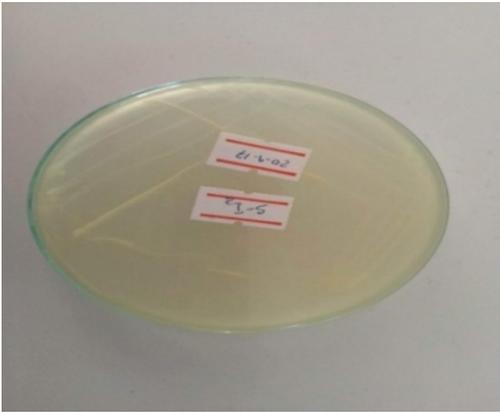


Plate 4.1

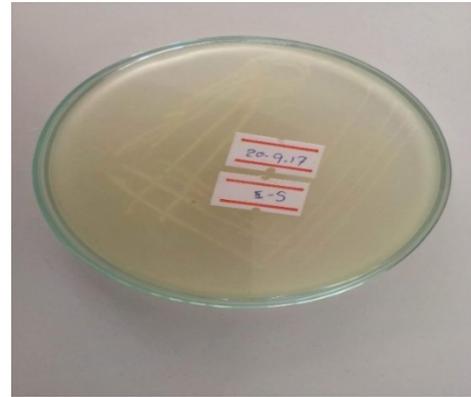


Plate 4.2



Plate 4.3

#### IV. DISCUSSION AND CONCLUSION

Six acid producing bacteria were isolated from three sample bottle in traditional rice vinegar. It can be examined that culture on MRS media, titration for acid content, measure pH, alcohol and specific gravity. The isolated bacteria samples were isolated by gram staining by gram and test by biochemical reaction. According to result data, SI<sub>1</sub>, SII<sub>1</sub>, SIII<sub>1</sub> and SIII<sub>2</sub> are assumed as the Lactic acid producing bacteria but SI<sub>2</sub>, SII<sub>2</sub> are not. Because SII<sub>2</sub> is catalase positive and SI<sub>2</sub> is Methyl red negative. According to literature Lactic acid producing bacteria are catalase negative.

BRV<sub>1</sub>, BRV<sub>3</sub>, BRV<sub>5</sub> and BRV<sub>6</sub> may not confirmed, Lactic acid producing bacteria. It was needed to test acid in rice vinegar that was lactic acid and biochemical reaction for confirmation. Other probiotic bacteria will collect and study for further study. And BRV will be measured its nutritive value for production and food safety.

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# The Paradox of Glass Ceiling Effect: A Study on the Individual Barrier and Organizational Barrier among Female Executives in the Selected Large Apparel Industry, Sri Lanka

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DOI: 10.29322/IJSRP.8.8.2018.p8042  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8042>

**Abstract** - Glass ceiling effect and women is yet the most debatable topic even several years into the 21<sup>st</sup> century. So this study attempts to identify how individual barrier and organizational barrier leads to create the glass ceiling effect among female executives in the selected large apparel industry, Sri Lanka. The sample of the study is 320 executive female employees who employed in large apparel industry, Sri Lanka. Data were collected by using a questionnaire, which consist of 50 questions/statements with 5-point scale. The data analyses include the univariate and bivariate analyses. From the results of the study it was proven that there is a moderately strong positive correlation between the barriers (Individual and Organizational Barrier) and glass ceiling effect. Where 36.2% of the variance of glass ceiling effect is explained by an individual barrier and 40.3% of the variance of glass ceiling effect is explained by an organizational barrier.

**Index Terms** – Glass Ceiling Effect, Individual Barrier, Organizational Barrier

## I. INTRODUCTION

In recent years' women and gender issues turn in to a major area of concern (Bombuwela & De Alwis 2013). And also Kiaye and Singh (2013) further stated that the participation of women in the world, in general, has been on the increase over the past years and it is continuously improving. So women are no longer employed to perform unskilled or semi-skilled jobs due to their access to education and as a result of that, they represent in all the functional areas of the organization (Kiaye & Singh 2013).

According to the Myers (2010), there is an increasing participation from the women in higher education and it is almost similar or greater than males but there is in the disparity in the attainment of leadership positions. One of the prime reasons is an individual barrier that blocks the women attainment of leadership positions (Cross 2010). The individual barrier can be defined as, 'the extent to which individual barriers coming from themselves which influences the outcome' (Bombuwela & De Alwis 2013, p. 9).

And also, women career progression is hammered by the organizational structure and practices (Tlaiss & Kauser 2010). As per the Tlaiss and Kauser (2010) organizational culture, human resource practices, organizational networks, interpersonal relations, mentoring, role modelling and tokenism and minority presence identified as some organizational barriers for women advancement. The organizational barrier can be defined as, 'the extent to which the employees see the organization as being responsible for lack performance of the employee or the extent to which organizational barriers that coming from organizational structure and practices influence the employee development' (Bombuwela & De Alwis 2013, p. 9).

Due to above mention two different points it is important to identify the impact of the individual barrier and organizational barrier on glass ceiling effect which is timely required gender-related issue that prevents female employees to climbed their corporate ladder.

## **II. PROBLEM BACKGROUND AND PROBLEM OF THE STUDY**

Female representation at lower and middle management is on the increasing trend but this situation was not seen in the top or senior management positions in all over the world (Dimovski, Skerlavaj & Kimman 2010). As stated by the Bombuwela and De Alwis (2013) individual barrier is the most influential factors for women advancement. But Clrevenger and Singh (2013) stated female employees are stagnated in a certain position because their organization itself been a barrier for them to be a chief executive officer.

As per the Sri Lanka Department of Census and Statistics, Ministry of Finance and Planning (2014), women represent more than half of the Sri Lankan population but the labour force participation rate is comparatively less than the men. And their employment in managers, senior officials and legislators was less than the male employees (Sri Lanka Department of Census and Statistics 2013). Among all other employers in Sri Lankan manufacturing sector apparel industry is the single largest employer where the industry is feminized with 75 percent of female employees (Sri Lanka Department of Census and Statistics 2013). But all most all the top positions are held by men and around 67 percent female employees were in machine operative positions (Sri Lanka Department of Census and Statistics 2013). Therefor researcher addresses the research problem as, how individual barrier and organization barrier leads to create the glass ceiling effect among Female Executives in the Selected Large Apparel Industry, Sri Lanka?

## **III. METHODOLOGY**

The objective of the study is to find out how individual and organizational barrier impact on glass ceiling effect among female executives in the selected large apparel industry, Sri Lanka. The type of the study was analytical because this study attempts to establish the relationship between these independent variables and the dependent variable (Sekaran & Bougie 2010). And the type of the investigation is a correlational study which aims to outline the significant relationship between two variables (Sekaran & Bougie 2010). This is the field study because it examines how individual and organizational barrier impact on glass ceiling effect among female executives in the selected large apparel industry, Sri Lanka. Therefore, this study can be done in the natural environment where work proceeds normally, that is non-contrived setting (Sekaran & Bougie 2010). No, any artificial or contrived setting was created for the study. This study took over six months for the collection of data. The data for the study was collected within the particular time period and there was no subsequent extension of the research contemplated. Hence the study was cross-sectional in nature. For this study, the data were collected from each individual. Thus, the unity of the study is individual: female executives in the selected large apparel industry. The population of the study is female executives in the selected large apparel industry. The total population size is 1896. The sample size was 320 (Krejcie and Morgan Table 1970). In this study, both primary and secondary data collection methods were used. A questionnaire was used to collect primary data and the secondary data were collected from the various sources such as organization report, books, journals, government reports, internet and other publications. Data collected from primary sources were analyzed using the Microsoft Excel and computer-based statistical data analysis package, SPSS (version 16.0.) and the data analysis include univariate and bivariate analyses.

## **IV. RESULTS**

To investigate the responses for independent and dependent variables of the female executive employees in Sri Lankan selected large apparel industry univariate analysis was conducted. The results of the univariate analysis were given in Table 1.

Table 1: Univariate Analysis

	Individual Barrier	Organizational Barrier	Glass Ceiling Effect
N Valid	320	320	320
Missing	0	0	0
Mean	3.77	3.65	3.67
Median	4.00	4.00	4.00
Mode	4	4	4
Std. Deviation	.679	.630	.670
Variance	.460	.397	.449
Skewness	-1.011	-.845	-.182
Std. Error of Skewness	.136	.136	.136
Kurtosis	2.385	1.056	.326
Std. Error of Kurtosis	.272	.272	.272
Range	4	4	4
Minimum	1	1	1
Maximum	5	5	5

Source: Survey Data

As stated in table 01 individual barrier, organizational barrier and glass ceiling effect were normally distributed. Mean value of the glass ceiling effect is 3.67. it is at a high level and it indicates that female executives are facing the glass ceiling effect. As per the mean value of barriers of glass ceiling effect (Individual and organizational barrier), female executives were think that these barriers lead to creating the glass ceiling effect. Mean value of the individual barrier is higher than the mean value of the organizational barrier.

Bivariate analysis, Person’s correlation between individual barrier, organizational barrier, and glass ceiling effect among female executives in the selected large apparel industry, Sri Lanka were presented in Table 2 and Table 4 respectively. And the results of the simple regression analysis of individual barrier, organizational barrier and glass ceiling effect presented in table 3.

Table 2: Person’s correlation between individual barrier and glass ceiling effect

		Glass Ceiling Effect	Individual Barrier
Glass Ceiling Effect	Pearson Correlation	1	.602**
	Sig. (2-tailed)		.000
	N	320	320
Individual Barrier	Pearson Correlation	.602**	1
	Sig. (2-tailed)	.000	
	N	320	320

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Source: Survey Data

As per the results presented in table 2, Person’s correlation coefficient there is a moderately strong positive correlation between the individual barrier and glass ceiling effect ( $p < 0.05$ ). Further, this proves with the finding of a positive relationship between individual barrier and glass ceiling effect at 5% significance level ( $\beta = - 0.594$ ,  $p = 0.000$ ). And as indicated by R-Square, which is presented in table 3, 36.2% of the variance of glass ceiling effect is explained by an individual barrier.

Table 3: Simple Regression Analysis

Variable	Individual Barrier	Organizational Barrier
Method	Linear	Linear
R-Square	0.362	0.403
Adjusted R Square	0.360	0.401
F	180.361	214.669
Significance	0.000	0.000
B-Constant	1.427	1.203
b-Value	0.594	0.675

Source: Survey Data

Person’s correlation coefficient between the organizational barrier and glass ceiling effect presented in table 4. According to the results, there is a moderately strong positive correlation between the organizational barrier and glass ceiling effect ( $p < 0.05$ ). Further, this proves with the finding of a positive relationship between organizational barrier and glass ceiling effect at 5% significance level ( $\beta = - 0.675$ ,  $p = 0.000$ ). As per table 3, R-Square value 40.3% of the variance of glass ceiling effect is explained by an organizational barrier.

Table 4: Person’s correlation between organizational barrier and glass ceiling effect

Correlations			
		Glass Ceiling Effect	Organizational Barrier
Glass Ceiling Effect	Pearson Correlation	1	.635**
	Sig. (2-tailed)		.000
	N	320	320
Organizational Barrier	Pearson Correlation	.635**	1
	Sig. (2-tailed)	.000	
	N	320	320

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Source: Survey Data

## V. DISCUSSION AND CONCLUSION

The first objective of the analysis is to study about whether the female executives face for the glass ceiling effect. As per the results of the analysis it indicates that majority of the female executives agrees with the statements where they facing for the glass ceiling effect. And the second objective of the study is to investigate the behavior of the individual barrier and the organizational barrier. From the results driven from the analysis it shown that, mean value of the individual barrier is higher than the mean value of the organizational barrier. The potential impact of individual barrier and organizational barrier on glass ceiling effect is the

final objective of this study. So according to the results, there is a moderately strong positive correlation between the individual barrier and glass ceiling effect where 36.2% of the variance of glass ceiling effect is explained by an individual barrier. When concern about the relationship between organizational barrier and glass ceiling effect results proven that there is a moderately strong positive correlation between the organizational barrier and glass ceiling effect where 40.3% of the variance of glass ceiling effect is explained by an organizational barrier.

By considering all these facts, we can conclude that individual barrier and organizational barrier impact on glass ceiling effect among female executives in the selected large apparel industry, Sri Lanka.

Based on the above findings of the study the following recommendations were made which could be extremely useful for the apparel industry for reduce or avoid glass ceiling effect by overcoming of barriers; Individual and organizational barrier, that leads to create the glass ceiling effect.

Gender unbiased company policies to safeguard women form gender related issues, create the work environment that the women can balance their multiple roles, in organizations where a woman's qualifications are found to be inadequate or inappropriate, organizations that are having financial ability they can sponsor women employees' studies and most importantly women needs to put their maximum effort to overcome the barriers which are come from them self that negatively affect them to climb their corporate ladder.

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# Urban Park Arrangement Concept to Support Improvement of Active Physical Activity and Recreation Activity

## (Case Study : Active Parks in Sub-District Gubeng of Surabaya City)

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DOI: 10.29322/IJSRP.8.8.2018.p8043

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8043>

**Abstract** – Some studies on parks in Gubeng Sub-District shown that there is park that can not be used optimally by the community in terms of function, design, accessibility and it's compiler materials. So how the concept of an active park arrangement that can meet and encourage active physical activities and recreational activities on active park in Gubeng Sub-District area? Mixed method sequential is the research approach that used in this research. Data were collected using field observation and questionnaire, then analyzed using descriptive analysis and correlation statistics. Observation and analysis on park characteristics shown that active parks in Gubeng Sub-District belongs to three typologies, first is an active park that available in housing area that serve neighborhood community (neighborhood park). Second is an active park that serve urban society (urban park). Third is an active park which not only serve Surabaya urban community but also citizen from other city or region (urban-regional park). Correlation analysis then show that active park on higher level of service have more variables that are correlated significantly with visitors satisfaction while they're doing activities in active park. Arrangement concept for neighborhood park is directed to use participatory with citizen in housing community. On urban park, the arrangement concept is directed to match existing park theme and major activities that occur in urban park. Next for active urban-regional park, it's arrangement directive is to optimize operational management system as well as their competence of park management personnel to support it's high intensity of park utilization at it's peak visiting hours.

**Kata Kunci** - active park, active physical activity and recreation activity, active park arrangement concept.

### I. INTRODUCTION

Since 2002, Surabaya Local Government has sought to improve the number of parks as part of public green open space provision to fulfill mandate of Law No. 26 Year 2007 on Spatial Planning which ask that 20% (twenty percent) of city area serves as public green open space [1]. On 2016, Gubeng Sub-District Area have already had 124.548,14 m<sup>2</sup>

of public green open space. This numbers consist of 87.132,72 m<sup>2</sup> passive public green open space and 37.415,42 m<sup>2</sup> active public green open space [2].

Active public green open space in Sub-District Gubeng Area are Srikana Park, Biliton Park and Flora Park. Previous research on Biliton Park shown that this park performance is not yet optimal [2] on variables like function, design, accessibility, and it's compiler materials [3]. On Flora Park, almost every day there are students from kindergarden to college student and even out of town tourist groups visit this park and spend their time here doing various activities like studying and doing outdoor exercise [4].

Previous study mention that park accesibility is an important value in encouraging visitors interest to visit a park in almost all urban park studies [5]. Other study also note that feature or park facilities, aesthetic value of park, and perception on safety in urban park are also part of park characteristics that take effect on visitors physical activities while in a park [6]. So in this research, we try to compose concept for active park arrangement that can fulfill and encourage active recreation activity in Gubeng Sub-District active parks.

### II. ACTIVE PHYSICAL ACTIVITIES AND RECREATION ACTIVITIES IN URBAN PARK

Physical activities is any body movement that produced by skeletal muscles that need that require energy expenditure, including activities performed during work, play, completion of domestic work, activities in travel or transportation, and includes recreational activities [7]. Recreation is an activity outside of earning a living which is different from everyday activities, and only done occasionally [8].

There are various types of recreational activities, one of those is recreational activity according to the subject participation. In this type, recreational activity are divided into active recreation and passive recreation. In active recreation, subject goes straight and plays a direct role to perform the recreational action for himself. Subject of this type of recreation usually performe physical activities that spent energy. Those

activities are like sports activities such as hiking and playing soccer, traveling and cplay hildren traditional plays. As for passive recreation, recreational actors are not doing much activities, they just enjoy the object of recreation and more silent. Examples : watching movie or television and listening music [9].

Ministry of Public Work Regulation No. 05 year 2008 about Guidelines for the Provision and Utilization of Green Open Space, defines an urban park as open spaces which have social and aesthetic function to be use for recreational activities. Ussually local goverment define urban park only as park [10].

Type of urban park base on its activity consist of [11] :

1. Urban park for active recreation activities  
 This park is equipped with facilities that support active park use to gain fun, freshness and fitness. This park can serve as park for sports activities, children's playground, park for boy scout activities and so on.
2. Urban park for passive recreation activities  
 This park is formed so visitors can enjoy it's visuals beauty and it's shady area without holding any activities while they spend time at the park. Fences usually was installed along outer side of the park to maintain the beauty of plants in the park. In this park, visitors can not hold activities because the park ussually locate at T-junction, crossroads, or on the road median. [12].
3. City's recreation park  
 Is a park for active and passive recreation where in this park visitors can enjoy the beauty of the park as well as utilizing the park area for other activities.

Generally a park physical characteristics consist of two main elements which are hardscape like walkways, benches, garden lights, etc. and softscape like shady plants, shrubs, grass etc. [13]. For visitors characteristics consist of social economic characteristics such as gender, age, address, education level, occupation and income, and also characteristic of visitation pattern like type of activity, frequency, visiting duration, companion, and transportation type [14].

In Benefits of Urban Park report, it was mentioned there are few aspects considered to be influential on correlation between park provision and it's usage for active physical activities and recreational activities. Those aspects are distance or proximity, facilities, park quality in general, park size, total plants shading area, species diversity, duration of time spend in the park and park visiting frequencies (Konijnendijk, et.al, 2013) [15]. In comparison, these aspects are also in accordance with the review results by McCormak et. al. (2010) and the framework concept developed by Bedimo-Rung et. al. (2005) which explains that accessibility to parks, park features or facilities, park conditions, park aesthetic value and perception of a park's security is characteristics of parks that can overlap and influence each other, both positively and negatively and also can affect visitors active physical activity while in the park [5][6]. Based on this review, aspect of observation that used in this research includes aspects of facilities and features within the park, accessibility to the park, cleanliness and maintenance of the park, aesthetic value and the condition park vegetation, and security within the urban park.

### III. RESEARCH METHODE

In this research, we are is using mixed methode sequential as the research approach. Observation aspects used in this research are park physical characteristics, visitors characteristics, and aspects that influential to visitors active physical activities and recreational activities. Those aspects are aspect of urban park feature and facilities, aspect of urban park accesibility, aspect of aesthetic value and vegetation condition in urban park, and also safety aspect of urban park. Each aspect of observation is spelled out into several research variables as presented in Table 1.

Table 1. Variables that considered to have an effect on visitors active physical activity and recreational activity in active park

Observation Aspects	Variables Number	Variables Name
(1)	(2)	(3)
Urban park feature and facilities	1	Overall quality of facilities
	2	Pedestrian paths and walkways
	3	Seating facilities
	4	Playing facilities
	5	Health and sports facilities
	6	Public toilet facilities
Urban park accesibility	7	Accessibility and ease of access
	8	Access to the park using public transport
	9	Parking area
	10	Access for people with special needs
	11	Distance from residence
	12	Travel time to the urban park
Cleanliness and maintenance	13	Quality of facilities maintenance and cleanliness
	14	Quality of facility maintenance
	15	Quality of hygiene maintenance
	16	Number and quality of the trash bin
Aesthetic value and vegetation condition in urban park	17	Aesthetic value and condition of vegetation
	18	Conformity of facility placement
	19	Quality of scenery and visual appeal
	20	Suitability of plant and plant maintenance
	21	Arrangement of informal sector
Safety of urban park	22	Urban park quality of safety
	23	Availability of security posts and presence of security personnel
	24	Condition of fences
	25	Urban park lighting conditions

Source : Research synthesis, 2017

Data collection wes done using field observation and questionnaire. Field observation was conducted to observe the condition of existing active site park. Furthermore, we conduct questionnaires distribution to 97 respondents act as samples for visitors of active park Gubeng Sub-District. Each park has different number of respondents, 20 respondents for Srikana

parcs, 30 respondents for Biliton parks, and 47 respondents for Flora Parks.

After completing data compilation, data was then analyze using some analysis technique from descriptive analysis, statistic descriptive analysis, and correlation statistics. Results from this analyzes then used as basics in drafting active park arrangement concept that can support active physical activities and recreational activities in active parks at Gubeng Sub-District.

#### IV. RESULT AND DISCUSSION

##### A. Typology and Characteristic of Active Parks in Gubeng Sub-District

Active parks in Gubeng Sub-District's can be categorized into three categories :

1. Active parks serve in level of neighborhood environment. This type of parks is used for social interaction between residents in the community of housing environment. This type of park was represented by Srikana Parks that located at 2<sup>nd</sup> Karang Wismo street RT.002 / RW.007 Kelurahan Airlangga, Gubeng Sub-District. Facilities in this park include paths, reflection paths, park benches, bins, garden lights and 25 (twenty five) vegetation species.



Figure 1. Layout of Srikana Park

2. Active parks serve in level of urban community (urban park), used for resting, sports, and transit activities. This park is represented on Biliton Park located on the west side of Biliton Street in Gubeng Sub-District. Vegetation at Biliton Park consists of 18 (eighteen) species of shade plants, 29 (twenty nine) species of shrubs and grasses. Facilities in this park which mainly support for resting acitivity, sports and transit activities including sidewalks, walkways, reflection paths, park benches, children's play areas, areas with sports equipment, parking areas, garden lights, trash bins, some informal sidewalk vendors who sells around the park and the existence of a healthy gym program that is held every Sunday morning.



Figure 2. Layout of Biliton Park

3. Active park which serve on urban and regional level (urban-regional park). This park is represented by Flora Park which previously known as Bratang Seedling Garden. In this park which dominantly use for activities related to education, playing and family recreation, this activities was accommodate with the existence of various supporting facilities such as library and reading facilities, *Broadband Learning Center – BLC*, a number of children's play areas, animal-raising areas, areas for sports equipment, fish ponds, fountain ponds and halls that are usually used for various cultural events and cultural performances. In this park, picnic activities are usually done during peak visiting times such as on weekends or on national holidays.



Figure 3. Layout of Flora Park

##### B. Variables Which Have Significant Effect on Visitors Satisfaction While Spending Time in Active Park

This research is using correlational statistical analysis to know about variables that have significant effect on visitors perception of satisfaction during their time in active park. In neighborhood scale active park, visitors perception of satisfaction was influenced significantly by all variables on Cleanliness and Maintenance Aspect, and also most variables on Aspect Aesthetic Value and Vegetation Condition in Urban Park. In total, there are 11 (eleven) variables that affect visitors

perception of satisfaction at neighborhood scale active parks as presented in the Table 2. below.

Table 2. Influenced Variables on Respondent's Perception of Satisfaction at Neighborhood Scale Active Park.

Observation Aspects	Variables Number	Variables Name
(1)	(2)	(3)
Urban park feature and facilities	2	Pedestrian paths and walkways
	4	Seating facilities
Urban park accesibility	-	-
Cleanliness and maintenance	13	Quality of facilities maintenance and cleanliness
	14	Quality of facility maintenance
	15	Quality of hygiene maintenance
	16	Number and quality of the trash bin
	17	Aesthetic value and condition of vegetation
Aesthetic value and vegetation condition in urban park	18	Conformity of facility placement
	19	Quality of scenery and visual appeal
	20	Suitability of plant and plant maintenance
	21	Arrangement of informal sector
	22	Urban park quality of safety
Safety of urban park	23	Availability of security posts and presence of security personnel
	25	Urban park lighting conditions

Source : Analysis Result, 2018

At active park for urban area level of service and also in urban-regional level of service, visitors perception of satisfaction is influenced by variables on aspect of urban park feature and facilities, urban park accessibility aspect, cleanliness and maintenance aspect, aspect of aesthetic value and vegetation condition in urban park, and safety aspect of urban park.

Table 3. Influenced Variables on Respondent's Perception of Satisfaction at Urban Scale Active Park.

Observation Aspects	Variables Number	Variables Name
(1)	(2)	(3)
Urban park feature and facilities	1	Overall quality of facilities
	2	Pedestrian paths and walkways
	3	Seating facilities
	5	Health and sports facilities
	6	Public toilet facilities
	9	Parking area
Urban park accesibility	10	Access for people with special needs

Observation Aspects	Variables Number	Variables Name
(1)	(2)	(3)
Cleanliness and maintenance	13	Quality of facilities maintenance and cleanliness
	14	Quality of facility maintenance
	15	Quality of hygiene maintenance
	16	Number and quality of the trash bin
	18	Conformity of facility placement
Aesthetic value and vegetation condition in urban park	19	Quality of scenery and visual appeal
	20	Suitability of plant and plant maintenance
	21	Arrangement of informal sector
	22	Urban park quality of safety
	23	Availability of security posts and presence of security personnel
Safety of urban park	25	Urban park lighting conditions

Source : Analysis Result, 2018

Table 4. Influenced Variables on Respondent's Perception of Satisfaction at Urban-Regional Scale Active Park.

Observation Aspects	Variables Number	Variables Name
(1)	(2)	(3)
Urban park feature and facilities	1	Overall quality of facilities
	2	Pedestrian paths and walkways
	3	Seating facilities
	4	Playing facilities
	5	Health and sports facilities
	6	Public toilet facilities
Urban park accesibility	7	Accessibility and ease of access
	8	Access to the park using public transport
	9	Parking area
	10	Access for people with special needs
	12	Travel time to the urban park
Cleanliness and maintenance	13	Quality of facilities maintenance and cleanliness
	14	Quality of facility maintenance
	15	Quality of hygiene

Observation Aspects	Variables Number	Variables Name
(1)	(2)	(3)
		maintenance
	16	Number and quality of the trash bin
Aesthetic value and vegetation condition in urban park	17	Aesthetic value and condition of vegetation
	18	Conformity of facility placement
	19	Quality of scenery and visual appeal
	20	Suitability of plant and plant maintenance
	21	Arrangement of informal sector
Safety of urban park	22	Urban park quality of safety
	23	Availability of security posts and presence of security personnel
	24	Condition of fences
	25	Urban park lighting conditions

Source : Analysis Result, 2018

Based on the analysis of the variables that significantly affect the perception of visitor satisfaction as presented in Table 1, Table 2, and Table 3. it can be seen that the higher the scale of green open space service (RTH) of the active park public, the more variables that significantly influence the perception of the satisfaction of the active garden visitor.

### C. Active Park Concept of Arrangement in Gubeng Sub-District

The conceptual directives arrangement of each active garden are structured based on good public space criteria which is space that holds to democratic value, responsive value and value of a meaningful space as well. This arrangement also need to adapt to the park typology and characteristics.

1. Arrangement concept for typology of an active park in neighborhood environment scale (housing environment) is to apply on participatory concept. With this concept, we are trying to make neighborhood community to be more involve in every step of park management from planning, developing, and managing their neighborhood park. Hopefully this concept can help creating active neighborhood public park in accordance with specific requirements from neighborhood residents.
2. At urban scale of an active park, directives arrangement concept for this type of park can be prepared by formulating park function to be achieved in advance or it can also be done by accomodating and optimizing today existing park function. For example like what have been done in Biliton Park. Theme for this park has been set as park for elderly people and also serve it's dominant acivities which are place for resting, exercising, and place for transit. So

direction for proposed arrangement concept is endeavored to match with park theme and utilization function of the park. Efforts that can be done is like optimizing accessibility so it will be easier for elderly people to access the park even though they are using walker or wheel chair.

3. For active park at urban-regional level of services, directives arrangement concept for this type of active public park is by optimizing park operational and management system as well as competence of involved park management personnel. Hopefully this effort will greatly support visitors comfort while doing their activities in this active park. Optimum level of park operational and management are needed especially during weekends and national holidays which are the peak of visiting time to this active public park.

## V. CONCLUSION

As seen in their characteristics, active public parks in Gubeng Sub-District are belongs to three park typologies which are : first, active park that serve in neighborhood and housing community with functions for social interaction of citizens in residential environment. Second is active park that serve for urban community with function for resting, exercising, and transit. Third is active park that serve in level of urban and regional area which use for education related activities, playing, and family recreation. Furthermore, result from statistical correlation analysis shows that active park in higher level of services have more influenced variables that correlate significantly with visitors perception of satisfaction while they doing activities in active park.

Conceptual directives arrangement for each active park arranged based on good public space criteria which adheres to values of democratic, responsive and meaningful public place and also adapt to characteristics of each park typology. Concept of participatory with neighborhood housing community is directed for active park in level of neighborhood community. For active park in level of urban community , arrangement concept is directed to adjust on established park theme, park function and it's dominant activities. For active park which serve in level of city and regional, the proposed conceptual arrangement directives for this park is optimizing the park operational and management system, as well as competence of it's management personnel to support the high intensity of park utilization at the peak of the visiting time.

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# Can the CAMELS rating system Survive the Future?

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DOI: 10.29322/IJSRP.8.8.2018.p8044

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8044>

**Abstract-** The banking sector has experienced a change in paradigm, be it from the aspect of legislative, technological or financial changes. However, the curiosity into the causes of bank failure has somewhat lagged behind. One possible consequence of this scenario is that current rating system may no longer accurately assess the banking environment. This paper attempts to look beyond the numbers used in CAMELS rating system and see if there is a need to enhance the model used.

**Index Terms-** Bank Performance – Preventing Bank failure – Rating system – CAMELS – Failure trend in Banks – Banking Sector.

## I. INTRODUCTION

The banking industry, like many others, is changing fundamentally. Interest rates in some regions of the world are approaching 40-year lows, equity markets are far more unpredictable than in the bubble years of the 1990s, and the aging baby-boom generation is increasingly looking to accumulate secure assets.

Against the backdrop of these developments, three major dynamics pose formidable new challenges for financial institutions. Organizations that hope to control their own destiny in the years ahead must come to grips with these dynamics and devise the best ways to manage and profit from them-before their competitors do. The current climate of lower growth and higher uncertainty has put banking revenues and margins under greater pressure.

Consumers have become more demanding and more financially sophisticated. Finding themselves in a buyer's market, they not only are more vocal in expressing dissatisfaction with their financial relationships but also feel empowered by favorable regulatory developments. Moreover, they are increasingly willing to switch institutions if they feel neglected, and they will keep switching until they are fully satisfied that their banking and financial-planning needs are being properly looked after. Holding on to these customers is an increasingly critical driver of revenue and profit for financial institutions-and losing them to competitors is becoming more and more costly

But banks had yet another problem. How to prevent future bank failures?

## II. RESEARCH PROBLEM

It has been discussed then, it is being discussed now and perhaps, it will be, for time to come. Everyone is looking for a better solution and looking for the missing link.

From the literature reviews, there is definitely no lacking in examples and views offered by the academics, the professionals as well as the regulators on the issue of bank performance.

So far, the banking sector in India has been on a steady rock. But this should not prevent us from learning from the failures of others and applying the right solution where appropriate. The banking sector comprises licensed institutions namely commercial banks, finance companies, merchant banks, discount houses and money brokers which are licensed under the regulations and supervised by Reserve Bank of India.

The research problems are summarized as follows

- 1) There is no clear trend in the failures seen so far
- 2) CAMELS rating system is not being used widely.

## III. OBJECTIVES OF THE RESEARCH

The objectives of the research are:

- 1) To map out any significant trend in the failures or crisis observed so far.
- 2) To see if the CAMELS rating can still be used in the current dynamic environment

## IV. SCOPE OF STUDY

The scope of study of this topic is set to limit to review some of the banking crisis seen around the world, from South America to Asia. The discussion as well as the analysis of this paper will be discussed around the failures seen and the views from the regulators as well as the academicians.

## V. SURVEY OF LITERATURE

Is there any way to prevent bank failure? Is the current rating system used a good early warning sign? Is there a formula to guide the regulators?

Lets look at the cases and perspectives from different corners of the world as well as the views from the academics and the regulators.

*Argentina*

Dabos and Mera (1998) study the main consequences that the Mexican crisis of December 1994 had on Argentina's financial system. Several different factors seem to have contributed to the outbreak of the Mexican crisis. Political turmoil during 1994, the bad shape of Mexican macroeconomic fundamentals, and external factors such as the rise in international interest rates, had been affecting the behavior of financial markets during 1994 (Folkerts-Landau and Ito 1995). Citing Garrido (1996), the institutional design of the financial system and its regulatory framework, added to its vulnerability to external pressures and its limited development, were the main determinants of the December 1994 Mexican crisis. The Convertibility Plan was introduced in 1991, with the purpose of putting an end to several decades of inflation, fiscal deficits and mismanagement of the economy. Its main objective was to achieve price stability, fixing full convertibility of the domestic currency into American dollars, and setting limitations to the ability of the Central Bank to employ the dangerous instrument of money printing. The monetary measures established the convertibility of one peso for one dollar, binding the Central Bank to back up the whole monetary base with international reserves. Apart from this, in 1992 the Central Bank Charter and the Law of Financial

Institutions were modified. As a consequence, the Central Bank was banned to conduct active monetary policy. Other reforms introduced at the time increased reserve requirements and minimum required capital to assets ratios which was set at 11.5%, were established according to the risk undertaken by each financial institution. The high reserve requirements had the objective of creating a liquidity mass, which could be released in case of a run. The severe minimum capital regulations, apart from constituting an alternative liquidity source, tried to penalize banks according to the risk undertaken. The reversion of capital inflows had a strong impact on Argentina. The confidence crisis translated into an important deposit and international reserve withdrawal, posing a threat to the convertibility commitment and to the banking system, and having a negative impact over investors' credibility. The fall in deposits started affecting only a group of banks, and reaching only peso deposits, before it was generalized to the whole financial system and to deposits in all denominations. The crisis was also evidenced by an increase in country risk, which translated into a fall in Argentine bonds' and stock prices. Furthermore, liquidity problems were responsible for an abrupt increase in nominal interest rates. The evolution of financial system indicators shows the negative effects of the crisis. The indicators analyzed include the main variables considered by the CAMEL system.

#### *Asia (Indonesia, South Korea and Thailand)*

Rahman, Tan, Hew and Tan (2004) attempt to investigate empirically financial ratios that could better identify the problem banks in Asia and to develop accurate problem bank identification models for each country. Logistic regression technique was used to achieve this with ratios serving as financial distress indicators. These authors study on bank data from Indonesia, South Korea and Thailand. The focus is on five key aspects of a bank's operation to the CAMEL framework, namely capital adequacy, asset quality, management quality, profitability and liquidity. The result for the Indonesian banking

industry shows that both the interest income/ interest expense and operating efficiency ratios are good enough to trigger the alarm for bank failure. As for the Korean banking sector, profit margin ratio can best single out the problematic and non-problematic banks. The interest income/ interest expense ratio once again is the indicator here for the Korean banks. Capital adequacy ratio is one that is critical to the Thai banking industry in order to avoid financial distress in the earlier years. However, for 1995 and 1996, interest income/ interest expense ratio us the most significant variable. As a result, the authors listed three common financial indicators, which are vital in identifying problem banks in all the three countries: capital adequacy, interest income/ interest expense and operating efficiency. In this study, capital adequacy is measured by the variations of the basic capital/ asset ratio. Interest income/ interest expense ratio measures the number of times interest expense is covered by the interest income. Interest rates are positively correlated to the profitability of a bank. Operating efficiency measures the effects of inefficient bank operations on profitability, which is a subsequent reduced stream of earnings. Asset quality per the findings did not appear to indicate financial distress of the banks. One reason cited in this study is the possibility that the banks' credit grading methods are liberal. Bank regulators of those countries studied did not impose strict guidelines in relation to the classification of loans. Perhaps these authors ought to study the unique features of the selected countries where banks were selected for the analysis.

#### *China*

Bekier, Huang and Wilson (2005) discuss on the issue of the huge stock of bad loans that is eating up into its banking system. The country's loan classification system has been upgraded to uncover problem loans more quickly and consistently, asset-management companies were established to help banks dispose of their non-performing loans, and billions of dollars from China's vast foreign reserves have been used to sustain insolvent banks until the problems can be resolved. The regulators must introduce better corporate-governance practices to curb the ability of influential organizations and people to meddle in the lending decisions of banks, improve their risk-management practices, and limit fraud. Banks must recognize their new problem loans more rapidly. Banks in China have a disincentive to sell their distressed assets because once they do, they must recognize a loss. Nevertheless, experience elsewhere suggests that the quick disposal of such assets is the right way forward, since the longer a bank waits, the less value it recoups from the sale. Faster recovery of non-performing loans will also remove a drag on bank earnings by reducing charge-off and the need to build up reserves. It will also free capital and therefore improve the ability of banks to supply the credit that China's businesses so desperately need. To increase the amount of bad debt ready for disposal and to have it disposed of more quickly, regulators should give banks and asset-management companies specific targets. Progress—or the lack of it—should be made public, and the senior managers of these institutions should be held accountable. Building the most fundamental components of good corporate governance and credit-risk-management skills are the top to-do things for the bank regulators. The regulators should also take an active role in monitoring compliance and

make their findings public. The authors also suggest that moving to a performance- and risk- based supervisory system is another necessary step. Banks from Southeast Asia require credit processes to be certified and only banks that meet certain requirements can have their license renewed. The authors urge the banking regulators to look seriously into the existing bad loans and to stop the flow of new ones, despite the fact China's banking system is not in immediate danger of failing. Even though the authors recommend that to have a stronger banking system, one has to have better governance and risk management.

### *Indonesia*

McLeod (2004) studies the collapse of Indonesia banking system and the government's policy response to it, under the advice from the IMF. He comments that the Indonesia's crisis recovery program had failed badly in relation to the two key objectives of development economics policy making- efficiency and equity. To ward off bank failures the central bank began operating as lender of last resort—before long on a very large scale—but its failure to sterilise the monetary impact of its actions meant that it was supplying the liquidity needed by all those investors who wanted to purchase foreign currency, either to unwind their exchange rate risk exposure or to speculate against the rupiah. The upheaval in the foreign exchange market came to be so great that the IMF was called upon for assistance and, as a condition of this support, the government had to accept a number of policy reforms that amounted to direct attacks on the president through his family and cronies. The massive collapse of the banking sector has been perhaps the most extraordinary aspect of Indonesia's crisis. The general public has been left burdened by a debt amounting to at least 40% of GDP as a result of the way the impact of the crisis on the banking system was handled. The October 1998 LOI provides the first indication that, despite the previously expressed intention to strengthen prudential standards for the banking system, policy makers were so keen to minimise the number of further bank closures that they decided instead to soften the most fundamentally important of those standards: namely, the minimum acceptable capital adequacy ratio. The near-term target was now set at 4%, rather than 9%—the standard originally to be achieved by September 1997. There was no explicit mention of the fact that the minimum standard had been so drastically lowered, much less any attempt to justify this decision. Dealing with the banking system was being given the highest priority, because this was regarded as an essential precondition for the recovery of the corporate sector. The banks had failed because the corporate sector had failed to repay its loans to them. Even if the banks' capital could now be restored, it is difficult to understand how they could simply have resumed lending to the corporate sector when it remained heavily in default to them. The only way that this could have made any sense would be if the banks were prepared to forgive non-repayment of loans they had previously issued, taking the implied losses onto their own books and, in effect, passing the losses on to the government as guarantor of their liabilities. A superior approach to handling banking crises would be to treat them in much the same way as insolvencies of non-banking sector enterprises, in which losses in excess of shareholders' equity are borne by creditors, not by 'innocent bystanders'—the general public.

Frecaut (2004) looks at the conventional approach, embedded in business accounting, used to manage the banking crisis, with an alternative approach that relies on national accounting concepts. It shows how the latter can provide a new perspective, elucidating the massive transfers of wealth that took place during the crisis. This suggests possible improvements in bank resolution strategies, through the identification and quantification of the main transfers of wealth, followed by their taxation. A number of banks, often among the largest, avoided financial collapse only through massive central bank emergency liquidity support. The government eventually had to provide a blanket guarantee of bank liabilities to avert the threat of a system-wide financial meltdown. This and the rehabilitation of the surviving banks ended up imposing enormous costs on the general public by virtue of a dramatic increase in public debt. The main focus of banking supervisors is on banks' solvency, i.e. their net worth or equity, defined as the surplus of assets over liabilities, and thus their ability to repay their depositors. Bank solvency is measured through business accounting standards and benchmarked against internationally accepted prudential norms, with a prominent role assigned to the capital adequacy ratio (CAR) as defined by the Basel Committee on Banking Supervision. The interest margin is used as a core item for the assessment of bank profitability and viability. Banks that feature a negative net margin are viewed as inefficient, loss-making institutions, slated for closure if they cannot improve their performance. The focus is on measuring the performance of individual banks separately from that of other types of economic entities. The author notes that it is important to focus on the possibility of an accumulation in the economy, over a number of years, of undetected losses on bank loans. The place where these problems develop is the corporate sector. Banks have an important role to play in preventing the silent accumulation of such losses. Prudential reviews of loan portfolios should generally be able to detect them, although this will not always be the case. Too much faith might be put in historical costs and/or in the significance of the borrower's repayment history. Banking supervisors need to pay special attention to this issue. Another action one needed is to be prepared always. Two components are cited here- one at the country level and another, at the multilateral level. The author concludes that in the rapidly globalising economy, where systemic banking crises seem to multiply, perhaps the System of National Accounts (SNA) holds the promising potential to assist in the analysis of a large-scale financial disaster of macroeconomic importance.

### *Japan*

Hoshi and Kashyap (year unknown) look into Japan's financial system is in the midst of a major transformation. One driving force is deregulation. The other is the financial crisis. The lopsided nature of the Financial deregulation, combined with maturing of the Japanese economy and slow growth starting in the mid-1970s, created a disequilibrium situation that has lasted to date. To eliminate the disequilibrium, further deregulation of the financial system will be inevitable. Once the deregulation is complete, the Japanese allocation of savings and the investment financing patterns will move further towards the patterns seen in the United States. Until the 1920s, the Japanese banking system was characterized by free competition with little regulation. The

Bank Act of 1890, for instance, set no minimum capital level for banks. A series of banking crises in the 1920s, especially the banking panic of 1927, led the Japanese government to change completely its attitude toward regulating banks, and tight regulation of the banking sector began. The financial system was also highly segmented. The regulatory framework that was completed during the occupation period stayed more or less in place until the mid-1970s. During the high-growth era from 1955 through 1973, banks dominated the financial system. Bond markets were repressed, and equity issuance was relatively uncommon. In the 1970s this all began to change. One big change was slower aggregate growth. Up until this time household savings were mostly channeled through banks to finance business investment. With lower growth the corporate funding requirements fell. The success of the Japanese economy in the rapid-economic-growth period also helped the corporations accumulate internal funds. This intensified the decline in the borrowing requirements of the companies. A third feature of the economy in the 1970s was that the government began to run sizable deficits. The deficits arose because of a combination of slower tax revenue growth, a policy decision to engage in deficit spending to try to spur the economy, and an expansion of the Social Security system. To finance the deficits, the government significantly ramped up its bond issuance. The speed of adjustment of the financial sector will primarily depend on three factors: how fast corporations adjust their financing, how fast households shift their funds out of bank deposits, and how fast the banking industry is reorganized. The shrinkage of bank loans will imply a substantial exit in the banking industry unless Japanese banks shift away from traditional banking business very aggressively. The speed of such reorganization obviously depends on the government's policy stance toward bank failures. The authors suggest closures of insolvent banks, and not mergers among the largest banks.

### ***Korea***

Yoon and Miller (2004) investigate the major causes of the Korean financial crisis in 1997. Korea's financial system is characterised by the lack of independence from the business conglomerates as well as from the government. Korean banks are not educated and exposed to understand consolidated financial statements. The bankers do not check on the possibility of the misuse of loans by some borrowers to create slush funds to politicians. Besides, these business conglomerates borrow funds from their financial affiliates based on cross-guarantees. Banks, on the other hand, wanted to maintain good relations with the business conglomerates in expanding their business volume and earning large fees. Another weakness in Korea's financial system related to the weak and poorly planned supervision of financial institutions. There were three independent supervisory bodies for banks, insurance and security businesses. This environment is responsible for the skewed distribution of loans to the business conglomerates and resulted in bad debts and non-performing assets by banks. The political and financial scandals, the accumulation of trade deficits and a series of corporate failures were quickly publicised in the international financial community. Confidence eroded and this was compounded by the foreign exchange crisis in the South East Asia. Many foreign investors started to pull their money out and some refused to roll over the

loans to Korean banks and companies. The Korean government believed that the main cause of the financial crisis in 1997 was a lack of market discipline and the malfunctioning of the market system rather than macroeconomics imbalance. It is believed that the government's role in the matured market system should be limited to that of surveillance and ensuring that market discipline is upheld. Structural reforms and the establishment of market driven institutional frameworks must be implemented. In addition, software reforms such as eliminating the anachronistic attitudes and business practices, rewarding innovation and performance should complete the restructuring process.

### ***Mexico***

Graf (year unknown) reviews the banking sector in Mexico after the 1994 crisis. Macroeconomic, microeconomic and institutional factors combined to produce increasingly difficult problems for Mexican banks even before the December 1994 devaluation. The sharp contraction of the economy that followed the devaluation made these problems worse. Capital inflows poured into the country in the early 1990s, fed into the banking system. Lending to activities in which the banks had no previous experience, such as housing and consumption grew very rapidly. Credit given to traditional sectors also increased. Investors paid an average price of 3.34 times the book value when privatisation took place in 1991-92. Wanting to quickly recover their investments, there was a natural tendency to undertake risky business. Banks extended large amount of loans without sufficient credit analysis. There were also many cases whereby the value of the mortgage exceeded the price of the house or land purchased. The shares of the NPLs in total loans began to rise well before the 1994 crisis. Discovery of fraud also led the authorities to take over two banks in the late 1994. Just like putting salt to injury, the devaluation of peso and its effect on interest rates aggravated the whole situation. Debtors were finding it hard to service their debts with the increase of inflation and nominal interest rates, and falling of real income. Several programs were put in place to avoid the collapse of the banking system. The policies adopted in bank restructuring succeeded in bank run as successive programmes were put in place to reassure investors' confidence in the stability of the system. However, according to the author, the Mexican banking system remains weak. Banks have yet to contribute to the recovery and leaving firms to finance themselves from suppliers or abroad. Credit has not expanded as banks have tightened credit standards and the supervisory commission now requires banks to establish reserves for 100% of those loans granted to debtors with a bad credit record. There is also a suggestion to further increase the capital of banks from the current level of 12%.

### ***New Zealand***

Turner (2000) investigates on the Hayekian approach to banking supervision in New Zealand. New Zealand became the only developed country not to have some form of deposit insurance and, to abandon the practice of conducting on-site examinations. Instead, depositors must carry out the bank monitoring through the disclosure statement produced by the banks every quarterly. This is done with a hope to reduce the moral hazard issue pertaining to the deposit insurance. The 1989/90 crisis caused the Reserve Bank of New Zealand (RBNZ)

to implement a review of its banking regulatory arrangements. From 1987 until 1995, the RBNZ had a conventional practice to bank supervision. Banks faced minimum capital requirements, limits to foreign exchange exposure and off-site monitoring by the RBNZ. However, the new regulatory regime introduced in 1996 had some changes made namely the removal of the deposit insurance and 'too-big-to-fail' policy, introduction of a public disclosure regime and reduction in RBNZ monitoring of banks. In addition, a structured early intervention and resolution program was introduced, and the removal of limits on single borrower and foreign exchange exposure. There was a big debate arose on the fact that banking instability was due to the moral hazard problem associated with deposit insurance. It is argued that deposit insurance removes the incentives for depositors to monitor banks and provides incentives for banks to increase their risk-taking. RBNZ decided to adopt the Hayekian approach to deposit insurance and replacing it with public disclosure regime and caveat depositors. There are two types of statements issued quarterly, one for the ordinary depositor and another is for the professional analyst. This, they say, will enhance the market role in ensuring a stable and efficient banking system. Deposit insurance simply shifts the inherent instability problem from depositors to the government. The banking problems in New Zealand were not due to the existence of deposit insurance per se but rather the removal of the comprehensive bank regulation. There is also an argument that not many depositors will read or even understand the disclosure statements. Furthermore, it does not provide depositors with information to value the loan portfolio of a bank. Despite these weaknesses, there are still depositors in the New Zealand banks. Why? One possible reason is that depositors do not believe that the RBNZ promises not to bail out ailing banks are credible and another possible reason is that RBNZ is free-riding on foreign regulatory systems since six out of the eight locally incorporated banks are totally foreign-owned. The author concluded that moral hazard problem still exists in the absence of deposit insurance and that depositors have inadequate information to monitor banks and prevent them engaging in opportunism. The only way to prevent this is for governments to regulate them. The New Zealand model is not one, which should be copied.

### **Norway**

Knutsen and Lie (2002) looks into the main causes of the major banks in Norway during the banking crisis in 1987-92 and the reasons as to why some banks failed while others did not. Quoting Schwartz, a genuine banking crisis is characterised by panic and depositor-runs on banks. However, according to the authors such a reason is not an appropriate answer to the banking crisis, which hit the Norwegian banking sector. The authors have applied the financial fragility approach to better understand the mechanisms that caused a general financial crisis and increased systemic risk for both of the largest banks in Norway- DnC and Christiania Banks. During 1987-92, there was a huge credit expansion as well as deregulation of the financial markets. These led to the huge loan losses suffered by both banks. The lax monetary policy and an expansive fiscal policy by the government stimulated the boom condition. As a result, debt levels risen especially from the corporate sector, as well as the household sector. The abrupt downswing of the business cycle

and the contractionary economic policy increased the number of bankruptcies. Many firms were unable to service their loans and both the banks incurred huge loan losses. From the analysis done by these authors, both the banks dropped what they had practiced before the shadow of failures slowly crept in.

DnC practised rigid rules determining how credits were to be evaluated and how documentation was to be handled and collected. However, during the period of the expansion, profits became the key factor each branch has to achieve. Credit approval limits were increased and new types of leaders were needed- the ones who knew sales and management. The traditional informal system of control and diffusion of competence were undermined. The same scenario can be observed at the Christiania Bank. It had a tight and functioning system of credit decisions and credit control, and a working system for internal governance. The merger with the Andersens Bank in 1980 and the reorganisation later on- along with the huge credit expansion activity- caused a complete dissolution of these systems. The internal auditors and the external consultants pointed out the weakness in the internal control systems and the bank's deteriorating risk profile. When the stock of defaulted loan increased, the bank was in a weak position to absorb the bad debt. The authors concluded that the expansionist strategies contributed to the breakdown in the steering and control systems and it is the internal organisational effects are of great importance in explaining the banks' failure.

From the perspective of the regulators and academicians...

Barr and Siems (1996) develop two bank failure models for assessing a bank's management quality. Assessing a bank's management quality requires professional judgement of a bank's compliance to policies and procedures, aptitude for risk taking, development of strategic plans and the degree of involvement by the bank's officers and directors in making decisions. The quality of management has often being cited as the main reason for bank failure. Using data envelopment analysis (DEA), a management quality metric is established that is designed as a proxy for the "M" in the CAMEL rating. For failure prediction, the management quality metric is combined with the other four factors in the CAMEL rating, as well as a proxy for local economic condition. The authors model the bank as a decision making model that is concerned with transforming a set of different inputs into another set of outputs; using a series of simple ratios of individual outputs to individual inputs. The research reveals that significant statistical differences in average management quality existed up to three years prior to failure. The empirical results of the study confirm that the quality of management is crucial to a bank's survival. Scores of surviving institutions are statistically higher than the scores for failed banks. In addition, banks that are nearer failure are found to have low efficiency scores. Hence, to the authors, the use of these scores as a variable in a bank-failure prediction model seems promising. A more accurate bank-failure prediction model has four key implications to policy makers. One, banking regulators can deploy their examination resources more efficiently. An effective early warning model will detect and classify the weakest institution. Regulators can focus on those with greatest threat to the deposit insurance fund. A potential saving to the taxpayers is also one gain from the early identification of weak

banks. Second, the regulators can use the model to further understand the reasons of bank failure. With this armed, the regulators will be able to offer bankers on how to become more stable. Managers will also be alerted before more serious problems arise. A better bank-failure prediction model strengthens the entire examination process by identifying banks more objectively. Finally, this model can be used to develop a variable-rate deposit-insurance-premium structure.

By using the other four factors in the CAMEL rating in the management quality metric, this can be viewed as “double counting” for the CA\_EL factors. In addition, the authors did not mention the basis for using six input variables. Understanding the immediate need to quantify the M factor in CAMEL rating, we cannot ignore the very fact that there is also a need to understand the qualitative side of the management of a bank. What kind of investors are they? Are they the risk takers, risk avoiders or risk neutrals?

Estrella, Park and Peristiani (2000) investigate on the use of capital ratios as predictors of bank failure. Capital ratios have long been a valuable tool for assessing the safety and soundness of banks. In the United States, minimum capital ratios have been required in the banking institutions since 1981. The authors examine the roles that capital ratios play in bank regulation and to be successful in any of these roles, capital ratios should bear a significant negative relationship to the risk of subsequent bank failure. The focus here is on three types of ratios namely risk weighted, leverage and gross revenue ratios. The denominator of the leverage ratio is the total asset of the bank. This measure assumes implicitly that the capital needs of the bank are directly proportional to its level of asset. Despite some flaws in this ratio, a clear advantage of the leverage ratio is simplicity and virtually costless to administer. Risk weighting effectively requires financial institutions to charge more capital for riskier assets, discouraging them holding risky assets. The authors argue that banking is exposed to more than just credit risk, such as interest rate risk, operational risk and reputational risk. It is also costly to administer risk-based capital requirements, especially both monitoring and reporting burdens may be heavy. Gross revenue includes off-balance sheet activities. Moreover, it contains crude “risk adjustment” in that riskier projects are likely to be undertaken only if they provide larger revenues. Thus, gross revenue may reflect the riskiness of bank assets better than total assets. From the analysis, the most complex ratio- the risk-weighted ratio- is the most effective predictor of failure over long time horizon. However, it does not consistently outperform the other two simpler ratios for the short-term period of less than two years. Therefore, the leverage and gross revenue ratios can play a crucial role as timely backstop thresholds that would trigger regulators. These ratios have the advantages of being less costly to calculate and report.

Cole and Gunther (2001) comment on the Financial Institutional Monitoring System (FIMS), which is significantly more accurate than previous off-site bank monitoring systems in identifying financially troubled banking institutions. There are two bank monitoring types here, on-site and off-site systems. The on-site system uses the CAMEL rating system and between on-site examinations, regulators monitor financial institutions using computer-based system. Before FMIS was introduced, the Federal Reserve System used the Uniform Bank Surveillance

Screen and CAEL System, which used the quarterly bank Call Report data. FIMS addresses the limitations of the previous off-sites bank-monitoring systems by providing two complementary surveillance scores based upon FIMS rating and FIMS risk rank. The FIMS rating represents an estimate, based upon the most recent Call Report data, of what a bank’s CAMEL rating would be if it were assigned during the current quarter. The FIMS risk rank represents an estimate, based upon the bank’s financial condition as measured by the most recent Call Report data, of the probability that a bank will fail during the subsequent two years. The accuracy of the FIMS in estimating the financial condition of banks as indicated both by subsequent on-site examination ratings and by subsequent failures is superior than of the Federal Reserve’s previous models. It provides objective and consistent measures of a bank’s financial conditions. In addition, it provides timely measure of the financial condition as well as it is more flexible. Explanatory variables can be added to or deleted from FIMS with minimal revision to the softwares or procedures. Lastly, it identifies deterioration or improvement in the banking industry within peer groups and systemwide.

In his award winning paper, Couto (2002) provides a very detail analysis on how to go about assessing the earning power of a bank using accounting and managerial information on past performances as an indicator of what may be expected in the future. According to the authors, three essential questions must be asked: What are the bank’s expected results considering the available information and a given set of business conditions? , How does it generate its income? and lastly , What is the sensitivity of its earnings to changes in interest rates, spreads, loan volumes , delinquency and other banking factors ? Earnings are an important indicator of financial health as well as an early indicator of weakness. The author warns that by simple assessment on the earnings records of the bank is insufficient for the bank supervisor to form a sound opinion about its earnings position. More often than not, earnings are influenced by extraordinary events and conditions, which distort results. It is also essential to know where the bank’s income comes from. There is a need to review from two aspects here, the sustainable and non-recurring sources of income to its earnings. The more income of a bank comes from sustainable core business sources, the more reliable and stable are its earnings and these should cover operating expenses, provisions and taxes, and to provide an adequate return on capital. The sensitivity of bank earnings to changes in relevant business conditions is an important part of risk assessment. In the author’s framework analysis, the income and expense items are classified into two categories: structural determinants of profitability and secondary determinants of profitability. Analyzing separately these items particularly subject to misrepresentation gives the analyst some insight into these manipulative maneuvers. Access to comprehensive, detailed and accurate managerial information on profitability enables the analyst to implement the framework to the fullest extent. The managerial information systems used by the bank to measure business unit, product and client profitability usually contain a wealth of relevant information. The earning of a bank may be categorized as strong, substandard and weak. This is perhaps an alternative to the conventional method of measuring the E factor in CAMELS rating system, which is more comprehensive.

Tripe (year unknown) makes a comparison between the New Zealand banks and other banks in the area of liquidity management. The author asks if liquidity is of no importance when discussing about a bank's risk management. As quoted by the author in his other works, liquidity risk for a bank is a risk that it will not have funds available, when requested, to meet a demand for repayment by a depositor, or to satisfy a demand for funding by a borrower who has a commitment by the bank to lend. There are two bases for approaching liquidity risk in a New Zealand banking environment. One is from the perspective of banks themselves and the other is from the disclosure regime that is the basis for banking supervision. It is noted that on a general note, New Zealand banks' stated liquidity policies lack details. The disclosure regime for New Zealand banks is supposed to provide a basis for public and expert assessment of banks' riskiness, including their liquidity risk. Taking the cue from textbook discussions on bank liquidity management, the author lists four approaches to measure and manage the bank liquidity risk in New Zealand, namely to measure the source of liquidity, peer group comparison, using liquidity index and looking at the financing gap where it is defined as average loans less average deposits, while a financing requirement is considered to be the same as borrowed funds, and is equivalent to the financing gap plus liquid assets. The only one constructive approach to measure the New Zealand banks' liquidity risk exposure is by peer group comparison. Where information needed is not publicly available or no realistic market is available for most New Zealand banks, the other approaches are not feasible. The specific ratios used for the peer group analysis are loans to total assets, wholesale deposits to total assets, retail deposits to total assets, loan commitments to total assets, liquid assets to total assets and loan commitments to liquid assets. From the analysis the author concludes that New Zealand banks appear to be less liquid than other countries' banks. This could possibly due to the fact that most New Zealand banks are part of large international banks and this leads the author to comment that liquidity in other countries is an adequate substitute for liquidity in New Zealand. Another reason the author says is the quarterly disclosure makes it harder for banks to hide problems and thus reducing the likelihood of shocks to the New Zealand banking system. Because of this, banks need to hold less liquidity. However, the author considers this unlikely and hopes to study further on this area.

Basu (2003) asks why do banks fail? A rather simple question but yet it is not an easy question to answer.

Bank failures are not uncommon and they are everywhere. The cost of bank failure can be high, and if this causes instability in the financial system, it can affect the nation's growth rate. The author argues here that the possibility of bank failure mainly arises from the fact that the bank is either cannot or does not pay adequate attention to the credit standard requirements. The financial sector operates on the presence of uncertainty. Here, the lender always need to introduce the credit standard in order to ensure that should the borrower default on a loan there remains an alternative to recoup the loan capital. However in reality there is no way there is a standard and uniform credit standard to protect the overall portfolio. There will be some with high credit risk and some zero. According to the author, liberalisation of the

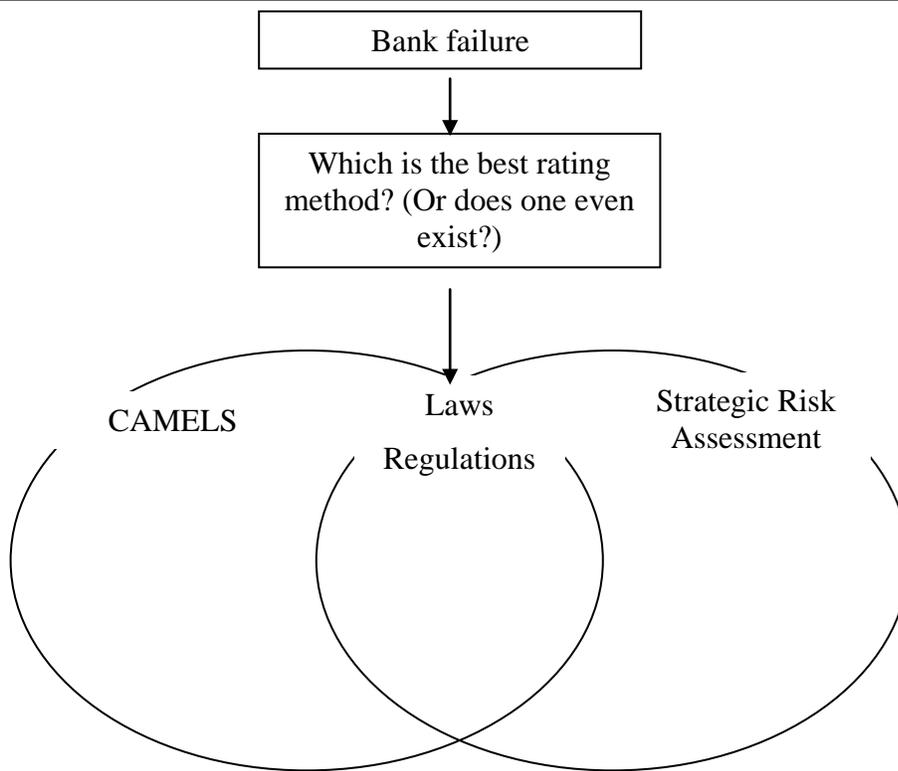
financial system will set the sector more fragile. The competition brought forward by the system will likely to focus on the large borrowers. This end of the market normally carries substantial credit risk. High exposure to credit risk may cause bank to collapse when the loans are defaulted. Here the author stresses the point that contagion effect is not the primary reason a bank fails, but rather contagion effect arises after the bad news is spreaded around, for example, some banks which are exposed to high credit risk found out that its big borrowers default on loans. Therefore there is a need to reach an international agreement in relation to the minimum level of credit standard that a borrower has to meet in order to obtain a loan. In the presence of ever changing risky level, it is not possible to calculate such risk in advance without any information about the future. As such, deposit insurance does not provide the appropriate shield to the bank. In addition, private deposit insurance does not have sufficient resources to meet the losses that occur in the face of a large scale run on banks. Maintenance of a minimum credit standard is therefore essential to protect the economy from the possibility of financial crisis. Having a minimum credit is just a number to guide the bank but there is more than what meets the eye here. One has to assess the risks the borrower faces. By being sensitive to the external forces and trends, there is always ways to mitigate one's losses.

David A. Nadler (2004) explores on the factors needed to build better boards. Recent scandals have exposed boards as too passive, too indulgent or flat-out oblivious to what goes on around them. Companies facing new governance requirements are scrambling to buttress financial reporting, overhaul board structure- whatever it takes to become compliant. Board building is a continuous improvement process through annual assessment process. By making routine the practice of rigorous introspection, boards ensure that they are fit to cope with existing situation and adapt to new ones. Boards must decide how they want to influence the management. They need to move beyond the letter of reform and begin to focus on its spirit. The deepest level of ongoing board involvement is the operating board. Here, they make key decisions that management implement. The board needs to identify the work they need to focus on. Next, there is a need to have the right mix of people. Sarbanes-Oxley prescribes a heavy dose of independent directors but according to the author, this is not the real issue. It is competencies relating to the company, its environment and its industry. Under growing pressure to perform, more boards are adopting formal assessment of individual directors, including peer review. The board needs to play a more active role during the board meeting where they need to collectively set the agenda with the management and decide how much time is needed by both sides. Board should also find ways to stay engaged with the company's issues outside the regular meetings as well. Having too much or too little information may put the board in a dark side of communication. It is the management's responsibility to ensure that boards get the right information at the right time and in the right format to perform their duties. Boards should also be allowed to collect information on their own, informally and without management supervision. Culture is an informal yet powerful norm that influence behaviour. Board cannot easily change their cultures. But as members start to act as a team, the culture will eventually change. The closer directors get to an engaged culture, the closer

they are to being the best boards possible. Board building contributes not only to performance but also to member satisfaction. The author is basically talking about the directors rolling up their sleeves and get dirty with the management. However, there is no mention in this article about how board

building process can eliminate the issues faced today. Is the key to better corporate governance really lying in the working relationships between the boards and the management?

## VI. RESEARCH METHODOLOGY



The method used for researching this topic is to look at and to further understand some of the selected banking failures around the world today. Views from all perspectives are studied and analysed. There is definitely no one reason or even two to be pinned as the reason for banking crisis. From huge loan losses and influences from the economy, there are many reasons documented.

## VII. DISCUSSION, ANALYSIS AND FINDINGS

From the literature review, while some failures are laced with political influences, huge loan losses are seen as the main theme for bank failures .

What are CAMELS ratings?

During an on-site bank exam, supervisors gather private information, such as details on problem loans, with which to evaluate a bank's financial condition and to monitor its compliance with laws and regulatory policies. A key product of such an exam is a supervisory rating of the bank's overall condition, commonly referred to as a CAMELS rating. The three federal banking supervisors (the Federal Reserve, the FDIC, and the OCC) use this rating system and other financial supervisory agencies to provide a convenient summary of bank conditions at the time of an exam.

The acronym "CAMEL" refers to the five components of a bank's condition that are assessed: Capital adequacy, Asset quality, Management, Earnings, and Liquidity. A sixth

component, a bank's Sensitivity to market risk, was added in 1997; hence the acronym was changed to CAMELS. Ratings are assigned for each component in addition to the overall rating of a bank's financial condition. The ratings are assigned on a scale from 1 to 5. Banks with ratings of 1 or 2 are considered to present few, if any, supervisory concerns, while banks with ratings of 3, 4, or 5 present moderate to extreme degrees of supervisory concern.

All exam materials are highly confidential, including the CAMELS. A bank's CAMELS rating is directly known only by the bank's senior management and the appropriate supervisory staff. CAMELS ratings are never released by supervisory agencies even on a lagged basis. While exam results are confidential, the public may infer such supervisory information on bank conditions based on subsequent bank actions or specific disclosures. Overall, the private supervisory information gathered during a bank exam is not disclosed to the public by supervisors, although studies show that it does filter into the financial markets

FDIC economists studied about 2,000 banks that appeared on the problem-bank list between 1990 and 2002. Each bank failed, recovered, merged, or remained a problem between six and 24 months from its first appearance on the list. The study found that the banks' asset quality provided the best clue to their fate, rather than capital levels, as many assume. (Bergman, 2005)

Bank examiners need to take more seriously the increased threat of failure posed by a single executive who wields too much power, the Federal Deposit Insurance Corp. Inspector General's Office wrote in a report. A common element observed in many of the failed bank material loss reviews is that a dominant bank official had a direct impact on the failure of the bank. The FDIC specifies two key dangers of "one-man" banks: the incapacitation of a preeminent manager could leave a major leadership void, and a corrupt executive who amasses too much power could commit misdeeds unchecked. (Bergman, 2004)

One, two many reasons of banking failures...

Could there be other reasons to bank failure other than contagion and inherent fragility?

According to Walter (2005), there is one possible other answer to the widespread failures before 1934 in the US. One possible explanation is that the banking industry was experiencing a shakeout, not unusual in industries those have previously enjoyed significant growth. The number of banks had grown briskly from the mid-1880s until 1921. Beginning in 1921, bank failures increased significantly, such that the number of banks began a precipitous decline that continued until 1934. There are reasons to think that the industry had become overbuilt and that macroeconomic shocks, in conjunction with overbuilding, produced a retrenchment in the industry that lasted for the next 12 years. Indeed, many authors point to the relationship between bank failures and weakening economic conditions. This author suggests that overbuilding could have made the banking industry all the more sensitive to macroeconomic shocks. A number of other industries provide examples of growth followed by shakeouts, the most recent of which is the telecom industry. As for the solution to contagion,

there is deposit insurance provided by the federal government, which put a stop to failures.

Lets look at the downfall of Barings, Britain's oldest merchant bank. Barings' collapse shocked the financial world not because of its size—with £5.9 billion of assets at the end of 1993 – but because of the strong position it had built in emerging markets even before they became fashionable, and because of the bank's illustrious 233-year-old history. How did a single trader, Nick Leeson, a 28-year old derivative trader, bring down such a giant ? Nobody was watching him. Nobody questioned the growth of Barings position at that time. The bank had allowed a dual capacity to Leeson, he was both the head of settlement and head of trading. Allowing a trader to settle his own deal makes it easier and simpler for him to hide the risks he is taking. In addition, there was a lack of risk-management unit to check on him. Leeson was trading at the Osaka Securities Exchange and the Singapore Monetary Exchange. It is sad to note that both exchanges failed to detect such abnormality.

It is clear in this case that lack of supervision and control is the fault here.

Where do we go from here?

A bank's traditional role is to be a depositor and a lender. However, as time passes, banks are looking into another source of income , which is more interesting and of course, risky. Capital markets have lured banks away from its tradition.

Risk. Risk. Risk.

Banking is all about seeking profits but without taking excessive risk. Managing risk is becoming the single most important issue for the regulators and financial institution. What are the risks a bank usually faces ?

Credit risk, interest rate risk, foreign rate risk, market risk, legal risk, operational risk and liquidity risk are among the common risks a bank would face. With the competition and deregulation activities going at a faster rate today, there is an increasing complexity of risks faced by banks.

With the operations going beyond the borders, we are now having talks cross-border mergers. There was an earlier discussion between the boss of Dexia, a Franco-Belgian bank and the boss of an Italian bank, Sanpaolo IMI as reported in November 2004 on a merger. However, both the banks' shareholders were upset with the news. Nevertheless, this is happening. And there will be more to come.

Is the banking industry equipped to face the surprises posed by an array of external events and trends?

A watchmaker today has to face stiff competition from a mobile telephone maker today. Why? There is a recent trend today seen by the top watchmakers of the world where sales are dropping as the task of time telling today has been slowly and quietly taken over by mobile telephones.

Strategic risk is being labeled as the biggest risk of all, regardless of one's industry. The key to surviving strategic risk is knowing how to assess and respond to them. What are the components of this new risk?

Industry margin squeeze, technology shift, brand erosion, one-of-a-kind competitor, customer priority shift, new project failure and market stagnation are identified.

The countermeasure proposed for the squeeze on margins is shifting the compete/collaborate ratio.

One very near cousin of collaborating is the merger activity. Around the world, we are seeing such a trend.

This indicates that the people in the banking industry acknowledge that profit margins are gradually diminishing and something must be quickly done to stop another crisis. Technology shift is one whereby a process which will become outdated. Today, 24-hour banking is no longer a unique feature a bank can offer but rather, it has become a standard. With e-banking, one is able to access from any corner of the world.

Funds will be transferred through the Internet and this will add to the risk a bank already poses.

Services and product quality are the two-prong issues related to brand erosion. A pioneer in the charge card industry, Amex almost lost its foothold in the game to Visa and several major banks, which began to steal the market share from Amex globally by challenging the consumer perceptions of the Amex brand. Amex bounced back with the reallocation of investments by reducing the transaction fees, speeding up payment, and increasing support for their advertising. On the flip side of the coin, the banks must be always prepared to continuously upgrade their services and product quality as the opposite may happen, too.

It is very important to scan the horizon constantly to identify and track one's competitor where the threat may come from new product or the ability to do business with lower cost structures. For the banking industry, while it pays to watch what your rivals are doing, it is also equally important to check and balance what the fiscal and monetary policies can affect one's capital structure.

A new product or service venture faces the chance that it will not work technically will fail to attract profitable customers and competitors may be quick to copy it. The best protection against this risk begins with a clear-eye assessment of a project's chance of success before it is launched. There are three approaches in achieving this task. These are smart sequencing which means undertaking the better understood, more controllable project first; developing access options where the best one is eventually picked and employing the stepping-stone method.

Will banks face market stagnation problem? If a bank is unable to find new sources of growth, it will definitely face this risk. Demand innovation is the answer to this issue.

It is evident that strategic risk can be overcome if one has the talent in adapting to changes in financial conditions. And unfortunately today it is not about having the latest gadgets or the latest hardwares.

It is all about having the right knowledge to be able to sense what is coming, it is about having the ability to look into the crystal ball...it is about having the right knowledge.

According to the management guru, Peter F. Drucker, the next society will be a knowledge society.

Knowledge will be its key resource, and knowledge workers will be the dominant group in its workforce. Its three main characteristics will be:

- Borderlessness, because knowledge travels even more effortlessly than money.
- Upward mobility, available to everyone through easily acquired formal education.
- The potential for failure as well as success. Anyone can acquire the "means of production", that is, the knowledge required for the job, but not everyone can win.

It is perhaps also a good idea to have besides the regulatory agencies to monitor the banks, the private companies to keep an eye on the banks as well. In the United States, there are six of such companies who analyze quarterly call report data to provide safety and soundness ratings to every bank in the country.(Milligan 2002). These firms are also listed in the Federal Reserve website. While their classification systems vary, most of them use analytical formulas that draw heavily on the same rating methodology used by the federal and state regulators. CAMELS rating are shared with individual banks only. Therefore, these firms have stepped in to fill the void. The firms' customers include individual consumers, insurance companies and agents. However, if these firms start to sell the ratings in form of wall certificates and window decal as noted in the article, this could be the start of a bad business. The good intention created earlier will be diminished. With firms trying to earn from such trade, there is a tendency to go easy on the ratings and eventually it will look like as if the banks are buying certificates to plaster on the walls to impress customers.

## VIII. LIMITATIONS

There is always a great deal of pressure to find the perfect solution.

The role the regulators play in the 21<sup>st</sup> century is naturally more demanding as the capital markets expand globally. To say that we no longer need the bank regulators is not true. We need them even more now. And the ones who carry with them the values of which will protect the interest of innocent, small investors will be in demand. They are the diamonds in the rough.

Basel II, international banking policy relating to bank capital reserve requirements, requires banks measure credit risk more precisely and hold sufficient capital to protect the bank's stockholders from the credit risk in the portfolio. Basel II is based on the "three pillars": minimum capital requirement, supervisory review and market discipline. It imposes a discipline on banks according to the riskiness of the loan. By the start of 2007, Basel II is scheduled to replace the original Basel I adopted in 1998.

While the laws exist and regulations tighten, there is also a greater to enforce them. Another law passed or another rule introduced will not prevent another failure.

## IX. CONCLUSION

Just as the sand dunes in the desert change patterns at every blow of the wind, perhaps there is a need to revise the CAMELS rating.

Is a good rating system good enough to predict bank failures? Maybe for now.

There is definitely a greater need today to look beyond the numbers published on the financial statements.

And, maybe, just maybe, prudent banking is what the industry needs right now.

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# Influence of Demographic Factors on the Preference of Future Kuala Lumpur Riverfront

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DOI: 10.29322/IJSRP.8.8.2018.p8045

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8045>

**Abstract-** Development of an urban riverfront offers a great opportunity for a city to enrich its social and economic landscape. In the effort to develop a sustainable riverfront development, it is important to understand the key factors that influence the user's preference towards the river. This paper examines the relationship between the demographic characteristics of the users who reside along the river and their visual preferences towards future riverfront in the city of Kuala Lumpur, Malaysia. The study involved a photo-questionnaire survey with 304 respondents coming from different ethnic groups and socio-economic backgrounds. Correlation analysis was used to measure the significant difference between the visual preference dimension and the cultural dimensions of the respondents. This study revealed that the respondents identified strongly with a more organized riverfront setting and also spaces that have greater accessibility to the water body for future image of Kuala Lumpur riverfront.

**Index Terms-** Urban riverfront, socio-demography, visual preference.

## I. INTRODUCTION

In recent years, there has been an increasing interest in accommodating the water and river management, especially in the city region. Revitalization of the river in the city has been done to improve the city image and to provide an opportunity for development close to the city center [2]. Improvement of the waterfront communities and public spaces will contribute into a high quality of life for residents and visitors alike [10]. Even a simple rivers provide a source of enjoyment and tranquillity for many who use only the riverbanks, view the river from afar, or who only know that it is there and available.

Current situation in Kuala Lumpur repeats the history of the other riverfront cities in undergoing the riverfront transformation. The ensuing development that tends to maximize the strategic location near the river and the effort to tackle the flooding problems made the natural river of Kuala Lumpur change into the huge concrete drain [18]. However, it is important to preserve the river in order to sustain the identity of the city towards achieving a sustainable environment. The community should be informed and involved in discussions continuously in any development proposal and intervention.

The purpose of this study is to figure out the influence of socio-demographic factors upon preference which includes gender, ethnic groups, age, level of education and living place. Residents who live near to the river were selected to be a part of this study. It is expected that there will be a logical explanation on the respondents' visual preferences and in the same time, it could benefit for it articulates a more conceptually refined account of memory and its relation to identity and history. This research is important to generate a research framework and approach that integrate the personal background of the respondent and visual dimensions of riverfront. Therefore, this study will identify the impact of the people's background in making an appropriate design for the riverfront area.

## II. LITERATURE REVIEW

It has been agreed by many researchers that person's backgrounds are the major factor in influencing the result of the preference study [12]; [19]; [6]; [17]. People grow up in a different cultural setting, thus the differences in lifestyles give informal lessons about how one should perceive their environment. Moreover, people from the same cultural background are likely to have similar preferences because of their similar experiences. Attend conferences, workshops and symposiums on the same fields or on related counterparts.

Numerous findings have proved the assumption above. It is argued that the differences in culture play an important role in their understanding of nature or landscapes and what roles should the people play with nature. Buijs, Elands, and Langers investigate to

what extent immigrants from Islamic countries and the native Dutch have different images of nature and landscape preferences [3]. They found the interesting finding which is Native Dutch people are strong supporters of the wilderness image, while immigrants generally support the functional image. This may be related to the divine task in Islam for humans to manage nature and to bring wild areas into the culture. Another finding outlined the cultural differences in the perception of the world where individuals from Western cultures tend to focus on that which is object-based, categorically related, or self-relevant whereas people from Eastern cultures tend to focus more on contextual details, similarities, and group-relevant information [7]; [13].

Furthermore, a study about culture can also shed lights on reasons why certain society failed to sustain their environment and make this aspect become more pertinent for getting a quality of life. Another finding that resembles the point of view above is the survey which explored Malaysian preferences of the garden scenes and elements seemingly most favorable for Malaysian gardens. The finding shows that the most preferred garden scenes for Malaysians in the iconography of their own gardens include a large area of water and plant. Moreover, a clear, clean and reflective water presented by both lake and geometrical basins are the most preferred types of water scenes [11].

In general, any type of arrangement and intervention such as plantation, hardscape, and landscaping in the cities should comply with the adaptable culture of the area. It is crucial for maintaining the environment of the area which shaped a modern society and has a great value for our understanding of how we should live today. The study needs to explain the reasons why a particular culture becomes a significant predictor for landscape preferences. In this context, a study about the relationship between culture and landscape preference becomes important. Therefore, the cultural background has much effect towards preferences and it is important to look at the relationship between the culture and preferences for the future Kuala Lumpur riverfront since Malaysia is a multi-racial country with three major ethnic groups which is Malay, Chinese, and Indian.

Several types of research suggested that the potential outcomes of the subcultural show substantial difference in preferences occurred when samples are sharing the same landscape [21]; [8]; [14]. In terms of gender and age, the effect has regularly been found in the environmental studies. However, the effect is still ambiguous caused many different findings have been found. Studies report that women tend to be more concerned about the environment rather than men in particular landscape setting which had more flower. Thus, females gain more benefits from passive recreational activities in urban green spaces since they more concerned with it [21]; [1]. In other finding, females are more hesitant to participate in outdoor recreation than men [24]. The same pattern was shown in another finding where parks with sports fields are actively dominated by men and under-utilized by women [25]. However, both male and female show a similar preference towards flora and fauna. Moreover, urban and rural residents from all gender and ages show the similar preference when it comes to the natural setting.

In term of age, several researchers indicate the importance of it to influence the environment changes for the future. Nearly one-quarter of Generation Y from the previous sample research says it's very important to work in a green, environmentally conscious workplace even down to the details of office energy use (Reshape et al., 2009). The people awareness towards their environment change with time and also with age. Yamashita (2002) found the difference respond between adult and children mainly in evaluating a river landscape. Therefore, the age of the participants did affect their level of preferences [26]; [16].

Education has been shown to be the most consistent predictor of environmental concern. A lot of the work indicates that individuals with high levels of education tend to be concerned more about the environment [5]; [28]. Instead of it, most of the researchers have explained these preferences in socio-economic terms, showing for example that preferences for managed landscapes are positively correlated with age and negatively correlated with education [23]; [14]. In line with it, Tveit (2009) found that the students in design field preferences do not reflect the landscape preferences of the wider public and that future landscape professionals have a different appreciation of visual scale in the landscape than the general public. It may not be surprising that professional and academic expert has a different preference that differs from those of the general public. Moreover, employment is including in this research considering students and other groups might affect the preferences differences though it is not a popular predictor.

Despite that, public spaces have been found work well when they establish a direct relationship between the space and the people who live and work around it [27]. Evidence for the importance of community in creating the public spaces can be found in numbers of studies. In Singapore, Yuen & Hien examines residents' perceptions and expectations of rooftop gardens. Moreover, these physical and visual experiences will help to create lively and diverse places to encourage a sense of community and an appreciation for nature [4]. In addition, Hoyle agreed that community groups provide a significant influence on the processes of change in waterfront zones [9]. The residents' images were more extensive, more detailed, and less amorphous than the visitor images [15]; [20]. Generally, this group hopes for a more ecologically sound relationship between the cities and rivers.

### III. METHODOLOGY

Visual preference survey (VPS) with the 5-Likert scale was conducted in this study to discover the residents' preference of the visual image for the future Kuala Lumpur riverfront. This analysis employed the factor analysis (Principal Component Analysis or PCA). The PCA is a data reduction technique for grouping the photographs to certain dimension based on internal consistency in response.

The means of 80 scenes were calculated and by using the Principle Component Analysis (PCA), the data has been reduced to five dimensions which represent the type of the riverfront.

The independent t-test was applied to identify the impact of age on each preferences dimension while one-way between groups ANOVA (Analysis of Variance) was applied to identify the impact of age, ethnic groups, and level of education, employment and living place. This finding is to answer the objective of the study which is to identify the possible effects of personal factors on residents' priorities towards the future of the Kuala Lumpur Riverfront.

#### IV. SAMPLE

Residents at Kampung Bharu, Brickfields, Titiwangsa, and Chow Kit were selected to be surveyed since they were expected to be the frequent user and they recognize the river better than others. The selected study area was in the residential area near to the Kuala Lumpur riverfront area which is Kampung Bharu, Brickfields, Titiwangsa, and Chow Kit. The respondents for this study have various backgrounds in term of gender, age, ethnicity, education level, place of living and employment status. Based on the data, they are 136 males (44.7%) and 168 females (55.3%). Most of the respondents are in the group of 18 to 24 years (n=182, 59.9%), followed by 25 to 34 years (n=90, 24%) and the above 34 years old group are the nominate group (n=31, 10.2%), while one respondent missed to indicate the gender. Rather than questioning the real age of the respondents, the age is categorized into three roughly equal quotas to make the comparison more reliable.

The ethnicity of the Malay group reported significantly higher than the other three groups. There were 218 Malays (71.7%), 50 Chinese (16.4%), 26 Indians (8.6%) and 10 were from another ethnicity (3.3%). In terms of the education level 23.4% SPM level has been stated while 21.4% demonstrate the STPM (Sijil Tinggi Pelajaran Malaysia), Diploma and Certificate level. The following group of Undergraduate level is 53.3%, significantly more than others and only 1.6% are post-graduates group while one participant missed to indicate the education level. A relatively high level of education is very secure because the more educated respondents represent a low human error in academic research.

Employment information of the respondents in the student group is 51.3% are the big number of other groups followed by 22% of Private sector. The government sector is 10.2%, self-employment is 8.9%, while about only 7.2% is unemployment. This data has one missing to indicate the employment detail. As there are several educational institutions nearby the residential areas, the number of students becomes the dominant amount as respondent in the study results. Furthermore, they are willing to spend time for this study. The participants were distributed almost equally based on where they live. There were 27% live at Kampung Bharu, 30.6% at Chow Kit, 23.7% at Titiwangsa and about 18.8% were from Brickfields. This is due to the fact that if a sample is taken from a particular group is too small, it does not give a robust result. These results are instructive in two major respects. Some striking differences identified in preferences might be considered to be cross-cultural.

#### V. RESULT AND DISCUSSION

The purpose of this analysis is to figure out the influence of socio-demographic factors upon preference which includes gender, ethnic groups, age, level of education and living place. The independent t-test was applied to identify the impact of gender on each preferences dimension while one-way between groups ANOVA (Analysis of Variance) was applied to identify the impact of age, ethnic groups, and level of education, employment and living place. This finding is to answer the objective of the study which is to identify the possible effects of personal factors on residents' priorities towards the future of the Kuala Lumpur Riverfront.

##### 1. Gender

Based on Table 1, the statistical analysis of an independent sample t-test was carried out between all types of dimension and the gender of female and male to compare their means. The result revealed that gender of the respondents did not affect their visual preferences on four dimensions which are Unorganized Riverfront Landscape Dimension, Organized and Open View Riverfront Landscape Dimension, Shaded Riverfront Landscape and Organized Narrow Riverfront Landscape Dimension but did affect one dimension which is Natural Looked Riverfront Landscape Dimension. Females differ from that of males only in reaction to the preference Dimension 2, Natural looked riverfront. Male preferred this dimension in which a group of scenes presents a greenery along the river and also a green forest river.

Table 1: Result of Independent Sample t-test comparing preference dimension between males and females.

Preference dimensions	Mean		T-test for Equality of Means		
	Male	Female	t	Df	Sig. (2-tailed)
<b>Dimension 1</b> Unorganized riverfront landscape	3.6410	3.5456	1.048	298	.296
<b>Dimension 2</b> Natural looked riverfront	<b>3.9985</b>	<b>3.8457</b>	<b>1.973</b>	<b>298</b>	<b>.049</b>
<b>Dimension 3</b> Organized and open view riverfront	3.8528	3.7909	.719	298	.472
<b>Dimension 4</b> Shaded riverfront	3.8531	3.7752	.904	297	.367
<b>Dimension 5</b> Organized narrow riverfront	4.1630	4.0561	1.412	298	.159
<b>Total Visual Preferences</b>	3.9017	3.8037	1.423	298	.156

The result shows that the female mean ranking for all dimension is lower than male. As indicated in the literature review, females were more concerned with passive recreational activities in urban green spaces than male. Therefore, while ranking the preferences to select the ideal visuals for riverfront view in the future, they are more likely to observe detail elements in the surrounding areas that can reduce their stress and balance their mood to gain a benefit from it. However, in this study, both gender preferred the Organized Narrow Riverfront Landscape Dimension than another dimension.

## 2. Age

The analysis of variance, ANOVA was applied to explore the impact of age on visual preferences in each dimension. Respondents were divided into three groups according to their age (Group 1: 18 to 25 years old; Group 2: 25 to 34 years old; Group 3: 35 years old and above). According to Pallant (2005), Welch test is one of the appropriate tests should be applied if Levene’s test has significant value < 0.05. As stated in Table 2, the significant value for all dimension is  $p < 0.05$ . All dimensions show a significant difference between the age group. This result of this part was consistent with Yamashita’s (2002), Reshape, Sherbin and Sumberg (2009), which stated the age of the respondents did affect their level of preferences.

Table 2: Results of a One-way ANOVA comparing preference dimension among participants according to age group

Preference dimensions	Sig.	Anova		Mean		
		F	Sig	<25 years old	25-34 years old	>34 years Old
<b>Dimension 1</b> Unorganized riverfront landscape	.292	6.067	.003	3.4665	3.8067	3.6900
<b>Dimension 2</b> Natural looked riverfront	.000	9.624	.000	3.7827	4.1165	4.1280
<b>Dimension 3</b> Organized and open view riverfront	.493	6.501	.002	3.7060	3.9396	4.1452
<b>Dimension 4</b> Shaded riverfront	.018	10.154	.000	3.6702	3.9775	4.1944
<b>Dimension 5</b> Organized narrow riverfront	.003	3.934	.021	4.0223	4.2416	4.2177
<b>Total Visual Preferences</b>	.111	10.076	.000	3.7295	4.0164	4.0777

The post-hoc comparison using the Tukey HSD (Honestly Significant Difference) verified that all age group had significant differences in visual preference scores in all Dimensions. In Unorganized Riverfront Landscape Dimension, the HSD analysis indicated only the 18 to 25 years old group had a significant difference with the 25 to 34 years old group. The similar result goes to the Organized Narrow Riverfront Dimension which indicated the significant difference between the 18 to 25 years old group and the 25 to 34 years old group.

34 years old group. While for the Natural Looked Riverfront Dimension, Organized and Open View Riverfront Dimension and the Shaded Riverfront Dimension had a significant difference between the group aged 25 years old and below 25 to 34 years old age group. The 25 years old and below age group also had a significant difference with the 34 years old and above age group. Table 2 summarized the descriptive analysis for each dimension. For Natural Looked Riverfront Dimension, Organized and Open View Riverfront Dimension and the Shaded Riverfront Dimension, as the respondent's age increased, their preferences towards these dimensions were increased too. While for Unorganized Riverfront Landscape Dimension and Organized Narrow Riverfront Dimension indicated that the middle age group which is 25 to 34 years old respondents, had a higher mean score for the age groups followed by the below 25 years old age group and above 34 years old age group. However, there was an agreement among the age groups, the respondents of all age groups preferred the Organized Narrow Riverfront Dimension the most and preferred the natural embankment the least. The possible explanation for the age group below 25 years old had a lowest mean score for all dimension is because this group represents the highest number of respondents and this group also represent the Y generation who are expecting more from their environment.

### 3. Ethnicity

In order to determine if there is a significant difference in visual preference according to ethnicity, repeated measures of ANOVA were used. Table 3 shows only Shaded Riverfront Dimension indicated the significant difference for ethnic group,  $p < 0.05$  (0.015), while there is no significant mean difference for Unorganized Riverfront Landscape Dimension, Natural Looked Riverfront, Shaded Riverfront Dimension and Organized Narrow Riverfront Dimension,  $p > 0.05$ .

Table 3: Results of Levene's test of homogeneity of variances, ANOVA and Robust test to identify visual preference according to ethnic groups.

Preference dimensions	Sig.	Anova		Mean			
		F	Sig	Malay	Chinese	Indian	Others
<b>Dimension 1</b> Unorganized riverfront landscape	.101	.479	.697	3.5646	3.6586	3.7026	3.4533
<b>Dimension 2</b> Natural looked riverfront	.044	2.219	.086	3.8679	3.9280	4.2038	4.0900
<b>Dimension 3</b> Organized and open view riverfront	.100	1.851	.138	3.7810	3.8625	4.1154	3.6375
<b>Dimension 4</b> Shaded riverfront	<b>.038</b>	<b>3.545</b>	<b>.015</b>	<b>3.7823</b>	<b>3.7167</b>	<b>4.2500</b>	<b>3.7333</b>
<b>Dimension 5</b> Organized narrow riverfront	.498	1.206	.308	4.1028	4.0500	4.2981	3.9000
<b>Total Visual Preferences</b>	.019	1.979	.117	3.8205	3.8431	4.1140	3.7628

The post-hoc comparison using the Turkey HSD shows that for Shade Dimension, there is a significant difference between Malay and Indian, and Chinese with Indian ethnic group. Table 3 shows the descriptive analysis for Shade Riverfront Dimension, which indicates the significant difference. Shaded Riverfront Dimension, which provides shades from trees or sheltered spaces to the user was mostly preferred by the Indian respondents but least preferred by the Chinese respondents. However, all the ethnic groups preferred the Organized Narrow Riverfront Dimension the most, which emphasized on wall attraction that attracted the respondent's eye. The findings from the above analysis support the previous study which found that Malaysian enjoys the area that includes a large area of water and plant.

### 4. Level of education

In this section, respondents from four different levels of education were compared against the total preference score and five dimension groups. The results shown in Table 4 indicate that there is a statistically significant difference in mean scores for all dimensions according to the respondents' level of education at  $p < 0.05$ .

Table 4: Results of Levene’s test of homogeneity of variances, ANOVA and Robust test on visual preferences according to level of education.

Preference dimensions	Sig.	Anova		Mean			
		F	Sig	SPM	STPM/ DIP/ CERT	Under-graduate	Post-graduate
<b>Dimension 1</b> Unorganized riverfront landscape	<b>.000</b>	<b>5.383</b>	<b>.001</b>	3.7136	3.8483	3.4287	3.6000
<b>Dimension 2</b> Natural looked riverfront	<b>.000</b>	<b>6.891</b>	<b>.000</b>	3.9563	4.2057	3.7748	4.0600
<b>Dimension 3</b> Organized and open view riverfront	<b>.060</b>	<b>10.271</b>	<b>.000</b>	3.8856	4.2090	3.6359	3.7250
<b>Dimension 4</b> Shaded riverfront	<b>.018</b>	<b>9.975</b>	<b>.000</b>	3.8991	4.1878	3.6310	3.5333
<b>Dimension 5</b> Organized narrow riverfront	<b>.059</b>	<b>4.322</b>	<b>.005</b>	4.1373	4.3359	4.0031	3.9000
<b>Total Visual Preferences</b>	<b>.000</b>	<b>10.695</b>	<b>.000</b>	3.9184	4.1586	3.6947	3.7637

As can be seen from the Table 4 above, in Unorganized Riverfront Landscape Dimension, the most preferred for this dimension was by the respondents from STPM, Diploma and Certificates group while the least preferred for this dimension was by respondents from Undergraduates group. The findings are similar to the Natural Looked Riverfront Dimension group and Organized and Open View Riverfront Dimension. These groups also reported that respondents from level STPM, Diploma, and Certificates group preferred the most and Undergraduates group preferred the least. The score means for the Shaded Riverfront Dimension and the Organized Narrow Riverfront Dimension interpreted that the most preferred respondents for those dimensions were from the STPM, Diploma and Certificates group also but in this case, the least preferred was from the Post-graduates groups. Therefore, it would be the valuable finding that respondents with higher education (Group Undergraduate and Post-graduates) giving a lower scale on the majority of the dimensions available for visual preferences in riverfront of Kuala Lumpur, while those with lower education (Group SPM, STPM, Diploma, and Certificate) giving a higher scale. The result is supporting the previous research that individuals with high levels of education tend to concern more about the environment. This shows that they have a higher taste and a deeper desire to choose the ideal visuals for the river.

**5. Location of residence**

As mentioned in the literature review, it is clear that community groups provide a significant influence on the processes of change in riverfront zones. Therefore, four locations were chosen for this research from four ports cities that located near to the Kuala Lumpur riverfront. This research was focused only on residents at Kampung Bharu, Brickfields, Titiwangsa and Chow Kit. It is apparent from Table 5 that total preference score of residents toward the study area differs significantly in accordance with their location of residence. Surprisingly, all the dimensions of visual preference show the significant difference at  $p < 0.05$ .

Table 5: Results of Levene’s test of homogeneity of variances, ANOVA and Robust test on visual preference according to locations of residence

Preference dimensions	Sig.	Anova		Mean			
		F	Sig	Kg. Baru	Chow Kit	Brick-fields	Titiwang -sa
<b>Dimension 1</b> Unorganized riverfront landscape	<b>.000</b>	<b>34.124</b>	<b>.000</b>	3.8115	3.3112	4.2351	3.1704
<b>Dimension 2</b> Natural looked riverfront	<b>.000</b>	<b>13.604</b>	<b>.000</b>	4.0481	3.8941	4.2158	3.5460
<b>Dimension 3</b> Organized and open view riverfront	<b>.000</b>	<b>19.403</b>	<b>.000</b>	3.9167	3.8585	4.2215	3.3327
<b>Dimension 4</b> Shaded riverfront	<b>.000</b>	<b>22.694</b>	<b>.000</b>	3.9712	3.7611	4.2632	3.3258
<b>Dimension 5</b> Organized narrow riverfront	<b>.000</b>	<b>11.363</b>	<b>.000</b>	4.1296	4.2418	4.2982	3.7430
<b>Total Visual Preferences</b>	<b>.000</b>	<b>27.897</b>	<b>.000</b>	3.9754	3.8152	4.2468	3.4236

This is parallel to the theory of literature reviews where public spaces work well if they create a direct connection between space and people living or working around it. Residents nearby the river are more aware of the wants in their public space as they are the users who will often use the river area. Moreover, this finding emphasized that the respondents that live in Brickfields preferred most for all five dimensions while the respondents that live in Titiwangsa shows the least preferred for all dimension. A possible explanation for this is that the respondents from Brickfields interest in the expanded area of a natural embankment that full of greenery on it and provides the shelter area and street arts rather than the respondents that live in the Titiwangsa. This is because the differences in current rivers in each settlement area have influenced their visual preferences. The area in Brickfields has been found to have green areas whereas the areas in Titiwangsa and others are mostly being concrete drainage areas. Therefore, they have higher expectations and know well their needs for the river as the existing river conditions have the opportunity to be made as in the choice of the given picture. The scenery for the current riverside visual for each residential area can be referred to the study area in chapter three. It is parallel with the previous theory by Kaplan which people with different experience might have different preferences towards nature.

## 6. Employment

Table 6 shows that there is a statistically significant difference in mean for the visual preference scores for all dimensions among the respondent's employment groups at  $p < 0.05$ . This indicates a similar finding with the visual preference according to the age groups, level of education and location of residence.

Table 6: Results of Levene's test of homogeneity of variances, ANOVA and Robust test on the visual preference in relation to employment.

Preference dimensions	Sig.	Anova		Mean				
		F	Sig	Gov. Sec.	Pri. Sec.	Un-employ	Self-employ	Stu-ent
<b>Dimension 1</b> Unorganized riverfront landscape	.012	8.680	.000	3.8301	3.8828	3.6970	3.8885	3.3431
<b>Dimension 2</b> Natural looked riverfront	.000	5.178	.000	4.0871	4.0965	4.0636	4.1062	3.7477
<b>Dimension 3</b> Organized and open view riverfront	.027	5.580	.000	3.8710	4.0152	4.0227	4.1528	3.6381
<b>Dimension 4</b> Shaded riverfront	<b>.004</b>	<b>9.710</b>	<b>.000</b>	4.0000	4.1313	4.0076	4.0513	3.5717
<b>Dimension 5</b> Organized narrow riverfront	.022	2.521	.041	4.2177	4.1023	4.2955	4.3611	4.0147
<b>Total Visual Preferences</b>	.001	8.669	.000	4.0012	4.0456	4.0173	4.1160	3.6631

The post-hoc comparison using the Tukey HSD on all dimensions found that there are significant differences for the respondents who are self-employed and the respondents who are the students. The descriptive analysis in the Table 6 reveals that the respondents who are under the self-employment group prefer all five preferences dimension the most which are Unorganized Riverfront Landscape Dimension, Natural Looked Riverfront Dimension, Organized and Open View Riverfront Dimension, Shaded Riverfront Dimension and Organized Narrow Riverfront Dimension. In contrast, the student groups prefer the least from all the five preference dimensions. The possible explanation from the result above will be the same as the age group which is because most of the students are Y generation. They are more exposed to the worldwide through the internet and they are more aware of the importance of the environment as mentioned by Reshap W. and others. Therefore, this leads them to be more expectation in creating their future surrounding based on their imagination.

Respondents who are under the self-employment group prefer all five preferences dimension the most which are Unorganized Riverfront Landscape Dimension (URLD), Natural Looked Riverfront Dimension (NLRD), Organized and Open View Riverfront Dimension (OORD), Shaded Riverfront Dimension (SRD) and Organized Narrow Riverfront Dimension (ONRD). In contrast, the student groups prefer the least from all the five preference dimensions. The possible explanation from the result above will be the same with the age group which is because most of the students are Y generation. They are more exposed to the worldwide through the internet and they are more aware of the importance of the environment as mentioned by Reshap W. and others. Therefore, this leads them to a higher expectation in creating their future surrounding based on their imagination.

## VI. CONCLUSION

In conclusion, certain aspects of demography had a significant correlation with landscape preference. It would affect the people preferences and would make some gaps in the outcomes. Thus, a limitation to present the study is related to the fact that all participants were the residents in the area in question and the number of the participants for each group of socio-demographic should be equally distributed to represent the findings. Subculture for this study is referring to the gender, age, the level of education, place of residence and employment. The findings are important to ensure that the newly revitalized riverfront in Kuala Lumpur will suit the need of the city inhabitant psychologically and aesthetically.

## ACKNOWLEDGMENT

I would like to take this great opportunity to show my gratitude to all those who had made this study possible. This would not have been completed without the assistance, guidance, support and kindness of those around me. First and utmost appreciation to all my supervisors Prof. Madya Dr. Norsidah Ujang and Prof. Madya Lar. Dr. Suhardi Maulan for their continual feedback, support, supervision, suggestion, assistance and kindness throughout this study.

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# Palaeocurrent Analysis of the Tertiary Rocks of Changkikong Range, Mokokchung District, Nagaland, Northeast India

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DOI: 10.29322/IJSRP.8.8.2018.p8046  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8046>

**Abstract:** Tertiary rocks of Changkikong Range constitutes a part of belt of Schuppen- a most prominent morphotectonic unit of Naga Hills. The palaeocurrent patterns for the Barail Group (Tikak Parbat Formation) , Changki Formation and Tipam Group (Tipam Sandstone Formation) have been studied . Interpretation reveals polymodal, bimodal , bimodal-pipolar palaeocurrent patterns in the study area.

**Key words:** Palaeocurrent analysis, Belt of Schuppen, Changkikong Range, Naga Hills, North east India.

## Introduction

The Changkikong Range one of the majestic hill ranges in the Mokokchung District of Nagaland. To its west lies a parallel range named Japukong Range. These are manifestations of thrust slices in the belt of Schuppen – the western most morpho-tectonic unit of NE-SW trending Naga Hills. The study area covers nearly 125 square kilometres bounded between north parallels of 94°20' and 94°30' east meridians of 26°24' and 26°30' of the Topographic Sheet No.83 G/7 of Survey of India.

The Tertiary succession (Evans,1932; 1964) of the study area preserves well developed cyclic pattern and normal stratigraphic succession except along the western face of the Changkikong Range where the thrust contact between the successive litho-units has been recorded. The succession comprises of coal bearing Tikak Parbat Formation of the Barail Group (Oligocene), the Changki Formation and Tipam Sandstone Formation of the Tipam Group (Miocene).The Tipam sandstone Formation is in turn overlain by Dihing Formation. During recent years, increasing attention has been paid towards interpretation of dispersal patterns and depositional environments of clastic sedimentary rocks on the basis of measurement of directional sedimentary structures and dimensional fabrics. In the present area of investigation, palaeocurrent data have been collected from the field through the measurement of small and large scale cross-stratifications, ripple marks and channels.

## Methods of investigation

The following methods were used for determining the palaeocurrent directions .

## Cross-stratifications

Cross-stratifications encountered in the Tertiary rocks of the study area are mostly trough and planar varieties (Michelson and Dott, 1973). Foresets of these units are essentially plane or concave upwards and meet the overlying and underlying 'normal' bedding either at sharp angle or erosional base (Photo no.3&4). Pebbles and granules are commonly concentrated along the forests or parallel to the bedding plane . Cross-stratification generally occurs as a single sedimentation unit overlain and underlain by normal bedding planes.In some vertical profile sections, it occurs as co-sets or grouped sets (McKee and Weir, 1953).

For the cross-stratifications, the following measurements were made and recorded in the field.

- (i) Dip and strike of the 'normal' bedding.
- (ii) Dip and strike of foresets beds.
- (iii) Dip and strike of trough cross - strata, measured according to the procedure outlined by Slingerland and Williams (1979).

- (iv). Thickness or scale of cross-bedded units according to the classification proposed by Miall (1974), large scale cross-beds > 25 cms. Medium scale cross-beds 5-25 cms. Small scale cross-beds <5 cms.
- (v). Length of foreset beds.

The area was arbitrarily divided into 3 square kilometres sectors following approximately 'nested' or hierarchical sample design (Olson and Potter, 1954). However, the cross-bedding measurements were made keeping in view availability of exposures. Nearly 100 readings were taken for each Formation from approximately fifteen exposures of Tertiary rocks under study. The thickness of cross-bedded units in Tikak Parbat, Changki and Tipam Sandstone Formations range between 5 to 20 cm, 15 to 60 cm and 10 to 25 cm respectively. The cross-bedding inclination or dihedral angle between the plane of foreset beds and plane of bedding ranges respectively between  $5^{\circ}$  to  $25^{\circ}$ ,  $5^{\circ}$  to  $15^{\circ}$  and  $5^{\circ}$  to  $10^{\circ}$ . The inclination of a foreset bed is a function of angle of repose of the sedimentary particle at the time of deposition. According to McKee (1940) and others, eolian sandstone has inclination of  $33^{\circ}$  or more where as it is upto  $28^{\circ}$  for water-laid sandstones. In the present case, almost all the data on foreset inclinations fall within water-laid deposits.

### Ripple Marks

Both asymmetrical and symmetrical ripple marks were observed in the Tertiary sediments of the study area. Linguoid small ripples and sinuous, bifurcating wave ripples with ripple index ranging from 4 to 5 are commonly associated with calcareous sandstones of Tipam Sandstone Formation. Both current and wave modified ripples are prevalent in Tikak Parbat and Tipam Sandstone Formations. Well preserved straight crested dunes ( $L=2.75m$ ,  $H=0.4m$ ) with succession of tidal bundles containing reactivation surfaces were also recorded from Tikak Parbat.

Comparatively, the ripple marks are fairly common in Tipam Sandstone Formation, moderate in Barails and rare in Changki Formation. Approximately ten, fifteen and five measurements of ripple crest Azimuths were recorded in Tikak Parbat, Changki and Tipam Sandstone Formations respectively (photo no.2).

### Channel Structures

Erosional sedimentary structures, measuring approximately 0.5 meters across; concave up in cross section and showing cross cutting relationship to underlying sediments, were recognised as channels. These are usually infilled with coarser sediments than that below or adjacent, and there is commonly a basal conglomeratic layer. Cross bedded sandstones infill most of these channels. Such channel structures are fairly common in Changki Formation and not very uncommon in Barails and Tipam Sandstone Formation. All together approximately ten readings on orientation of channels were made depending on their availability in respective Formations (photo. no.1).

### Conclusion

#### Palaeocurrent patterns

Empirical studies on palaeocurrents have shown that for structural dips more than 25 degrees, a tilt correction is necessary (Carver, 1971; Sen Gupta, 1994) to ascertain the correct direction of palaeocurrents. In the area of investigation, the average amount of dip for various litho-units ranges between  $24^{\circ}$  to  $54^{\circ}$  and hence the possibility of tilt induced error between measured and original Azimuths become more likely. The orientation data on measurements of linear and planar sedimentary structures were treated to the tilt correction technique after Potter and Pettijohn (1977), before they were analysed for palaeocurrent patterns. Palaeocurrent measurements, thus corrected were grouped into compass intervals (i.e.  $0^{\circ}$  to  $29^{\circ}$ ,  $30^{\circ}$  to  $59^{\circ}$  and so on) and then plotted on a rose diagram (Table 4.8 Fig. 44) following Nemeč (1988). For data from structures giving current Azimuths, the rose diagram was conventionally constructed showing the current to sense, the directions. Calculations for Vector mean and dispersion were omitted as none of the palaeocurrent patterns were unimodal (Tucker, 1996; p.124). Accordingly, palaeocurrent patterns obtained may be grouped into three types, namely, bimodal bipolar, bimodal (oblique) and polymodal (Fig. 44). The polymodal pattern characterise the Changki Formation, where as, Barail Group and Tipam Sandstones display bimodal (oblique)- polymodal and bimodal (oblique)- bimodal bipolar patterns respectively. As a whole, the palaeocurrent patterns characterise a near-shore, beach environment having mixed wave-tide influence. All the three major litho-units viz. Barail Group, Changki Formation and Tipam Sandstone Formation, appear to have been deposited parallel to palaeoshore line. This is further substantiated by their overall shoestring type of geometries (Tucker, 1996).

### Transport mechanisms and dispersal

The transport mechanisms and dispersal patterns of the Tertiary sediments in the area appears to be rather complex. Detritals were transported from various source terranes mostly through fluvial process and reworked under marine conditions before they were finally deposited. The dispersal pattern, as revealed by dominant palaeocurrents, appear to be mostly longitudinal. During Barail sedimentation the dispersal took place from the Naga Hills ophiolite to the east as well as Mishimi Hills, Himalayas and Trans-Himalaya to the north. The Changki and the Tipam Sandstone Formations received detritals mostly from the east i.e. Naga Hills Ophiolite with subordinate contribution from the north. The nature and scae of sedimentary structures together with maximum clast size reveal general dominance of bed load during the deposition of Changki Formation, where as saltation and suspension dominated during the deposition of Barail and Tipam Sandstone Formation. All the petrofacies were influenced by frequent changes in energy conditions mostly due to storm induced wave dominated depositional environments. This is further substantiated by the polymodal, bimodal, bimodal-bipolar palaeocurrent patterns in the study area.



Photo 1: Well Defined Channel (0.5m across)



Photo 2: Linguoid small ripples (arrowhead) and sinuous bifurcating wave ripples.



Photo 3: Trough-Lenticular Cross-Bedding



Photo 4: Ripples seen towards lower side of the photograph while in the upper part major channels are. Straight crested dunes with succession of tidal bundles containing reactivation surfaces are seen in the middle.

**Table 1: FREQUENCY DISTRIBUTION (IN PERCENT) OF CROSS-BEDDING DATA MEASURED AT DIFFERENT LOCALITIES IN CHANGKIKONG RANGE. CLASS INTERVAL IN DEGREES**

LOCALITY	0-29	30-59	60-89	90-119	120-149	150-179	180-209	210-239	240-269	270-299	300-329	330-359
<b>BARAIL GROUP</b>												
West of Changki	0.00	0.00	0.00	66.66	0.00	0.00	33.33	0.00	0.00	0.00	0.00	0.00
North east of Longnak	10.00	0.00	0.00	15.00	37.00	0.00	0.00	0.00	10.00	10.00	10.00	0.00
<b>CHANGKI FORMATION</b>												
Changki	12.50	0.00	25.00	12.50	0.00	0.00	12.50	37.50	0.00	0.00	0.00	0.00
Mangkolemba	0.00	0.00	0.00	0.00	0.00	9.00	0.00	22.72	22.72	45.45	0.00	0.00
<b>TIPAM SANDSTONE FORMATION</b>												
Chungliyimsen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	0.00	50.00	0.00	0.00
Khar	0.00	0.00	0.00	25.00	25.00	0.00	0.00	0.00	0.00	0.00	50.00	0.00

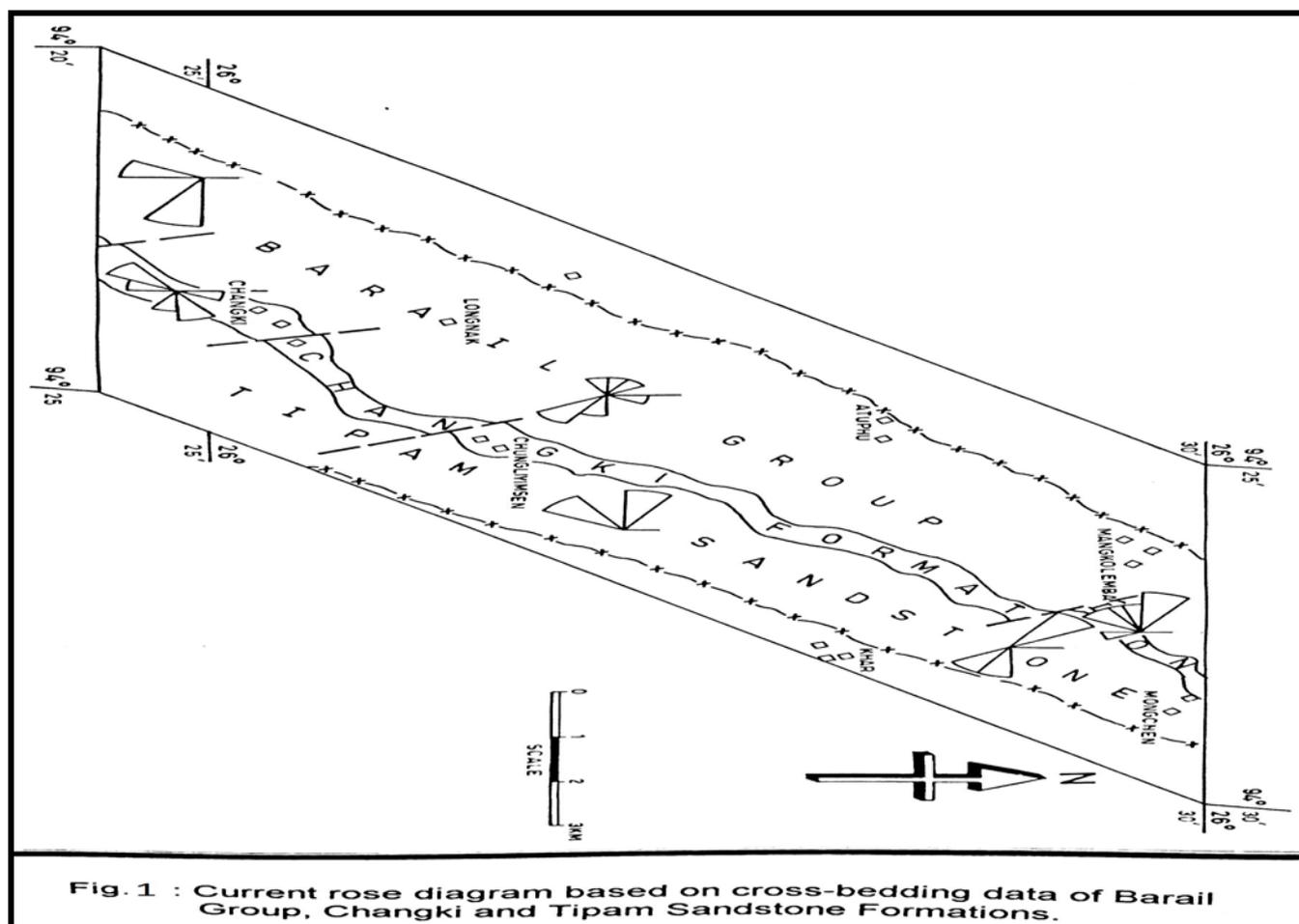


Fig. 1 : Current rose diagram based on cross-bedding data of Barail Group, Changki and Tipam Sandstone Formations.

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# Anthropogenic Contribution to Air Pollution with Background Emissions; Case of Nairobi, Mombasa and Kisumu

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DOI: 10.29322/IJSRP.8.8.2018.p8047

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8047>

## Abstract

The study followed a Driver-Pressure-State-Impact and Response (DPSIR) framework where cause-effect-response model was adopted. Mt Kenya Global Atmosphere Watch (GAW) station was used as background station with the assumption of natural pollution occurrence. The pollutants that were studied include Particulate Matter (PM<sub>2.5</sub>), Sulphur dioxide (SO<sub>2</sub>) and Carbon dioxide (CO<sub>2</sub>). The pollution dataset was sourced from Modern-Era Retrospective Analysis for Research and Application (MERRA – 2) while wind data was sourced from Kenya meteorological department (KMD) from 2000 to 2016. Time series and correlation analysis were used to describe data characteristics while cross-sectional analysis was done to ascertain spatial behaviour of pollutants. Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) and Wind Rose plotting (Wrplot) were used to determine wind trajectory and wind frequency

MAM and SON winds were light to moderate easterlies and sometimes southeasterly. However, the spatial and temporal interactions with different scales bring in a different flow characteristics of wind. This differential scale otherwise known as inhomogeneity, is seen in most stations that have built canopy particularly in urban centres. Moreover, the densely populated built structures that alter the flow of pollutants complicate the nature of flow. There were correlations of more pollutants during dry seasons of the year. The pollutants were dispersed beyond 50 km within short periods with least dispersion occurring during the long rain season.

The findings of this study indicate that background emission is increasing at a lower rate compared to increases at station located in urban areas due to human activities. The main contributors to the burden of pollutants in the near surface atmosphere are thus human activities followed by wind and other natural factors. Therefore, the study recommends for a consultative planning process of the management of urban centers that accounts not only for the expected increased human activities but also for the observed wind characteristics and other natural factors over the towns.

**Key words:** *Anthropogenic Contribution, Pollutants, Background Emission*

## 1.0 INTRODUCTION

Human beings need clean air as a basic requirement for good human health and his well-being (WHO 2012). Yet, air pollution remains a serious threat to life. A report by the World Health Organization (WHO, 2012) gave a worrying figure in terms of global air pollution contribution to mortality. The data released attributed seven million deaths to poor air quality in 2012 and double the figure released in 2004. These values show a reduction of desirable quality of air globally with two million premature deaths attributed to exposure to urban outdoor pollution and indoor pollution mostly as a result of burning of the solid fuel. What is more striking is the fact that most of this happens in the developing countries (WHO 2012).

Sulphur dioxide(SO<sub>2</sub>), nitrogen oxide (NO) and nitrogen dioxide (NO<sub>2</sub>), carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), and particulate matter (PM) are the critical pollutants that cause environmental and air pollution. These critical pollutants undergo chemical transformation in the atmosphere, leading to formation of secondary pollutants with the example of Sulfuric acid (H<sub>2</sub>SO<sub>4</sub> - acid deposition) and ozone (O<sub>3</sub>) (WHO, 2014). When these pollutants are spread by winds, they have a residency time of few days in the lower troposphere to several years in the upper stratosphere. Normally within the lower troposphere, CO<sub>2</sub> stays for up to 5 days depending on the rate at which it is removed from the atmosphere while SO<sub>2</sub> and PM stays up to two and 3 days respectively. Most of the pollutants are spread far off the origin depending on the mass and other chemical attributes and causing problems in some areas resulting to additional trans-boundary pollution problems (Hunter et al., 2002).

Due to this, there is a probability of environmental stress that is occasioned by population increase and this has an inherent health effect to the ecosystem, (State of the Environment, 2012). From this analogy, it is important to know the substance of pollutants and their significant distribution within the urban cities in Kenya. The main polluters emanate from industries and traffic, the vehicles with the motorbikes being the most contributors because of their increasing need in ballooning population (Hung, 2010). With this in mind, anthropogenic pollution is a significant contributor to poor air quality within developing nations (Hung, 2010).

Air pollution occurs partly as results of natural forces and human induced forces, and is exacerbated by anthropogenic activities. Volcanic eruptions, forest fires and dust are some of the examples of natural causes whilst industrial smoke, motor vehicle smoke constitute a continuous serious human induced pollution problem. The reason as to why this human induced pollution has a more influence is the fact that it occurs in human densely populated environments meaning the first-hand effects is on the inhabitants. Nairobi, the capital city, Mombasa the tourist hub, and Kisumu the Lakeside city are such areas in Kenya.

Dealing with air pollution is an issue that affects some more than others and with this in mind, there a probability of more effect to developing countries than the already developed. The developing countries have a poor strategy in dealing with air quality which makes them to be slave of the process of industrialization. Within this area a huge challenge emanates in balancing between which types of development, one that offers more economic abundance and another that favours the sustainability and cares about the environment; hence there is an out weighing of pollution mechanisms policies with short-term policies that have accrued benefits because of increased production and creation of jobs. Now, this overlooked important air management capabilities in these regions means pollution data apathy hence giving an assumption that all is well. This is on the contrary to the real case and only further shows the major pollution crisis in the developing world (Omanga et al., 2014).

Air pollution adversely impacts the environment and the magnitudes of the effects are mostly spread far beyond certain geographical boundaries. From the establishment of the United Nation Environmental Program (UNEP) in 1972, having its headquarters in Nairobi, there has been increased focus in terms of attention on national and international pollution effects. However, with this increased interest in pollution, a lot of efforts have been put towards reducing water related pollution and leaving the effects caused by air pollution still gaping, the negative effects of increased industrialization and resultant pollutant (Omanga et al., 2014).

Global perspective of the pollutants shows a varying trend, particularly for SO<sub>2</sub> and PM<sub>2.5</sub>. Estimates of SO<sub>2</sub> are found from the historical records of the fossil, imports and industrial processing outputs dating back to 1850. Industrialization led to a different point in SO<sub>2</sub> magnitude which was occasioned with burning of Sulphur fuels. From this perspective, Europe led followed by North America in the rise of SO<sub>2</sub>, which continued well in the 19<sup>th</sup> and 20<sup>th</sup> century. The trend of SO<sub>2</sub> emissions peaked in 1970 and 1980 in Europe

and South America respectively with North America showing the lowest SO<sub>2</sub> emission than any other time in the 20<sup>th</sup> century, and then a downward trend has been experienced in these areas (Klimont et al., 2013).

PM<sub>2.5</sub> has a serious effect on respiratory tracts and even with the ease of having this pollutant measured at the ground level; there is still a challenge in sufficient monitoring network to do so globally. However, best estimates have been developed to come up with pollution estimation using combination of satellite data, air transport models and local meteorological conditions-this helps in giving global-level coverage of local air quality (Brauer, et al., 2016). From the global perspective, it was estimated that over 3.7 million die annually on premature deaths as at 2012 (WHO, 2012) and most the causes are the Particulate matter exposures.

In Kenya, air quality is deteriorating over the years which have manifested itself in increased Upper Respiratory Tract infection (URTI) particularly in urban centres. From this, Provisions of air quality regulations draft, (2014) was drafted to come up with a framework that helps in reducing the impacts of air pollution and also appropriate control technologies in pollution. There is general trend of increasing pollutant in Africa while the same cannot be said of developed states in Europe and America (Klimont et al., 2013, Brauer et al., 2016), with this there is lack of better framework in monitoring and management of pollution (Henne et al., 2008).

### **1.1 Background Emissions**

Background emissions can be defined as total concentration of pollutant which comprises those from explicit local emission devoid of human contribution, (Wang et al., 2011). In many ways the background emissions represent a significant or dominant proportion of the total pollution concentration; hence the addition concentration is assumed to be human induced. The areas that are assumed to have less effect of human activities are the oceans and heavily forested areas. As part of the Mt. Kenya National Park the whole mountain area is protected and there are no local anthropogenic emissions, making the site suitable for continuous observations of the background free tropospheric composition.

Mt. Kenya GAW station is located in eastern equatorial Africa it is largely unaffected by direct African biomass burning emissions that are most prominent in the western parts of the continent but insignificant in Kenya. This station was used to differentiate natural emissions from non-natural sources. The immediate surroundings to GAW is generally free from anthropogenic emission and makes atmospheric baseline measurements possible. The DJF season maximum was caused by advection of northern hemispheric air that is enriched in pollutants during the boreal winter. In contrast, JJA maximum was observed during advection of southern hemispheric air loaded with emissions from biomass burning in southern part of the region; however, these emissions were slightly low. Inter-annual variability in summer time pollutants could mostly be explained by a combination of changes in transport patterns and biomass burning intensity.

### **1.2 Problem Context**

The effect of anthropogenic pollution is with no doubt a cause to worry. Nature does not forgive if its limit is stretched to points where it breaks. To understand leanings of pollution and its occurrence, a great depth of literature is needed particularly for the developing countries. There is a gap in understanding pollution in Kenyan urban cities, particularly with regard to health effects, built environment and ecosystem in general (Mulaku and Kariuki 2001, Gatari et al., 2001, Gatari et al., 2004). However, with developed countries increasingly adding on pollution literature, there is still inadequate literature on Kenyan context on how to deal with (Cohen et al., 2004). The inception of the act that deals conservation of the environment (Kenya Government, 1999) and enacting of National

Environmental Management Authority (NEMA), led to improved management of air quality to some extent. However, this still drags behind with professional capacity and framework still being an issue needed to urgently to spur the need to accurately monitor pollution.

To sum up all the aforementioned gaps, the main problem that we face is having no elaborate framework for monitoring of the anthropogenic pollution within cities in Kenya (Henne et al., 2008). With fewer studies concentrating on space-time distribution of emission, there is another gap in understanding the contribution trend and concentration of emission within urban centres. To understand the contribution of human induced air quality will help improve our understanding of anthropogenic contribution to air pollution over cities in Kenya and build a framework in its monitoring.

## **2 MATERIALS AND METHODS**

### **2.1 Area of study**

Kenya lies on the eastern side of African continent within coordinates 4° N and 4° S, and 34° and 41° east. The weather and climate of this place is highly controlled by mesoscale and synoptic scales that is the land-sea breezes and Inter-Tropical Convergence Zone (ITCZ), monsoon wind systems, and the Inland lakes which provide local sources of moisture. Kenya has a total area of 582,646 km<sup>2</sup> (KNBS 2010). This research on pollution contributed by urbanization is based on three main cities in Kenya: Nairobi, Mombasa, and Kisumu.

Kenyan climate is controlled by micro scale, mesoscale and synoptic features that are responsible for weather and climatic phases. The Inter-Tropical Convergence Zone (ITCZ) and the monsoons are the large scale contributors with local winds also having localized contribution to the weather (Asnani, 1993; Slingo et al., 2005). The seasonal displacement of the ITCZ leads to the variation of the monsoon winds which in turn affect the abundance of pollutants being transported. Throughout boreal winter, the ITCZ is assumed to be lying between (10-15° S) having the effect extending all the way from northern Madagascar to the south of Tanzania and then northwards to Lake Victoria. At this time East Africa is dominated with north-easterly monsoon transporting northern air to Kenya, and this is assumed to be rich in pollutants (Novelli et al., 1998a, 2003). When the ITCZ starts to migrate northwards, it is occasioned with long rains and this occurs from March-April-May season to the beginning of June. At this time clean air from the Indian Ocean is transported to Kenya. Together with the large scale circulations, Kenya is also affected with Land/ Sea breezes particularly in Mombasa and Kisumu, Mountain wind in Kisumu and Mt. Kenya region and effect of Urban Heat Island within the three cities: Nairobi, Mombasa and Kisumu (Ongoma et al., 2013).

Nairobi is the capital city and serves as a centre of administration, politics, economy, and culture within its administrative area of approximately 692 km<sup>2</sup> at coordinates (1° 9'S, 1° 28'S and 36° 4'E, 37° 10'E). This city accounts for half the proportion of employment and also provides over 50% to GDP. The population of Nairobi increases at a very high rate due to rural urban migration and reproduction. According to the past population census that was conducted late 2009, Nairobi had the population of excess of 3 million, which is around 8% of the national population (KNBS, 2010). Opijah et al. (2007), gives an account of winds in Nairobi that shows predominant easterlies accompanied by rainfall driven from the Indian Ocean. They give a seasonal distribution of winds during the DJF, which shows more predominant Northeast monsoons while JJA season showed southeasterly monsoons that are generally associated with rainfall. The general air quality condition of Nairobi has continuously deteriorated over the past decades while the population of the city continues to grow.

Mombasa happens to be the second largest city in Kenya which lies on the southeast of the Kenyan coast with coordinates (3°80', 4°10'S and 39°60' and 39°80'E). The city has an area of 295 km<sup>2</sup> and an increasing number of inhabitants at more than 0.9 million (KNBS, 2010). Mombasa, on the other hand, is a tourism and port city. This means it has a considerable population that depends and carries out their daily activities. The other reason why the study is important, this city has predominantly offshore and onshore winds, which will be important in interrogating contribution of meteorological variables.

The lakeside city of Kisumu is located over the western region with coordinates (0°6'S, 0.1°S and 34°45', 34.75°E) and having elevation of 1,131 m above sea level, and is estimated to have over 0.9 million people (KNBS, 2010). Kisumu comes third in terms of coverage at 417 Km<sup>2</sup>, with over two-thirds (297 Km<sup>2</sup>) being dry land with the rest of the area covered with water. Kisumu is a lakeside city and it will be important to also analyze the emission trends and meteorological trends within this city. Finally, Mt. Kenya GAW region data will be used for background emissions.

The sources of atmospheric pollution come from the motor vehicle and industries with some portion being because of household emissions. Because of this pattern, the source proximity and wind regime also play a part of problem in terms pollution distribution. With difference on location of these cities, there is a differential increase of pollutants and this forms a basis of this paper.

## 2.2 Data types and sources

Pollution data was sourced from archived satellite data, the second Modern-Era Retrospective Analysis for Research and Application (MERRA – 2). The data sourced was for SO<sub>2</sub> from the year 2000 to 2016 which was same for PM<sub>2.5</sub> for Nairobi, Mombasa, Kisumu and GAW. For CO<sub>2</sub>, there was no data for the first two years meaning the data is from 2002 to 2015. MERRA-2 is a NASA atmospheric reanalysis that replaced the original MERRA (Rienecker et al., 2011). It includes the updates of the model and to the Global Statistical Interpolation (GSI) scheme. All the data are provided in the horizontal grid with a corresponding resolution of 0.625° x 0.5°. MERRA-2 uses observation-based precipitation data as forcing for parameterization. Along with the enhanced use of the satellite observations in MERRA-2, the secondary motivation is the inclusion of more aspects of Earth system which helps in the assimilation of aerosols information based on “MERAero” that is integrated using meteorological. Pollution data was selected based on availability and climatology of the place and the impact to the ecosystem based on anthropogenic activities.

Pollution data was obtained from MERRA-2 satellite archived data for SO<sub>2</sub>, CO<sub>2</sub> and PM<sub>2.5</sub>. The period of interest was also chosen between 2000 and 2016 to analyze the trends in terms of spatial and temporal analysis. The reason to arrive at the three pollutants was because of the consistency of the available data and relevance of data to climate change. CO<sub>2</sub> represents climate change forcing which is imperative in coming up with how pollutants increase in the changing climate. SO<sub>2</sub> and PM<sub>2.5</sub> are industrial and land use gases which correlate to human activities; the increase informs the increase in human activities. SO<sub>2</sub> and PM<sub>2.5</sub> data were calibrated in micrograms per cubic (µg/m<sup>3</sup>) while for CO<sub>2</sub> was parts per million (ppm). SO<sub>2</sub> and PM<sub>2.5</sub> data was for the period from 2000 to 2016, while CO<sub>2</sub> had missing data for 2000 to 2002.

Background emissions site is basically free from anthropogenic emissions; however there are some episodes of intrusion of human activities that lead to pollution being transported to the forests around GAW. These episodic influences were however reduced by climatic filtering by use of monthly data which removes the local effects like bush fires that are prevalent. Not only was the local effects but also the effects of the influence of variable atmospheric boundary layer (ABL) which cause diurnal variation in

atmospheric trace gases, and this is particularly in the high altitude areas (Henne et al., 2008). This problem was mitigated by the use of monthly averages as opposed to daily data which is prone to short term variations.

Wind data used in this study was obtained from Kenya Meteorological Department that is tasked in observation, archiving and managing weather data in Kenya. The four-main station for the study has active wind recording instruments that corresponded with the data that was necessary for this study. Meteorological data that was used for this study was wind direction and speed for Kisumu, Nairobi, Mombasa and Mt. Kenya (GAW). The winds were analyzed from daily means to monthly means for the period between 2000 and 2016. The data was analyzed to come up with average wind direction based on the frequency of occurrence; this was done with the help of WrPlot which was used to come up with frequencies and later the wind rose.

## **2.3 Methodology**

### **2.2.1 Time series analysis**

To analyze pollution characteristics, time series analysis was conducted on SO<sub>2</sub>, PM<sub>2.5</sub> and CO<sub>2</sub> to ascertain the time-pollutant distribution. This was done in particular to ascertain the time-pollutant characteristics for each pollutant at a particular station. This method was important to give visual view of the behaviour of the pollutants. the cyclic and seasonality was best analyzed by variations with time. Anomaly indices were carried out to predict how the observed data varies from the presumed background pollution levels. The background pollution level was also adjusted to minimum to bring out the anomaly of the pollutants. For pollutants, time series analysis for individual pollutants and pooled series was presented. This in the end was used to compare the different amounts of pollutants within each city, and also within months and seasons. This was done to examine seasonal variation of air quality with time. Cross-sectional analysis sampling was done to ascertain behaviour of pollutants at the same time. This was critical in analyzing the spatial characteristics of the pollutants.

### **2.2.2 Statistical analysis**

Correlation statistics was done to give an insight of how pollutants trend is with respect to stations of interest. This was important to analyzing the coefficients of increase within stations with time. This increase however was prudently examined by looking at the trend series of the pollutant. This was done by plotting a trend line equation on the general distribution of pollutants and the data that was given for all the four stations was analyzed. To do this, a trend analysis for the annual distribution of pollutants over all the four stations was done.

T-test statistics was carried out to develop hypotheses of variable interaction. The main Statistical approach was carried out to determine significance of means in terms of difference at 95% confidence interval. This was to check for significance of difference of means from the background emissions.

### **2.2.3 Hysplit and WrPlot analysis**

Wind data was analyzed using the available software to answer the specific objective (ii). To analyze the temporal distribution of the winds, WrPlot was used to come up with wind rose which gave the frequency of the winds in terms of strengths and direction. The spatial distribution of winds will be analyzed from the WrPlot outputs showing the same distribution at the same time within the four seasons of the year. The main method used was wind rose plot where frequency of winds was pooled within all the stations and

different seasons to advance the dominant wind directions. The relationship between PM<sub>2.5</sub>, SO<sub>2</sub>, CO<sub>2</sub> and their interaction with winds was determined with the use of trajectory analysis. The prevailing wind direction over the area of study was obtained by plotting trajectories using the HYSPLIT software.

The Hybrid Single-Particle Lagrangian Integrated Trajectory model (HYSPLIT) was developed by the air resource laboratory is one of the tools that have been widely used in trajectory analysis (Stein et al, 2015). Used in Ready online platform contains archived wind data for gridded locations. GDAS data is used because of the ease of use in HYSPLIT and also the fact that the data span is slightly large covering from 1980 to current. A rigorous sampling of the years was done to ascertain the behaviour of pollutants within seasons. A sample of wet years was selected based on statistics from ICPAC, an organization charged with seasonal forecasting. After sampling, a midpoint of the selected season was chosen to represent the season long. To understand the boundary conditions, trajectory analysis was carried out with HYSPLIT, this was done with different height levels of 10, 500 and 1000 AGL, and this was for the purposes of bringing in the concept of planetary conditions. Trajectories were analyzed for the four seasons in all the four stations that were of interest. An initial monthly average was sampled for different years before finally choosing the week three of every mid-season month. This was in the assumption that localized wind regime stabilize within five day period. For this, the third week of March, July, October and January were chosen to represent MAM, JJA, SON and DJF seasons. The reasons why the third week in these months chosen was after sample runs (not shown) to represent 5-day period that present a better description on the season. The levels taken were 10m which is near surface, 50m and 1000m which give the behavior of the boundary conditions. Finally, to examine the concentration of particles, HYSPLIT trajectory concentration was also carried out within dates chosen in consonant with the wind trajectories, to follow path of the wind with the assumptions that the parcel of the aerosol follows the same trajectories.

The last specific objective of the study requires determining the anthropogenic contribution, trend analysis differences was conducted to come up with natural and human induced pollution. This was done by subtracting the GAW pollution levels trends from the current city pollution. GAW is assumed to be an area with less pollution. It is assumed to only have natural pollution whilst the city was assumed to have both natural and human induced pollution. Hence to find the final contribution the model

$$Y = \int_{x=2000}^{2016} \{(C1 + M1x) - (C2 + M2x)\} dx \quad (1)$$

Where Y is the contribution, M<sub>1</sub> and M<sub>2</sub> are the gradients for series 1 and 2.

### 3. RESULTS AND DISCUSSION

#### 3.1 Spatial-Temporal characteristics of air pollutants

The four stations, Kisumu recorded the highest PM<sub>2.5</sub> value of 20.3µg/m<sup>3</sup> while Nairobi registered the lowest of 11.5µg/m<sup>3</sup>. The clustered mean value of the four stations still showed Kisumu 3.8µg/m<sup>3</sup>, Nairobi 3.6 µg/m<sup>3</sup> and Mombasa 3.4 µg/m<sup>3</sup>. This compared with GAW which had 2.9 µg/m<sup>3</sup> showed a significant difference in terms of the means. SO<sub>2</sub> which is an industrial product from combustion of sulphur products is very corrosive. Less amounts of sulphur in the atmosphere have significant effects to the ecosystem. Kisumu recorded the highest amount in terms of mean at 0.59 µg/m<sup>3</sup> while Nairobi recorded lowest value of 0.53 µg/m<sup>3</sup>.

This however did not corroborate with the standard deviation, as Nairobi had the highest standard deviation and Kisumu had the lowest at 0.07 and 0.045 respectively. The variance will be discussed later in this chapter.

### 3.1.1 Descriptive analysis of pollutants

The average monthly PM<sub>2.5</sub> distribution within the three major cities in Kenya that is Kisumu, Nairobi and Mombasa were well below the WHO guidelines of PM<sub>2.5</sub>. The three cities had an average of 3.8µg/m<sup>3</sup> for Kisumu, 3.4 µg/m<sup>3</sup>, Mombasa and 3.6µg/m<sup>3</sup> for Nairobi. Compared to the background emission for PM<sub>2.5</sub>, GAW which had 2.9 µg/m<sup>3</sup>, which is within the accepted WHO standards. The WHO standard for PM<sub>2.5</sub> is 10 g/m<sup>3</sup> annual mean (WHO, 2005).

The variation in means for PM<sub>2.5</sub> almost remained steady within the three cities. The monthly variability for PM<sub>2.5</sub> was high during DJFM season which happens to be dry season and highest pollutant distribution. It was also noted low variability of the pollutants in May in almost all the cities with the exception of GAW and Nairobi having slightly a higher variability in June

**Table 1: Data summary of ambient PM<sub>2.5</sub>, SO<sub>2</sub> and CO<sub>2</sub> concentrations**

POLLUTANT	DESCRIPTORS	GAW	KISUMU	MOMBASA	NAIROBI
PM <sub>2.5</sub> concentrations (µg/m <sup>3</sup> )	MEAN	2.9	3.8	3.4	3.6
	STDEV	0.54	0.6	0.66	0.56
	MIN	0.4	0.35	0.08	0.3
	MAX	14.5	20.3	15.4	115
SO <sub>2</sub> concentrations (µg/m <sup>3</sup> )	MEAN	0.53	0.59	0.57	0.54
	STDEV	0.052	0.045	0.049	0.07
	MIN	0.26	0.1	0.1	0.1
	MAX	1.3	2.6	1.1	0.9
CO <sub>2</sub> concentrations (PPM)	MEAN	381.4719	381.6383	382.435	381.5123
	STDEV	6.66	6.6	6.19	6.72
	MIN	371.6	371.7	373.5	372.1
	MAX	391.12	391.5	392.3	391.8

Surface SO<sub>2</sub> were also measured in the same three cities and compared to Mt. Kenya (GAW) station. The concentration of the SO<sub>2</sub> was measured to ascertain the contribution of human activities towards increase in pollutants. The average monthly SO<sub>2</sub> distribution within Kisumu, Nairobi and Mombasa were well below the WHO guidelines of SO<sub>2</sub> of 5 – 10 µg/m<sup>3</sup> long term exposure. The three cities had an average of 0.53µg/m<sup>3</sup> for Kisumu, 0.59µg/m<sup>3</sup> Mombasa and 0.55µg/m<sup>3</sup> for Nairobi. It is worth noting the corrosive and harmful nature of SO<sub>2</sub> means its abundance in the atmosphere close to the surface has catastrophic effects. SO<sub>2</sub> basically is measured within 10-minute and 24-hour cycle with WHO standards requirements. When compared with the background emissions that's is GAW at a mean SO<sub>2</sub> which has less anthropogenic effects at 0.53µg/m<sup>3</sup> which is still less than WHO mean long-term exposure.

Carbon Dioxide unlike the PM<sub>2.5</sub> and SO<sub>2</sub> has a global footprint and is heavily transported globally leading to it being the greatest source of global warming at least from available literature. CO<sub>2</sub> is mainly caused as a result of fossil fuel and biomass burning in the

presence of sufficient oxygen. In the presence of insufficient oxygen, the product includes the presence of CO<sub>2</sub> as one of the product. CO<sub>2</sub> forms the basis of the changing climate because of its global warming attributes.

The concentration of CO<sub>2</sub> was monitored to analyze the increase of it based on the background emissions. The average monthly CO<sub>2</sub> distribution within Kisumu, Nairobi, and Mombasa cannot be a good indicator of CO<sub>2</sub> performance. CO<sub>2</sub> increase with time in all the stations showed a significant trend irrespective of season and time. The average value since 2002 to 2013 can be used to compare the moving mean values in the past and in the future to come up with the durational change in means. It is also worth noting that being a comparative study, the difference in means is an indicator of which station is recording high pollutants.

However, for this study, it was imperative to use statistical durational mean to compare station-wise and come up with factor contributing to this increase. The average concentration of CO<sub>2</sub> in indoor and outdoor surface emission is in the figure between 250ppm to 350ppm having Normal background concentration in outdoor ambient air, and 350 to 1000ppm having Concentrations typical of occupied indoor spaces with good air exchange. With our research based in occupied indoor space with good air exchange, the standardized CO<sub>2</sub> levels are between 350 – 1000ppm. Above this values complaint of un-comforting state will start setting in (WHO, 2012)

Based on this simple analysis, all the four stations had the mean of between 381ppm to 383ppm which occupies the base of the lower band well below the WHO guidelines of CO<sub>2</sub> severe levels. It is worth noting the effects of CO<sub>2</sub> on climate change, its warming effects hence its increase is subject of interest amongst climate change researchers. CO<sub>2</sub> also acts as a response indicator for biomass burning and so its increase can be used as a proxy for biomass burning which indicate human activities within a region, notwithstanding the global transport effects.

The Two-tailed test for significance of means also showed a significant difference in means PM<sub>2.5</sub> concentrations between Mt. Kenya and Kisumu for the period of study (P < 0.05). The concentration of PM<sub>2.5</sub> in Kisumu was significantly more compared to Mt. Kenya. T-test significance for PM<sub>2.5</sub> as shown in the table ---, shows all the stations having significant difference with GAW.

The Two-tailed test for significance of means showed significant difference in means of SO<sub>2</sub> concentration between Mt. Kenya (GAW) and other three stations at 95% confidence level. To start with Kisumu for the period of study, the critical value (P < 0.05) according to (Table 1) shows the concentration of SO<sub>2</sub> was significantly more compared to Mt. Kenya. SO<sub>2</sub> for GAW concentration ranged between 0.26µg/m<sup>3</sup> to 1.35µg/m<sup>3</sup> while the concentration of SO<sub>2</sub> in Kisumu ranged between 0.1µg/m<sup>3</sup> to 2.6µg/m<sup>3</sup> but with less variability. Mombasa also recorded a significant difference in means getting high amounts of SO<sub>2</sub> in the period of study (P < 0.05). The concentration of SO<sub>2</sub> was between 0.1µg/m<sup>3</sup> to 1.1µg/m<sup>3</sup>. The same can be said for Nairobi which also showed a significant mean difference with (P < 0.05) with mean values for the SO<sub>2</sub> between 0.1µg/m<sup>3</sup> to 0.8µg/m<sup>3</sup>.

The Two-tailed test for significance of means for CO<sub>2</sub>, showed no significant difference in the means for all the three stations as compared with GAW, which in simple terms shows less departure from the background emissions.

**Table 2: Two-tailed t-Test analysis with unequal variances of PM<sub>2.5</sub>, SO<sub>2</sub> and CO<sub>2</sub> concentrations**

Pollutants		Degrees of Freedom	T-Value	P- Value / α = 0.05	
				P	α
PM <sub>2.5</sub>	GAW & Kisumu	32	-4.29	P < 0.05	2.037

	GAW & Mombasa	32	-2.21		2.037
	GAW & Nairobi	32	-3.73		2.037
SO <sub>2</sub>	GAW & Kisumu	31	-3.0612	P < 0.05	2.04
	GAW & Mombasa	31	-2.2472		2.04
	GAW & Nairobi	31	-0.8594		2.04
CO <sub>2</sub>	GAW & Kisumu	20	-0.341	P < 0.05	2.086
	GAW & Mombasa	20	-0.4701		2.086
	GAW & Nairobi	20	-0.0175		2.086

### 3.1.2 Time series analysis

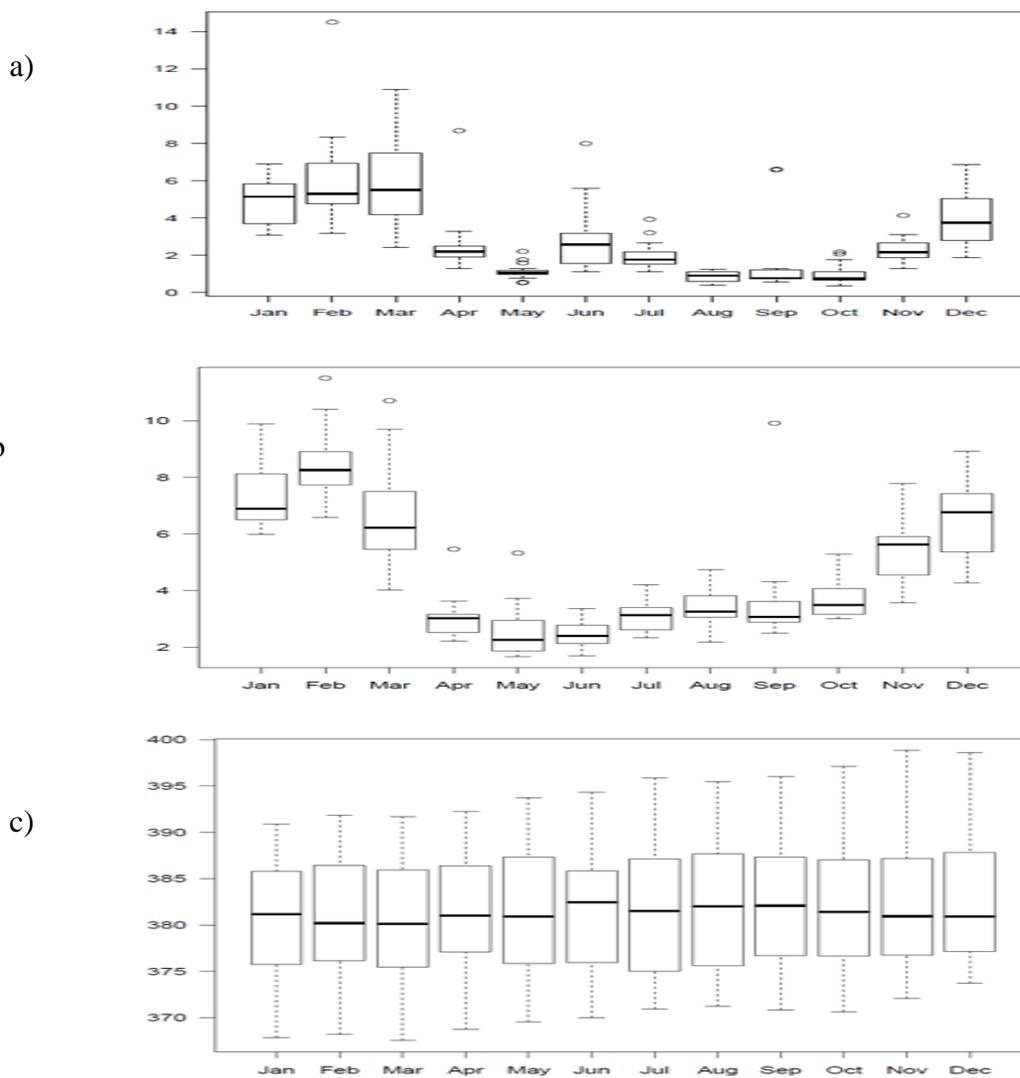
SO<sub>2</sub> showed two peaks in the general distribution annually with Kisumu having the highest pollutant distribution, followed by Nairobi then Mombasa. The values represented also shows a significant difference in terms of the means as the two cities that are Kisumu and Mombasa cities with T-statistic values of -3.0612 and -2.2472 respectively, which showed a significant difference in terms of the means. Nairobi, on the other hand, did not show significant difference in means. The two-tailed T-statistics with P < 0.05 showed the two cities values outside the values around the mean while for Nairobi it was within the means.

The distribution of the PM<sub>2.5</sub> and variability also showed temporal differences. The other cities also are represented with their maximum and minimum values also recorded. A keener look of the time series shows two peaks within a year. This distribution takes a near repetitive cycle in almost all the stations. Kisumu shows a significant high peak than the other stations while Nairobi showed slightly lower peak. This however was within the same cyclic trend that was observed in all the stations. Based on this finding, it is without doubt that Kisumu and Nairobi bring in interesting information in terms of PM<sub>2.5</sub> tendencies. There is a major player that leads to increased levels of this pollutant in Kisumu than in Nairobi. Land use and location of these stations to pollution is one reason this level was varying in this station. The season also played a crucial role in bringing this variation. However, the two stations enjoy near homogeneous climatology and such variation can be explained by factors that are more exterior to the contribution of climate. Land use comes in as one factor that can lead to increased PM<sub>2.5</sub>. Kisumu is fairly agricultural by the fact that vast of the lands in the immediate south border the Kano plains.

The general behaviour of SO<sub>2</sub> showed tendency of high pollutant values within dry season. These dry seasons are DJFM and JJA seasons. Kisumu showed less variation with a near flat behaviour and also less annual values. The behaviour of SO<sub>2</sub> in all the four stations did not depart from each other with all the stations having a major peak during the DJFM season which is regarded a dry one. There was also an agreement in terms of less SO<sub>2</sub> advection during the wet season. In deeper discussion this behaviour is due to the wash effect that is occasioned by rain deposition of the pollutants. SO<sub>2</sub> is highly soluble in water and you will expect it to be washed by rain if it is in the atmosphere and this is the reason why during wet season the amounts of SO<sub>2</sub> were at minimum.

Finally as expected the annual variations of CO<sub>2</sub> remained near flat as most of the CO<sub>2</sub> is as a result of global transport as will be discussed further in this section. But of interest were the annual variations in Mombasa where the distribution showed high values from November to March. CO<sub>2</sub> is as a result of combustion of fossil fuels and global transport. The near flat variability of distribution is partly aided by two by the spatial distribution of combustion activities. With global wind transport, CO<sub>2</sub> is able to be transported far and be mixed within environments that were initially devoid of pollution. Mombasa is affected by East African Low Level Jet that

steams near the coast joining Indian monsoons. These winds are partially the cause of variable tendencies of CO<sub>2</sub> distribution around Mombasa.



**Figure 4: Mean Monthly Variability of a)PM<sub>2.5</sub> Concentration (µg/m<sup>3</sup>) b) SO<sub>2</sub> Concentration (µg/m<sup>3</sup>) and c). CO<sub>2</sub> Concentration (PPM)**

### 3.1.3 Temporal interactions with pollutants

The general annual cycle of pollutants in Kenya can be explained from the behavior of seasonal variation of monsoon over equatorial East Africa which is heavily controlled by the seasonal displacement of the inter-tropical convergence zone (ITCZ) (Asnani, 1993; Slingo et al., 2005). Throughout DJF season, the ITCZ is in the southern hemisphere (10–15°S) extending from the northern tip of Madagascar towards southern Tanzania and then northward towards Lake Victoria. With this kind of synoptic behaviour, East Africa is generally dominated by north-easterly monsoon, transporting air from the northern hemisphere carrying northern hemispheric air towards Kenya that is enriched in pollutants (Novelli et al., 1998, 2003).

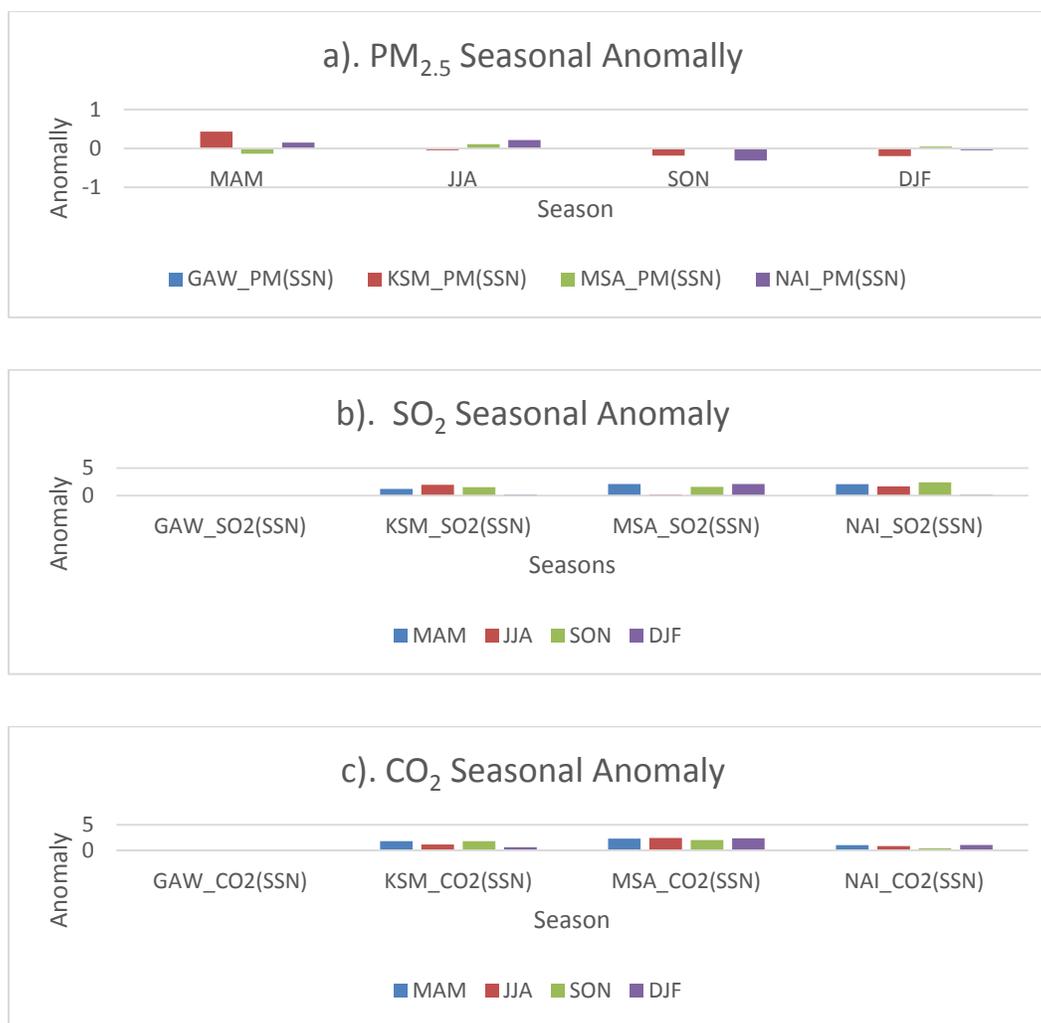
During the movement of ITCZ travelling to the north, it brings with it Long-rains in most parts of the country and this happens from mid-March to equatorial East Africa and with it clean air from the Indian ocean, causing less amounts of pollutants within the region. This is the explanation as to the behaviour of having most pollutants having high values during this boreal winter period. CO<sub>2</sub> on the other hand has a global foot print which means there is a tendency of its variability to be very minimal in almost all the stations. Mombasa on the other hand has a boundary characteristics since it borders a water body. Because of these characteristics, there is a distinct contribution based on where the winds are coming from. CO<sub>2</sub> in Mombasa comes from both maritime and continental source, and the assumption is the maritime component is perceived to be cleaner than the continental source, and this has been captured by the strong drop of CO<sub>2</sub> amounts during maritime source period, i.e. April to October.

Anomaly indices were done to compare departure of the pollutants from GAW, which in this study is assumed background. This was done by reducing GAW values to the minimum and comparing with other stations. This helped to give an insight of how stations compared to GAW with respect to the four seasons.

Anomaly distribution of PM<sub>2.5</sub> generally had MAM and JJA season with positive anomaly, whilst SON and DJF showing a negative anomaly. This was with the exception of Mombasa and Kisumu which still had negative anomaly during MAM and JJA seasons respectively. This can be attributed to the seasonality of the general flow and the boundary characteristics of land and water in Kisumu and Mombasa. During JJA and MAM, the general flow is South easterly towards GAW which brings with it emissions due to biomass burning particularly in JJA. While in MAM most of the places experience long rain season with maritime southerly winds meant to a scenario where most of the stations mentioned, i.e. Mombasa to have less PM<sub>2.5</sub> with respect to GAW. Kisumu on the other hand had less PM<sub>2.5</sub> due to less mixing occasioned by rainy season (MAM) and variable winds in JJA. In terms of monthly variability, December to March showed high variation with high values of the pollutants as compared to the rest of the months.

SO<sub>2</sub> showed positive anomaly for all the station with respect to GAW and this is because the city stations exhibited higher values of pollutants than GAW. DJF however had the lowest anomaly for both Nairobi and Kisumu and this because the two stations had near equatorial tendencies, and benefited from the synoptic strong winds during this time. The other three seasons however, the two stations registered higher anomalies. Mombasa had the lowest anomaly during the JJA season and this is because of the prevalence of onshore winds during this particular time of the year. The contribution of EALLJ can also not be assumed to have no effect during this season.

CO<sub>2</sub> also showed positive anomaly for all the stations and seasons as expected because of the global rising amounts. Nairobi showed slightly lower anomaly as compared with the rest of the stations with Mombasa registering the highest anomalies. The reason why Nairobi anomaly was lower is due to the fact that GAW and Nairobi share partially in terms of climatology. This gives picture of same behavior in terms of rain wash of the pollutants within a season. Again CO<sub>2</sub> has slightly longer resident time, which gives it a spatial mean that spreads greater distances compared to other pollutants that have less resident time. With this it is not easy to apportion point source for CO<sub>2</sub> as can be done with other pollutants; hence its presence in the atmosphere has less spatial variability. This said, the characteristics at GAW will have a near resemblance to Nairobi at least for CO<sub>2</sub>, hence having less anomaly.



**Figure 5: Seasonal anomaly of a) PM<sub>2.5</sub>, b) SO<sub>2</sub> and c) CO<sub>2</sub>**

Correlation coefficient of GAW to the three stations was positive. Of note was Nairobi that showed very strong correlation for all the pollutants. This was attributed to the fact that Nairobi though more industrialized than GAW, still showed near same tendency of increase in pollutants with time. By having a strong correlation in this study, it shows that pollutant increase in the station is close to the same increase at GAW. Lower coefficient shows more increase to the station than GAW. The correlation coefficients show Mombasa and Kisumu with low values particularly for PM<sub>2.5</sub> and SO<sub>2</sub>. This leads to a conclusion that the increase of pollutants in Kisumu and Mombasa is more significant as compared to Nairobi. CO<sub>2</sub> on the other hand showed very strong coefficients for all the stations with values ranging of 0.90 to 0.94. With this in mind it is hard to differentiate which station is recording maximum increase than the other. An interesting finding was none of the stations showed more than 1 in terms of correlation coefficient, which would have given a conclusion of having an increase in pollution that is less compared to GAW. Even with these high coefficients, it is easy to notice the increase in CO<sub>2</sub> within the three stations is higher than the increase at GAW. Correlation coefficients values are tabulated in the (Table 3) below.

**Table 3: Pollutant correlation coefficients between GAW and other Stations**

Pollutant	Correlation Stations	Correlation coefficients
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<b>PM<sub>2.5</sub></b>	GAW/Mombasa	0.73
	GAW/Kisumu	0.76
	GAW/Nairobi	0.94
<b>SO<sub>2</sub></b>	GAW/Mombasa	0.67
	GAW/Kisumu	0.65
	GAW/Nairobi	0.83
<b>CO<sub>2</sub></b>	GAW/Mombasa	0.94
	GAW/Kisumu	0.90
	GAW/Nairobi	0.93

### 3.2 Relationship between wind and pollutants

#### 3.2.1 Wind rose analysis

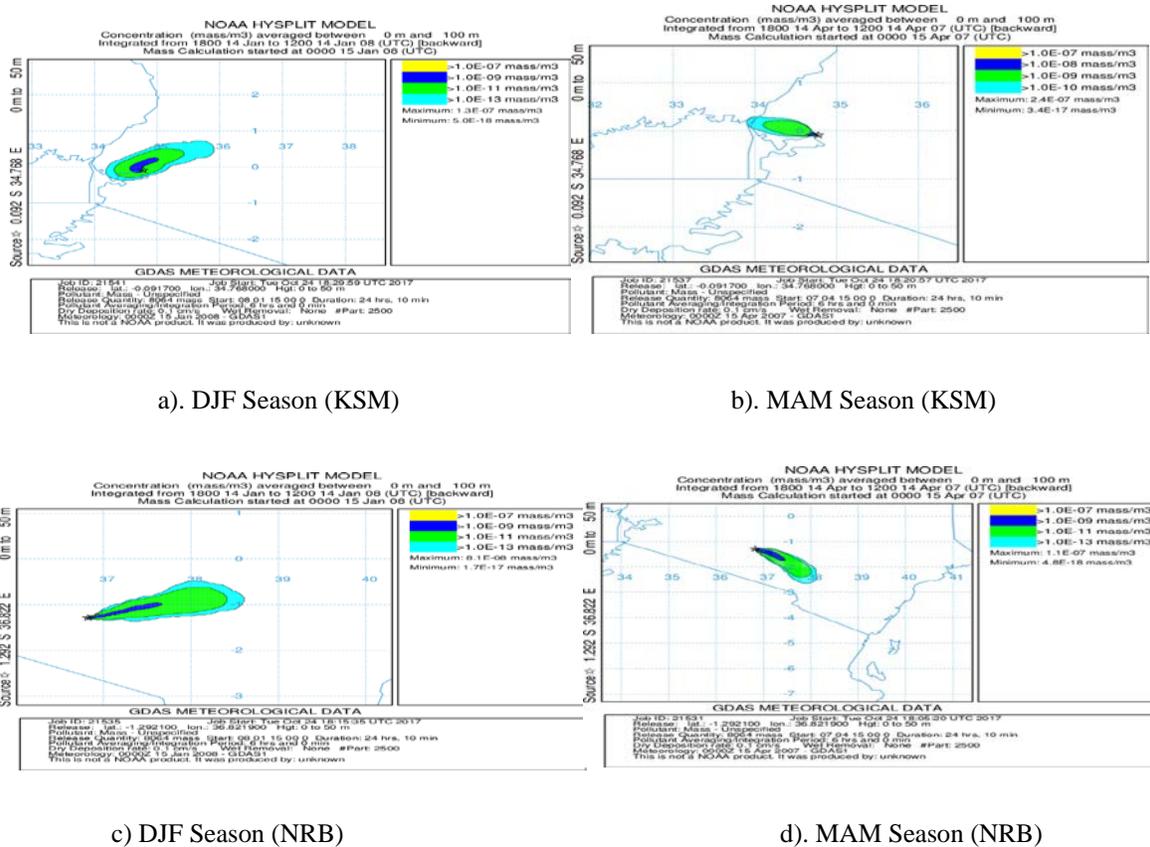
PM<sub>2.5</sub> can be regarded as dust particles in simple terms which mean it is heavily affected by winds, looking at the concentration of PM<sub>2.5</sub> within the cities and within seasons, there is a simple analysis which places a higher concentration of dust close to arid areas with close proximity with the direction of winds. There was a prevalence of dust particles in Mombasa and Kisumu during the DJF season. From the section above, it is evident that PM<sub>2.5</sub> thrives well when the atmosphere is deprived of moisture and that is the reason why DJF has the highest proportions in terms of concentration. In Kisumu, the atmosphere is dry hence much of the year we expect to have PM<sub>2.5</sub> in the atmosphere and this is the reason why Kisumu had the highest levels. It's important to note that the concentration of PM<sub>2.5</sub> increases with land use activities with basically attributes its occurrence to human activities. GAW is not spared either with the winds predominantly being easterly around Mt. Kenya hence bringing in the dust particles from the Eastern region which is perceived to be dry.

In matters to do with SO<sub>2</sub>, the concentration mostly is affected by the source of this then aided with the winds. Industries contribute this pollutant and it being slightly heavier, there is a probability of this pollutant being deposited close to the source. Looking at wind data from GAW, which is perceived a background source, an Easterly component of winds still dominate and basically, the contribution may be as a result of industries upwind. The upwind of Mt. Kenya is not fairly developed hence the contribution here can be attributed to global circulation and also localized pollution. Wet seasons, SON and MAM have slightly less concentration as opposed to dry seasons of DJF and JJA from the distribution. During these seasons, MAM happened to have the lowest concentration of the SO<sub>2</sub> and this is also represented with weak winds during this season. SO<sub>2</sub> has a high affinity to dissolve in water hence any increase in moisture in the atmosphere leads to its deposition.

Nairobi and Mombasa, on the other hand, have more industries than the other two stations. For Nairobi, there was more concentration of SO<sub>2</sub> during the JJA season. JJA season is fairly cold in Nairobi with weak to moderate easterly winds. This supposes that much of the aerosols in this region is basically local, coming from industries within the vicinity of Nairobi, which in this case are the factories around Mombasa road and Athi- River. Same cannot be further from the truth for Mombasa, as during the DJF season had predominantly NE winds which mean the SO<sub>2</sub> present in this region was as a result of the industries within this region. Mombasa has industries towards the north and NE of the city that produces more aerosols.

This coupled with the geographical distribution of these industries means more of the SO<sub>2</sub> is blown far past Mombasa to the ocean and the remaining bit is the one captured in this study. It is also important to note that street emissions have a better distribution than the satellite SO<sub>2</sub> distribution. Finally, Kisumu has weak to moderate easterly to variable winds and largely not covered with a good network of industries around this region. This means much of the aerosols are as a result of vehicle emissions as opposed to industrial emissions. In Kisumu, weak to moderate SW component of winds during JJA being the main contribution of the highest concentration which basically means the emissions were as a result of localized activities.

Finally, matters to do with CO<sub>2</sub>, all the station showed an increasing trend. However, within seasons all the stations showed high values during the dry seasons as opposed to wet seasons. CO<sub>2</sub> in MSA was high when the winds were moderate NE and low when the winds were strong southerlies. This as earlier explained is a response to prevalence and distribution of industries within the northern parts of Mombasa. In Nairobi, these two wet seasons have a slight difference in terms of wind contribution as Nairobi is dominated by an easterly component of winds. Easterly winds within Nairobi contributed more as compared to the SW component of winds. In Kisumu, weak winds contributed to slightly more concentration than moderate winds which also agree to the fact that most of the CO<sub>2</sub> and other aerosols within this city is caused by vehicles as opposed to industries. Finally, in Mt. Kenya (GAW) the strong winds contributed to high levels of CO<sub>2</sub> as opposed to moderate winds. GAW is dominated by southeasterly and mainly being blown from the NE and SE, with most concentration coming from the SE due to the strong winds from the coastal region.



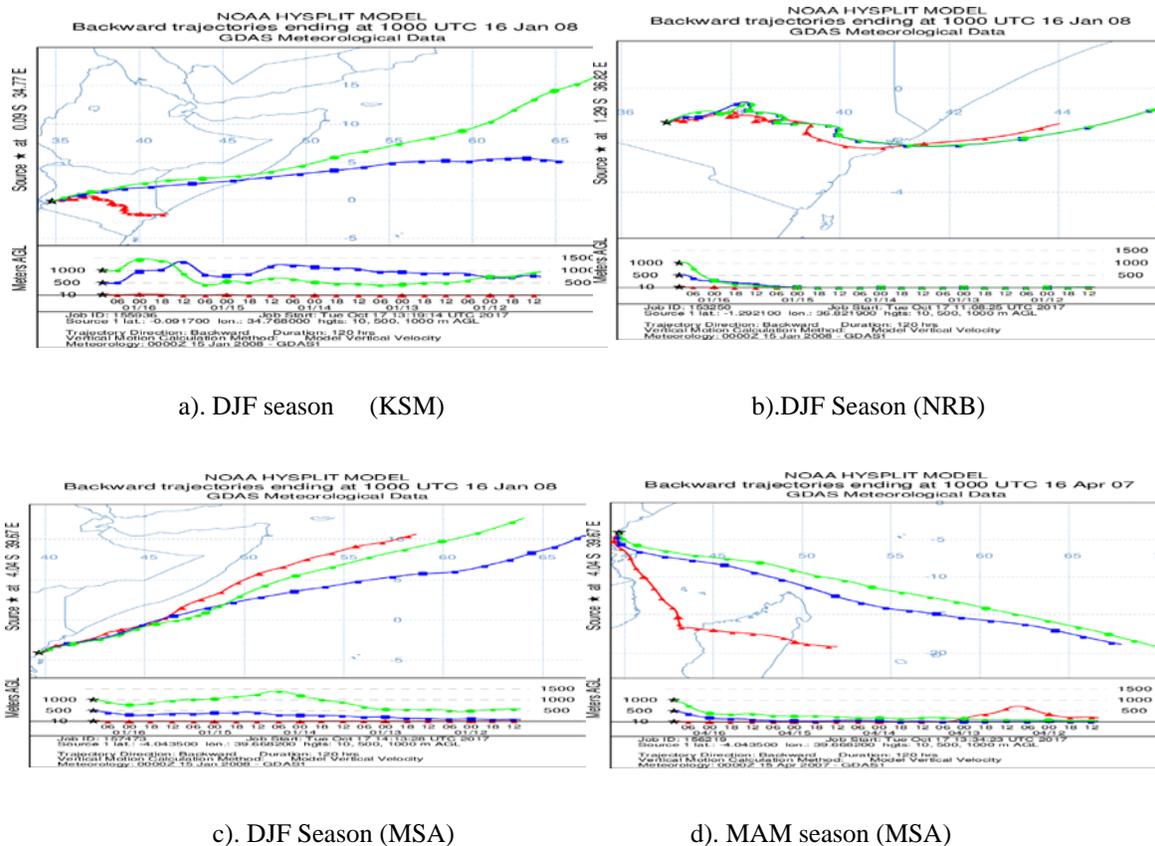
**Figure 6:(a-d): Concentration trajectories**

The concentration distribution as shown by the (Fig 5), there is a general distribution that follows the trends that was initially discussed for the winds. The concentration was done for different levels that are 10m, 500m and 1000m above sea level. In Kisumu,

winds were not specific with variable flow particularly during JJA season. The other three seasons showed Northeasterly, Easterly and near westerly contribution. The important point of distribution shows that most of the concentration around Kisumu came from near sources, the distance travelled were not so extensive.

### 3.2.2 Trajectory Analysis

Trajectories were analyzed for the four seasons in all the four stations that were of interest. The procedures to identify the selected days of interest were as the ones followed for winds. The levels were taken were 10m which is near surface, 50m and 1000m which give the behavior of the boundary conditions.



**Figure 1: (a-d): Wind trajectories**

Wind Trajectory for all the stations during DJF had an easterly component. This was particularly due to North east monsoon that is occasioned by intensification of the arabian Ridge. The trajectory for Kisumu gives an easterly direction which also adds to the fact that the pollutants are transported from the continent. The same can be said of Mombasa which had highest pollutant with northeast winds; this is in agreement with the trajectories. MAM was selected for Mombasa to show the shift of winds particularly with the displacement of the ITCZ towards the north.

Wind trajectory were most blowing from the east around Kisumu and Mombasa showing westerlies, though with generally weak speeds. During the rainy seasons MAM and SON, the air mass origin was easterly, indicating the presence of the ITCZ over Kenya. From the trajectory distribution, there is a general easterly component in most of the station studied. Starting from GAW, the trajectories oscillate generally from easterly to southeasterly component, this follows the position of the ITCZ in which during DJF,

there is a general northeasterly wind towards GAW, Nairobi and Mombasa. Within this oscillation, there is a great contribution of pollution when the trajectories are Easterlies and Southerlies and mostly during DJF and JJA seasons. DJF is dry season having less rainfall wash effect during which most of the pollutants this time are highest. The other two seasons are slightly wet and with the concentrations of CO<sub>2</sub>, PM<sub>2.5</sub> and SO<sub>2</sub> also recording slightly low values, which leaves a general conclusion of localised and global transport bringing in these pollutants. GAW borders the expansive Northeastern arid areas which provides a source of most of this pollutants during southerly component of the winds.

Dry seasons contributed more pollutants than the other two slightly wet seasons that is MAM and SON seasons in Kisumu. From the pollutants distribution CO<sub>2</sub>, SO<sub>2</sub> and PM<sub>2.5</sub> have high values within DJF and JJA seasons. Within these two seasons, the winds have an easterly component which means most of the pollutants came from the city itself as opposed to the winds that may emanate from the neighbouring countries and passing through the lake, this will be expounded further in the concentration discussion below.

Mombasa on the other hand has shown prevalence of onshore winds or near onshore winds. But of interest was the high concentrations of pollutants recorded when the winds were either northeasterlies and Southwesterlies. These two kind of trajectory distribution means that the winds were either blowing parallel to the shoreline or most of them were offshore. The two seasons that this winds were behaving this way was during the dry seasons which are DJF and JJA, with JJA having less contribution than DJF.

Finally, Nairobi recorded highest pollutants with Northeasterly and southerly trajectories and the two occurred during dry seasons climatologically within Nairobi. SO<sub>2</sub> was more pronounced during the JJA season as opposed to DJF season because of the strong winds at this particular time of the year. It is expected that during DJF the winds are slightly faster and stronger than JJA, which means SO<sub>2</sub> which is assumed heavier then deposits more during this time.

Mombasa which had predominant onshore winds particularly during DJF and SON seasons with SE during the remaining seasons showed a greater distance of pollutants. The distances that were covered by the pollutants travelled greater distances before being deposited. However, with this information there was low contribution of low level concentration which meant that most of the contributions were closer to the source. Nairobi on the other hand had Easterly and Southeasterly concentration. Depending with the season, there was more deposition from far and closer to the source.

Dominant wind speed over the Nairobi is generally easterly; with the direction ranging from north easterly in DJF to south easterly in JJA (Fig. 5). The results found in this study are agreeing with other studies on wind patterns (e.g. Opijah et al., 2007; Ongoma et al., 2013) which showed that easterlies are the dominant winds in January and November over Nairobi city. From these results, most of the pollutants appear to be transported beyond 100 m throughout the year. To put into perspective the trajectories during the cold season (Fig.5d), the dispersal of pollutants is observed to be in the north eastern direction.

The dispersal is observed to be furthest during the DJF and JJA seasons and least during the MAM and SON seasons. The reason as why most pollutants are dispersed furthest during dry seasons can be due to the fact that during this time, strong monsoons blow over the country during DJF and JJA (Omeny et al., 2008; Kalapureddy, 2007; Okoola, 1999). This implies that the concentration of pollutants in the atmosphere during the two rainy seasons is likely to be higher than what is observed in dry and cold seasons. However, wet deposition due to the precipitation occurring during rain seasons is likely to reduce atmospheric pollutants from atmosphere in the locality (Kaskaoutis et al., 2010).

### 3.3 Anthropogenic contribution

The monthly and seasonal distribution of PM<sub>2.5</sub> within the cities compared to the background emission (Mt. Kenya, GAW) also showed a tendency of having more emissions towards December, January, and February, with fewer emissions within other months (Figure 6). This also corroborated with the seasonal distribution of the PM<sub>2.5</sub> with JJA and SON posting less distribution.

Based on model equations (Table 5), Mombasa and Nairobi have a slightly higher increase per year at 0.05µg/m<sup>3</sup> which gives a difference 0.04µg/m<sup>3</sup> per year. This is arrived at by having the difference on the gradient of the two stations with that of GAW. This anthropogenic contribution may not sound so much but if the trend takes a straight line as opposed to a more random and realistic trend, where these trends are mostly controlled by industrialization, urbanization, population growth and other economic activities.

**Table 4:PM<sub>2.5</sub> Model gradients for the selected station**

Pollutants	STATION	MODEL EQNS
PM <sub>2.5</sub>	GAW	Y=0.01X+3
	KISUMU	Y=0.02X+4
	MOMBASA	Y=0.05X+1
	NAIROBI	Y=0.05X+2
SO <sub>2</sub>	GAW	Y=0.005X+0.5
	KISUMU	Y=0.005X+0.5
	MOMBASA	Y=0.006X+0.4
	NAIROBI	Y=0.007X+0.5
CO <sub>2</sub>	GAW	Y=1.9667X+396.58
	KISUMU	Y=2.0303X+370.57
	MOMBASA	Y=2.0321X+371.32
	NAIROBI	Y=2.2024X+369.37

Mt. Kenya (GAW) showed a yearly increase of the SO<sub>2</sub> of 0.005µg/m<sup>3</sup>. This forms the base or the background level in terms of the rate of increase without the influence of human activities. Kisumu had the same increase per year of 0.005µg/m<sup>3</sup> which means the contribution of human activities in Kisumu is well within the bounds of natural contribution. Generally, there is less proliferation of Sulphur based companies in Kisumu; hence the increase of this pollutant with time is not abnormal. Based on this it's highly likely that the increase may not necessarily follow a straight line but with this factual result shows an increase of 0.05µg/m<sup>3</sup> in the coming ten years. This is still low but considering the corrosive and health effect of this; it's worth monitoring its growth.

Mombasa and Nairobi had slightly higher increase per year at 0.006µg/m<sup>3</sup> and 0.007µg/m<sup>3</sup> respectively. Again, since SO<sub>2</sub> is basically an industrial gas its increase is highly correlated to increase in industries, and with this age of industrialization the projection will be at least best to say that it won't be a straight-line model but exponential or random but with the upward tendency.

CO<sub>2</sub> trend analysis for all the four stations showed increases with time with different gradients. Mt. Kenya (GAW) showed a yearly increase of 1.9667ppm. This forms the base or the background level in terms of the rate of increase without the influence of human activities. Kisumu had the increase per year of 2.0303ppm which means the contribution of human activities in Kisumu to be in the

region of 0.0636ppm per year. Mombasa had an increase of 0.0654 ppm per year while Nairobi, had 0.2357ppm. The reason why Nairobi values are higher is due to motor vehicle traffic and presence of industries.

To summarize on the anthropogenic contribution of PM<sub>2.5</sub> within the three major cities in Kenya, the result shows a 0.01, 0.04 and 0.04 inµg/m<sup>3</sup> per year surface increase of the particles for Kisumu, Mombasa and Nairobi respectively. The levels are still low and within WHO standards but if nothing is done the levels are bound to increase to level that are harmful to humans and the ecosystem. SO<sub>2</sub> on the other hand showed 0.0001, 0.001 and 0.002 in µg/m<sup>3</sup> per year surface increases of the emissions for Kisumu, Mombasa and Nairobi respectively. CO<sub>2</sub> showed 0.0636, 0.0654, and 0.2357 in ppm per year surface increase of the emissions for Kisumu, Mombasa and Nairobi. To just be factual from the annual increase, the average annual increase of CO<sub>2</sub> is almost 2ppm which translates to 200ppm in the next 100 years assuming that nothing changes in terms of new addition of vehicles, population, urbanization, and industries.

#### 4. CONCLUSIONS

All the air pollutants were within the WHO standards, there was no pollutant that was more than the WHO standards. The average monthly PM<sub>2.5</sub> distribution within Kisumu, Nairobi and Mombasa were 3.8µg/m<sup>3</sup>, 3.4 µg/m<sup>3</sup> and 3.6µg/m<sup>3</sup> respectively. The monthly and seasonal distribution of PM<sub>2.5</sub> showed a tendency of having higher emissions towards December, January, and February, which collaborates with dry period in the respective areas and periods of northeast monsoons that bring in northern-hemispheric air that is laden with pollutants. Biomass burning is also a significant contributor to particulate matter emissions during the dry months that have been listed, as a result of increased charcoal burning. However, according to (Kornelius et al., 2012; Naidoo et al., 2014), posits that during colder months domestic biomass burning is more than warmer months due to domestic heating.

The prevailing winds in Nairobi, Kisumu and Mombasa vary according to the season. Case for Nairobi, winds is mainly easterlies implying that the pollutants will mainly be transported to the southwest and northwest of the town. Mombasa has more pollutants during DJF where the winds take a northwesterly. The pollutants are transported mainly from the industries and land fields that are over the northeastern of Mombasa. Backward trajectories from Mombasa show Northwesterly flow of the pollutants particularly during DJF

Trajectories in Nairobi generally show an easterly flow of pollutants most periods in the year emitted within the city. The pollutants are dispersed beyond 50 km within short periods with the least dispersion occurring during the long rain season. However, the spatial and temporal interactions with different scales bring in a different flow characteristics of wind. This differential scale differences is seen in most stations that have built canopy particularly in urban centers. Another issue than complicates the nature of flow is the densely populated built structures that alter the flow of pollutants. This leads to a scenario called surface inhomogeneity. This inhomogeneity causes spatial and temporal differences that are intense which makes handling the forecast and monitoring of the pollution a challenge. This calls for specific space and time monitoring of flow of pollutant concentration.

The assumption of having natural emissions at GAW means that the values by and large for this station form the base level of pollution. Put this in consideration, the difference can be attributed to non-natural activities in the general conclusion. Based on this finding, anthropogenic contribution in Kisumu is in the range is gradually increasing. The contribution may not be as significant as

such but if only the trend takes a straight line as opposed to a more random and realistic trend where these trends are mostly controlled by industrialization, urbanization, population growth and other economic activities.

The findings of this study suggest that human activities are contributing to the burden of pollutants in the near surface atmosphere. Wind and other natural factors also come into play but the main player is human activities that have contributed much. This can be deduced to the fact that the background emission is increasing. The case of GAW having increasing trends of all the pollutants plays a bigger role to explain the fact that natural pollutants also have a huge proportion in terms of altering the ambient air quality.

The reality is in the fact that the gradient of the pollutants was increasing more than the background emissions. This shows the growing influence that human beings have placed on otherwise naturally growing pollutants. It is again simple to correlate the fact that pollutants have a correlation towards industrial emissions hence economic growth, which is also a factor of population growth. In a nutshell, with population growth, there is an inevitable reality of pollution growth. Now this economic and population growth are not on a straight-line curve, but more likely to be on an exponential and random curve that points upwards. This brings a sense of slightly more growth in terms of pollutants in the near future as opposed to the postulated straight-line increases.

Finally, the meteorological parameters only come in to aid in pollutant transport as opposed to increasing its presence. Some places it also depends on the strength of the winds as calm winds near the source help transport it from the source and help in spreading it near the source but strong winds near the source blows the pollutants away from the place to distant places. Another factor that also affects the suspension of the particles is its mass. This was not the objective of this study but cannot be assumed and wished away as mass is a function of density that enables a particle to be suspended in the atmosphere.

## **ACKNOWLEDGEMENT**

I am sincerely grateful to the System of Land-based Emission Estimation of Kenya (SLEEK), an initiative of the Kenyan and Australian Government, for graciously providing the financial, professional and scientific support that made the study a success.

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# The Influence of Single Double Tuck Jump and Side to Side Barrier Single Double Tuck Jump on Power and Strength

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DOI: 10.29322/IJSRP.8.8.2018.p8048

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8048>

**Abstract-** Plyometric is an exercise that involves eccentric muscle contraction. Plyometric is divided into some forms, however this study uses 4 plyometric forms, namely: single tuck jump, double tuck jump, side to side barrier single tuck jump and side to side barrier double tuck jump. This study aims to analyze the influence of single double tuck jump exercise and side to side barrier single double tuck jump exercise towards power and strength. The subjects of this study are the sports extracurricular students of State Junior High School 1 Candi with the number of 36 schoolboys, it is quantitative research type with the quasi-experimental method, the research design uses "matching only design" and analyzed using "ANOVA". The power data retrieval process uses jump MD and strength are using "leg dynamometer" during pretest and posttest. Furthermore, the data were analyzed using SPSS Version 21. The results of this study indicate the influence of single double tuck jump exercises and side to side barrier exercises single double tuck jump towards increase power and strength. It can be concluded that single double tuck jump exercises and side to side barrier single double tuck jump exercises are very efficient.

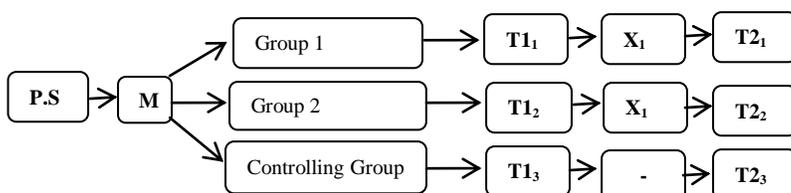
**Keywords:** *plyometric, power and strength, single tuck jump, double tuck jump, side to side barrier single tuck jump, side to side barrier double tuck jump.*

## I. INTRODUCTION

Trainer, instructional design and knowledge take important role concern with athlete's achievement. As matter of fact, achievement needs a long process, sport extracurricular can be a place to exercises to student physic, technique, skill and tricks. The physic condition is an important thing to keep as well as to improve performance. It is also being the prominent thing to achieve achievement. Volleyball, Basket, and Football really need power and strength to maximize athletes' performance. Thus, sports teachers should develop students' power and strength by implementing plyometric. This study used plyometric because it has various exercises so that students will not feel bored. According to Muzammil et al (2016), the effect of different modes of plyometric training increase explosive power. However, this study only examines on four types of exercises, including single tuck jump, double tuck jump, side to side barrier single tuck jump and side to side barrier double tuck jump taken place at state Junior high school (SMPN 1 Candi).

## II. METHODOLOGY

This study applied a quantitative method with quasi-experiment and matching the only program. This program is matching a subject based on the variable (Maksum, 2012 : p.100).



## Note:

P-S = *population and sample*

M = *matching*

T1<sub>1</sub> = *group 1 of power and strength pretest*

T1<sub>2</sub> = *group 2 of power and strength pretest*

T1<sub>3</sub> = *group 3 of power and strength pretest*

X<sub>1</sub> = *single tuck jump and double tuck jump exercise*

X<sub>2</sub> = *side to side barrier single tuck jump and side to side barrier double tuck jump*

T2<sub>1</sub> = *group 1 of power and strength posttest*

T2<sub>2</sub> = *group 2 of power and strength posttest*

T2<sub>3</sub> = *group 3 of power and strength posttest*

- = *conventionally exercise*

The population of this study is 120 students of sport extracurricular in SMPN 1 Candi with 30% of the students which taken as the sample. Yudhistira (2013) explained that if the subject of a study is less than 100 people, so all of them must be included a sample but if it is more than 100 people so the sample may be taken from only 10%-25% or more. Therefore, there are 36 schoolboys taken as a sample with age around 12-14 years old. The sample is divided into groups. Each group should get power and strength pretest because the different result of power and strength will be equal by t score arranged from the smaller (ordinal pairing technique). This technique is one of the ways to group sample with the ranking system. The aim of ordinal pairing is to equal each sample skill. Hence, Each group is provided an exercise course three times per week.



Figure 1: single tuck jump



Figure 2: double tuck jump



Figure 3: Side to side barrier single tuck jump



Figure 4: Side to side barrier double tuck jump

The controlling group is free from any exercise but they still do conventional exercises. This method based on Bompa theory (2015) that the exercise course has been done for three times per week during 18 meetings. In addition, Zbigniw, et al. (2014) set forth that six weeks exercise program will encourage power increase. However, this study only uses 40%-60% of the whole week since the sample is still students of Junior High School. The frequency of the exercise is explained through description, percentage and average. Then, the data were analyzed with SPSS 21 program. This is used to measure the data normality test. Kolmogrov-Smirnov analysis is applied if the data is normally distributed then continued by paired sample test and homogeneity test through ANOVA to know which exercise method is more effective.

### III. FINDINGS

#### A. Group 1 (single tuck jump and double tuck jump)

The test result for power and strength before and after the exercise on 12 students is displayed below.

Table 1: Result test of group 1

No	Name	POWER (Watt)		D	STRENGTH (Kg)		D
		<i>Pretest</i>	<i>Posttest</i>		<i>Pretest</i>	<i>Posttest</i>	
1	<b>DI</b>	191100	211680	20580	50	55	5
2	<b>MFJ</b>	165181	161210	-3971	50	47	-3
3	<b>RB</b>	116017	160418	44401	61	56	-5
4	<b>MAR</b>	104759	148690	43931	47	52.5	5.5
5	<b>YC</b>	108889	119070	10181	46	50	4
6	<b>FAW</b>	119952	114141	-5811	38	43	5
7	<b>MDJ</b>	97694	112896	15202	42	55	13
8	<b>GSP</b>	96600	98784	2184	37	36	-1
9	<b>ESK</b>	100100	211750	111650	34	41	7
10	<b>MKP</b>	86839	90275	3436	34	38	4
11	<b>RAK</b>	96674	113789	17115	30	32	2
12	<b>MHF</b>	76160	86839	10679	28	30.5	2.5
<b>TOTAL</b>		1,359,965	1,629,542	269,577	497	536	39
<b>AVERAGE</b>		113,330	135,795	22,465	41	45	3
<b>DEVIATION</b>		32,948	43,214		10	9	

Based on the table above, there is an increasing result between the pretest and posttest on each variable (power and strength). This is seen from the posttest average which rises up to 113,330 higher than present power with 135,795. Moreover, the comparison score result of strength variable is 45:41. Thus, the treatment of the first group can increase power and strength.

## B. Group 2 (Side to side barrier single tuck jump and side to side barrier double tuck jump)

The result test of group 2 is displayed in bellow table:

Table 2: The test result of group 2

No	Name	POWER (Watt)		D	STRENGTH (Kg)		D
		<i>Pretest</i>	<i>Posttest</i>		<i>Pretest</i>	<i>Posttest</i>	
1	<b>HA</b>	126000	129544	3544	67	68	1
2	<b>REA</b>	119070	161373	42303	65	40	-25
3	<b>FF</b>	183349	198613	15264	37	43	6
4	<b>MF</b>	121956	173727	51771	45	41	-4
5	<b>MGN</b>	124950	117600	-7350	41	73	32
6	<b>YA</b>	151778	165181	13403	29	51	22
7	<b>ADM</b>	108513	107520	-993	37	46	9
8	<b>AMM</b>	106909	113789	6880	35	60	25
9	<b>BGD</b>	114141	119070	4929	29	32	3
10	<b>RA</b>	86839	95822	8983	35	61	26
11	<b>AFA</b>	72520	69160	-3360	33	28	-5
12	<b>AFF</b>	79234	124950	45716	28	41	13
<b>TOTAL</b>		1,395,259	1,576,349	181,090	481	584	103
<b>AVERAGE</b>		116,272	131,362	15,091	40	49	9
<b>DEVIATION</b>		30,563	36,626		13	14	

The result of the group 2 test is rather alike with group one that average power score is higher than the pretest. The average score of power test rose to 131,362 higher than the pretest of 116,272. it also happens on the other variable, strength, which the comparison is 49 (pretest): 40 (posttest). Hence, it also increases a student's power and strength.

## C. Group 3 (controlling group)

The test result of power and strength were given to group 3 conventionally is seen in table 3.

Table 3: The test result of group 3

No	Name	POWER (Watt)		D	STRENGTH (Kg)		D
		<i>Pretest</i>	<i>Posttest</i>		<i>Pretest</i>	<i>Posttest</i>	
1	<b>LJW</b>	198613	86839	111774	43	52	9
2	<b>RDP</b>	140366	125337	-15029	61	43	18
3	<b>SPR</b>	137445	126824	-10621	44	52	8
4	<b>SRK</b>	120695	126000	5305	47	41	-6
5	<b>HAW</b>	129544	107520	-22024	38	52	14
6	<b>AJD</b>	115858	83458	-32400	40	55	15
7	<b>ADM</b>	108513	157067	48554	37	34	-3
8	<b>FSA</b>	78400	58550	-19850	45	40	-5
9	<b>AFR</b>	58800	49000	-9800	45	51	6
10	<b>MNH</b>	58800	49316	-9484	43	42	-1
11	<b>NB</b>	83745	118029	34284	28	30	2
12	<b>MHA</b>	72369	69160	-3209	30	33	3
<b>TOTAL</b>		1,303,148	1,157,100	146,048	501	525	24
<b>AVERAGE</b>		108,596	96,425	-12,171	42	44	2
<b>DEVIATION</b>		40,881	35,430		8	9	

The table above shows that the average between pretest and posttest of each variable is decreased. It is proven by the score of posttest (96.425) lower than the pretest (108.596). However, the strength score of the posttest is a bit more rising that the pretest with 44:42. Thus, the controlling group of strength only has small improvement because the treatment is nothing. Hence, power group is also worse.

## D. Requirement data test

### 1. Normality test

This test is used to know the normality of a datum so that this can be the step to test inferential statistic. It is a way to summarize wholly based on the data collected. In this case, this normality test used one sample kolmogrov-smirnov test. Also, SPSS 21.0 was also used to observe the normality signs as displayed in below table 4.

Table 4: Normality test

Variable	Test	Group 1	Group 2	Group 3	Note	Status
		Sig	Sig	Sig		
Power	First test	.423	.674	0.962	$P > 0,05$	Normal
	Final test	.527	.798	0.961	$P > 0,05$	Normal
Strength	First test	.977	.393	0.806	$P > 0,05$	Normal
	Final test	.980	.924	0.619	$P > 0,05$	Normal

The table above shows that both variables are linked to each other which means the data are distributed normally. This is caused by the significance ( $p$ ) of each group shows that ( $p$ )  $> 0.05$  causing  $H_0$  is accepted.

### 2. Homogeneity data test

This test is used to show that two group or more come from the population whose variable is alike. Thus, this test is used to know the subject of equality. The criteria of the variables are as followed:

- 1) Hypotheses test
- 2) Homogeneity test
- 3) If the significance level ( $p$ )  $> \alpha = 0.05$  so the variant is homogent
- 4) If ( $p$ )  $< \alpha = 0.05$  so the variant is not homogent

The measurement result using SPSS 21.0 is in below table.

Table 5: the result of the homogeneity test

Test of Homogeneity of Variances				
	Levene Statistic	df1	df2	Sig.
PREPOW	.734	2	33	.488
POSTPOW	.413	2	33	.665
PRESTRG	.928	2	33	.405
POSTSTRG	1.021	2	33	.371

Based on table 5 above, the data of both variables have homogent variable seen from each significance score. Each score is ( $p$ )  $> 0.05$  so that the variants on each group are alike.

### 3. Paired sample test

To know the difference condition of students before and after given exercises, this study also implemented t-test using SPSS 21, called as paired sample t-test. This test is to compare linked group data.

Table 6: t-test result

Variable	Pair	t-count	Sig.(2-tailed)	Status
Power	Post test-pretest	-2.402	.035	Different
Strength	Post test-pretest	-2.367	.037	Different

It can be explained that the difference of significance can be seen from *t-count* and significance score (2-tailed). The score of *t-count* on power variable is -2.402 with a probability score of 0.0035. Thus, the hypothesis H<sub>0</sub> is rejected while H<sub>1</sub> is accepted. Meanwhile, the *t-count* score of strength variable is 12.367 with 0.037 of the probability score. Hence, the hypothesis test is the same as the power variable. Indeed, the difference between the first test and the final test of the first experiment is understood. Therefore, single tuck jump and double tuck jump influence the increase of power and strength.

Table 7: t-test result

Variable	Pair	<i>t-count</i>	<i>Sig.(2-tailed)</i>	Status
Power	Post test-pretest	-2.593	.025	Different
Strength	Post test-pretest	10.199	.000	Different

The analysis shows that the *t-count* of power variable is -2.593 with .025 score of probability in the second experiment. This means H<sub>0</sub> is rejected while H<sub>1</sub> is accepted. However, the *t-count* of strength variable is 10.199 with .000 of probability score which means the hypothesis test is the same as the power variable experiment result.

Table 8: t-count result

Variable	Pair	T-count	<i>Sig.(2 tailed)</i>	Status
Power	Post test-pretest	9.202	.000	Different
Strength	Post test-pretest	16.432	.000	Different

From the table above, power variable *t-count* rise until 9.202 with 0.000 of probability score. Meanwhile, the score of strength variable *t-count* is 16.432 with 0.000 probability score. Thus, the result of the hypothesis testing is that H<sub>0</sub> is rejected while H<sub>1</sub> is accepted. Hence, there is the difference between the first and the final test on strength and power variable.

#### IV. DISCUSSION

This study was conducted to explore the influence of single double tuck jump and side to side barrier single double tuck jump on power and strength. Based on the analysis data, there is significant influence between group 1 of single double tuck jump and group 2 of side to side barrier single double tuck jump. Power is movements need strong and fast muscle contraction dynamically (Albertus and Muhyi, 2015). According to Muzammil, Faizal and Saqib (2016), six weeks of plyometric training increases explosive power. However, Lehnert, Hulka, and Thomas (2013) added six weeks of plyometric training increases explosive strength and agility. Based on the analysis, all sport exercises on controlling group showed pretest and posttest result. Thus, a single tuck jump and double tuck jump give significant influence on student's power and strength. Meanwhile, side to side barrier single tuck jump and side to side barrier double tuck jump only give significant influence on students' strength. Thus, the trainers may apply single double tuck jump and side to side barrier single double tuck jump properly and well.

#### V. CONCLUSION

This study can be summarized that single double tuck jump exercises are better at increasing power and side to side barrier single double exercises give a better influence on strength. However, there are some recommendations for the readers, as followed:

1. The method of single double tuck jump and side to side barrier single double tuck jump can be implemented to increase students power and strength in sport
2. Further research on this topic may use other condition of the sample
3. This study may become a comparative study for further research on this case

#### ACKNOWLEDGMENT

The writer really expresses a million thanks to my family, teachers, supervisors, and friend who have constantly support her to finish this paper.

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# Data and Information Mapping Of Participatory Plan for Village Development

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DOI: 10.29322/IJSRP.8.8.2018.p8049  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8049>

**Abstract-** A forum formed to conduct a participatory plan is commonly mentioned as *Musrembang*; a term for development plan discussion usually conducted in Indonesia. This discussion is commonly started from the lowest government. Thus, the decision made in the discussion is a priority to reconstruct a village. This study was conducted in Kampar, Riau, Indonesia. The implementation of participatory plan, in this study, used two approaches, are: *Top Down* approach and *Bottom Up* approach. The data were data and information related to the village development, such as: village profile, village administration, village financial and village management. Furthermore, the data were mapped to then evaluate the preparation of reconstructing the village. The result showed that the data and information related to the village development were not completely completed. Thus, the preparation could not strengthen the agenda of village development. Indeed, village development with participatory system could not be established.

**Index Terms-** participatory plan, village development, preparation, data mapping

## I. INTRODUCTION

Iwan Kartikawanto (2003) explained that participatory plan, in a village, tries to describe, to analyze, to interpret and to compare village *Musrembang*; a forum to discuss about participatory development. Participatory development plan is a development model which involves the society. They, the society, are being active to identify problem, to state the problem, to find alternative solution, to arrange solving problem agenda, to convers, to help, and to evaluate. However, the village administration officers need to conduct a discussion sharing about the village development plan with the society.

Kampar District is one of districts in Riau, Indonesia. It has 245 villages with 21 sub-districts. Thus, the village development becomes the responsibility of its society to solve problems existed in the village. As the result, the village development and development will be well achieved. Further, the society's prosperity will be highly increased. However, this study only takes three sub-districts on Kampar, including: Salo, Tambang and Koto. These sub-districts are taken as the study's participant because these sub-districts do not have perfect plan to develop its villages. This case is proven by the limited documents provided that there are no well-arranged documents concerning village development and development. Moreover, the data and information needed for village development program are not complete and less accurate so that those data cannot be recommended to arrange the plan for village development. This problem obstructs the development of the village.

The data and information availability will support the plan for village development. Thus, a forum discussion concerning to this must be conducted. Through this discussion, the society and village officers may map the data related to village information. Indeed, data mapping will facilitate and support the requirements of development village with participatory system program.

## II. LITERATURE REVIEW

The system of national development plan has been explained in The Law No 25 2004. This rule describes detail about development plan in long term conducted by central government and its staff involving the society. However, the Government Ordinance No. 8 2008 regulated the steps, ways, control, and evaluation of regional development. This regulation was made due to the Ministerial Regulation No. 54 2010 which mentioned that regional plan include the long term of regional development plan (RPJPD), the medium term of regional development plan (RPJMD) and the strategic plan (RESTRAS). These elements are formulated transparently, responsively, efficiently, effectively, accountably, fairly, participatory, scalable and environmentally.

Regional plan is a systematic effort from some aspects, such as: public, government, society and so on. These aspects depend on one other in term of politic, social, economic, physic and other environmental aspects through the following ways, are:

1. Continuously analyze the progress of regional development
2. Stating the goal and policy of regional development
3. Planning the strategic concepts of problem solving
4. Conducting the development program based on the resources availability so that the prosperity can be better (Hanif Nurcholis, 2009:9)

Hanif (2009), further explained that there are steps to arrange regional development, as followed:

1. Profile
2. Policy (vision, mission, goals, general strategy, priority)
3. Well-planned planning
4. Monitoring and evaluation

Based on the legal framework, development program of all region level must use participatory approach. This approach has two ways of direction, including: Top Down and Bottom Up. A forum formed to conduct a participatory plan is commonly mentioned as *Musrembang*; a term for development plan discussion usually conducted in Indonesia. This discussion must be attended by all sectors of regional administration officers, province officers and central officers.

Central officers should take strategic, directed and focus strategy plan to create the documents of participatory plan. Regional Development Planning Agency (BAPPEDA) designs the development program so that the documents can be created. The design includes the preparation, goods, schedule, facility, formulation, finalization and legislation process. There are three types of regional discussion, as followed:

1. Village (conducted per January)
2. Sub-district (conducted per February)
3. District (conducted per March)

The village officers have duty to conduct discussion forum that involve the society. The goals of the discussion conducted in village are:

1. Accommodating people's aspiration and prioritize their necessity
2. Prioritizing programs financed from Regional Government Budget (APBD)
3. Prioritizing programs that will be discussed in *Musrembang*

Then, the secretary of office village should prepare the following points.

1. The draft of problems existed in the village
2. The medium term of development plan
3. The evaluation result of the development program
4. Priority problems list

Further, the discussion conducted in village should result the following points.

1. Prioritized activity that will be financed by Regional Government Budget (APBD)
2. Prioritized activity that will be conducted through Regional Work Unit (SKPD) and will be discussed in *Musrembang*
3. The information of discussion agenda

The method of participatory plan implemented in a village has various types because its implementation involves many aspects that depend on one other. The first type is ZOPP. This term is abbreviated from *Ziel* (purpose), *Orienterte* (orientation), *Projet* (project), and *Planung* (plan). There are four elements of ZOPP to be applied in analyzing a village situation, are: analyzing problem, deciding goals, providing alternative ways, considering roles of any parties involved within the development program. Participatory Rural Appraisal (PRA) is the second type of participatory method. This method focuses on approaching the society to explore the condition of a village. On the other words, this method is directly involving the society to the process of village development (Driyamedia, 1996:15). This implementation of this method aims to create a development program based on the society's expectation and condition. Further, it also empowers the society through skill development. In general, the principle of PRA and ZOPP are rather alike; involving the society directly to the village development program. However, PRA does not emphasize on collecting data, applying tools and others. It instead emphasizes on the society's understanding concerning their own condition so that they will be able to find out the proper solution for their problem. The third method is participatory assessment method (MPA). According to Bambang Rustanto (2002:12), participatory assessment method applies four steps, as followed:

1. Finding the problem
2. Finding the potency
3. Analyzing the problem and the potency
4. Deciding solution for the problem

The planning for a village development must involve all sector of the village. The plans may include as below points mentioned, are;

1. Medium term of village development plan. This plan may be available per five years per period
2. A village development program plan. This may include the related documents for the first period. The planning describes detail about the economy of the village while considering the development program.

The data needed for planning a village development program (Nurcholis, 2011:108) are as followed:

1. The village profile
2. The village organization
3. The village administration

4. The village finance
5. Other important information about the village administration and the society empowerment

### III. METHODOLOGY

This study was conducted in in Kampar District, Riau, Indonesia. Further, the writer chose some villages as the sample of this study. This study used participatory rural appraisal (PRA). It took two years of investigation duration. In the first year, the writer could map the data and the information related to the village development program. Then, the writer could apply the method of participatory plan for the village development program.

### IV. FINDINGS

As previously mentioned, the study urgency has found participatory plan model of village development program in Kampar District, Riau. To result a participatory plan model, there must be data and information mapping such supporting documents that include village profile, administration, and organization and so on. The data and information must support one and others.

The data were collected through interviews to the officers of the village, sub-district and district. As the result, there must be area mapping to describe the availability of the data and information. Then, there also be priority decision of which area should be developed. Below is the villages mapped, as followed:

1. Koto Kampar Sub-district includes Lubuk Agung Village, Pulau Godang Village and Koto Mesjid Village. This sub-district is the very tip area of Kampar District
2. Salo Sub-district includes Salo village, East Salo Village, and Siabu Village. This sub-district is by Bangkinang City, the capital city of Kampar District.
3. Tambang Sub-district includes Tambang Village, Rimbo Panjang Village and Tirai Bangun Village. This sub-district border directly on the capital city of Riau, Pekanbaru.

The availability of data and information of the village will facilitate the village officers to plan the village development program. However, the village development program also needs the human resource ability and the society's participation. As the result, the study of data and information mapping needed to plan village development program is found less complete. Almost all villages in three sub-districts did not provide detail data and information for arranging the village development program plan.

### V. DISCUSSION

The main goal of this study was to find participatory plan model in developing village in Kampar District. The importance of data and information mapping of the village development plan is to obtain any information about the village and its society so that they can involve themselves in planning the programs of village development both discussed in *Musrebang* and *Musdes* (a general discussion conducted in village).

The goal of these discussions is to accommodate the society's aspiration concerning the programs. The prominent result of the discussion is deciding the priority of which village should be developed financed by regional budget. However, the general discussion conducted in the village prioritized the development whose finance allocated by the village financial. From the analysis, the result obtained is as followed:

#### 1. Village profile

This is the general description of a village explaining about the village condition wholly. This profile consists of family data, village potential, and village development. The detail data of village profile of nine villages are displayed in below table.

Table 1: the profile of nine villages in Kampar District 2018

No	Villages	Village profile			Note
		Family data	Village potency	Village development	
1	Lubuk agung	+	-	-	Incomplete
2	Koto Mesjid	+	-	-	Incomplete
3	Pulau godang	+	-	-	Incomplete
4	Salo	+	+	+	Complete
5	Salo timur	+	-	-	Incomplete

6	Siabu	+	-	-	Incomplete
7	Tarai bangun	+	+	+	Complete
8	Rimbo Panjang	+	-	-	Incomplete
9	Tambang	+	-	-	Incomplete

Source: the result of study field 2018

The table above explained that only three villages have complete data of the village profile. In contrast, there are seven villages whose data were incomplete and less accurate. The data of family existed in the village was showed to describe the society's condition socially, economically, religion and assets.

Further, the potency data was the description of village assets that can be developed to support the village financial source. The village financial sources could be the wealth from agriculture, plantations, village markets, public charges, taxes, rivers and tourism. This wealth should be managed and developed by the Village Administration and its society. Unfortunately, the village potential development has not been well explored due to the lack of knowledge to prepare the village development planning.

In fact, the village development became supporting data for village profiles. It included village infrastructure development, economic growth and village economic institutions development. Unfortunately, all villages observed did not have complete data concerning to its development whereas the data was important to understand the real condition of the village. However, the data of village development should be available so the administrators could follow up the unplanned developments. Thus, the data profiles of three villages were incomplete that it could not support the preparation of village development program plans.

## 2. Village Administration

The Village Administration is the implementation of Government affairs and local people interest. This implementation is the activity of village administrative organizations to organize government program, development, social and society's empowerment. This activity described the village governance duties and functions. The village head assistant consists of village secretariat, the technical implementation element, the territorial element. The implementation of Village Governments activity should follow the principles of legal certainty, regular village administration, public orderliness, openness, proportionality, professionalism and accountability, affectivity and efficiency, local wisdom, diversity and participatory.

The principle of the village administration is implemented as a basic principle must be applied by the village head and staffs. Proper administration would support the implementation of village administration instead. The village administration included the record of all activities processes concerning the implementation of Village Governance mentioned the Village Administration Book. Thus, this implementation could support the systematical data and information for further village development program.

The implementation of village administration should be supported by a complete administration which consisted of general administration, population administration, financial administration, development administration, and Village Consultative Board administration and so on. Based on the observations and interviews, almost all villages were less orderly and neat in term of village administration management. Therefore, the data should be supported by the village administration could not reach the requirement of village development plan data.

## 3. Village Organization and Management

Organization is a place of activities carried out by humans as executors to achieve the desired goals while management is the ability of village human resources officers to carry out the duties and functions of Village Government effectively. Data and information of the village organization and management were used as material and input to support the preparation of village development planning. These data and information covered the aspects of village management governance, facilities, infrastructure, and human resources officers.

There are various types of village informal social organizations whose activities should be able to support the implementation of village development activities. The implementation of Village Government and development had been regulated in Law No. 6 of 2014 by the Ministry of Home Affairs No.114 which explained the guidelines for village development. The organizational resources supported by qualified human resources could strengthen the village governance management system. Based on the observation and information obtained, the existence of village organization and management in three District of Kampar is known still less functional. This was because the village officers could not understand the duties and functions mandated in Law No 14.

The organizational structure of village administration consisted of village head, secretary, finance officers, government officers, planning officers, social officers, development officers, general affairs officers, and empowerment officers. All the affairs inherent in the village administration must exist and be occupied by the officer's capability to carry out the duties and responsibilities. The fact that there were duties and responsibilities could not run well because the education of the village officers was mostly educated junior high school and senior high school.

Based on the above explanation, the roles and functions of the village organization were not effective and less able to carry out the main duties and functions of the government such as preparing, planning, prioritizing, implementing, monitoring and evaluating the village development programs.

#### 4. Village Finance

Village finance is the rights and obligations for the implementation of village governance including all forms of property. It might be from the village's original revenue, regional budget and state budget. The implementation of village affairs became the authority of the village funded from regional budget, Central Government assistance and Local Government assistance.

Village governments were required to manage village finances in a transparent, accountable, participatory way. Transparent means openly managed while accountable means to be accounted for legally. Then, participatory means involving the society in the preparation.

The village head was assisted by the village financial management technical officer (PTPKD), the village secretary and other village officers to manage the village financial. The village secretary acts as the coordinator of the village financial management. However, the village cash holder is the village treasurer.

The village government, every year, is obliged to plan the village budget. It is the financing of annual development program organized by the village administration. The village's annual development program is conducted in medium-term development program (six years) which was called as the village mid-term development plan. This program is an elaboration of the village chief's vision and mission. After planning the mid-term plan, the village officers arrange the work plan of the village. This is the annual work plan of village government to organize the development and service programs in the village. The village secretary prepared the village regulation draft of village budget based on the village work plan.

The Village Revenue and Expenditure Budget were obtained from regional Government and central government assistance. The regional budget must be allocated to the villages, at least 10% of the budget. The implementation of financing activities was sourced from the allocation. The division of village budget is 3:7 which is 30% for the staffs and 70% for the society's empowerment. However, the village budget must be managed as well as possible based on its responsibility. The responsibility of budget management has been regulated in Law No.14 of 2014.

Below points explains the form report of finance management, as followed:

- a. Periodic reporting. It means the the budget management should be reported monthly.
- b. The budget final report. It includes the progress of fund management.

Thus, the village officers must manage and report the village budget properly. From some villages in Kampar regency, it is known that administrative officers and village financial administration are less able to carry out the duty of bookkeeping financial administration properly. This can be seen from the data of the budget use and unsynchronized previous report. This means that the use of village funds used for village development both in the previous year and in the current year is not yet integrated in the village budget revenue and expenditure book. Therefore, the village finance issue and the management of village budget management must be regular so that it can be a reference or guidance to plan the further village development program.

#### 5. The Information of Village Governance and society Empowerment.

The implementation of Village administration is the duty and responsibility of the village head with his staffs. In fact, the information about village governance and the society empowerment is used as supporting data in preparing Village Development planning. The availability of government information data and empowerment activities to the society can provide convenience to citizens to obtain all services provided by the Village Government. Therefore, the importance of government and community empowerment data and information organized will greatly help the public to know the information either directly or indirectly.

The information of government administration and services to the society should be provided by the organizers because it will provide materials and inputs in the development plan well. The importance of the information is not only to make connections between the organizers and the citizens, but also more importantly the convenience of the villages to design the development planning based on complete, accurate and accountable data and information.

Based on the observations and interviews obtained in the field, the availability of village government information as well as the information of empowerment provided by each village in Kampar district is still incomplete. It is proven that the information media both orally and in writing, electronically and non-electronic is still an obstacle and not provided by the Village Government. In this case, the information should be obtained by the society to obtain services could not be fulfilled by the public.

## VI. CONCLUSION

This research urgency was modeling participatory planning of village development in Kampar district. Yet, information and data mapping were needed to prepare village development planning. The preparation of village development planning could be effectively implemented if the supporting documents were complete and tighter. The data and information in the village facilitated the village planning officer in preparing the village development planning. The data and information needed include village profile, village administration, village organization and management, village finance and information about the governance and the society

empowerment. The finding of this study showed that the availability of data and information needed in the preparation of village development planning in 9 (nine) villages of Kampar regency is still incomplete and inaccurate so that the supporting documents for discussion about development planning is less effectively conducted. This is the reason of why the priority of village builders has not yet accommodated the problems and needs of villages in planning and implementing participatory village development in Kampar regency.

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# Information Quality Impact toward Continuous Intention of Using Tax E-Filing System

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DOI: 10.29322/IJSRP.8.8.2018.p8050

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8050>

**Abstract:** *Even though tax e-filing system have improved, issues regarding information quality such as the correctness of the output information, the availability of the output information at a time suitable for its use, and the comprehensiveness of the output information content issues which forced the users to queue in the system still exist. The purpose of this study is to investigate the relationship between information quality and individual taxpayers' continuous intention toward using e-filing system in Malaysia. This study adopts the DeLone & McLean Information System Success Model as a theoretical basis firstly because it is a well-established theory and is widely used in information system technical-related research..*

*This review will include quantitative techniques and focused on individual taxpayer in Malaysia. The quantitative data that gained from the questionnaire are analysed by using the Smart PLS3. The methods of data analysis are selected based on the research questions and the variable characteristics.*

**Keyword:** *E-filing, Information Quality, Individual Taxpayer, IS Success Model, Continuous Intention*

## I. INTRODUCTION

The development and management of e-government systems are becoming an essential element of modern public administration [1]. Government agencies around the world have embraced the digital revolution and placed a wide range of materials on the web including publications, databases, and actual online government services [2]. The initiatives of having such electronic information have been introduced worldwide into the early years in 1993 by the United States of America: Information superhighway updated with expanded electronic government 2001; followed by Malaysia: Electronic government in 1997; a year after by the United Kingdom: Information age government; in year 1999 by Canada: Government online; and in year 2000 by Singapore: E-government action plan [3].

According to Banerjee and Chou [4], e-government is to seem to be as a tool for the government to provide information, services and access in an electronically easiest way via personal computers, kiosks, telephones and other resources. E-government is technically referring to the delivery of information and services online via the internet [5] and it is claimed to be cost saving and improve public

satisfaction. E-government has become increasingly important to the aims at better and effective governance together with the significant benefits including the radically shrinking communications and information costs, improving connectivity, maximizing speed, broadening to reach, eradicating distance and encouraging participation of public in government [5]

Like many other developing countries, Malaysian government also has been investing in e-government [6]. Malaysia's strategic shift into the information and knowledge era offers the country and the world an attractive global multimedia environment where the unique elements and attributes of information, ideas, people, service and technology are able to fuse, grow and deliver a globally replicable chain of innovative products, services and best practices [7].

The idea of moving towards e-government in Malaysia as an alternative of the existing manual system started with the vision to be achieved in year 2020 to become a fully developed country. In rationalizing the vision, the Malaysian Government since then is spending more than RM211 million [8].

One prominent type of e-government is the introduction of the e-filing system for income tax. Compared to other online service delivered by government, online tax filing is one of the most developed and widely used services. In the public sector with the move of online service, tax authorities tend to be at the leading edge of IT application [9]. Through this system, taxpayers are able to submit their tax returns electronically to the tax authorities.

In Malaysia, electronic tax filing (e-filing) system is one of project under e-government flagship in Multimedia Super Corridor (MSC) [10]. Although e-filing system receiving much attention, growing trends and serves measurable benefits to the tax payers and tax authorities [11], this system has been slow in gaining acceptance among taxpayers [12] and quite low compared to the total number of registered tax payers and expectation of Inland Revenue Board Malaysia (IRBM) in Malaysia [13] despite huge investment, improvement of technology and various promotion activities to enhance or increase level of usage e-filing system [14]. Thus, understanding factors that influences continuance intention [15] towards e-government services is an essential step to achieve government goal [16] particularly to achieve government goal in e-filing context, to reduce more operation and management cost [17] and to ensure success of this services [18]. This is because continuance at individual level have

been deemed to be important for long term sustainable of web-based services [19] and central to the survival for the electronic service providers.

Moreover, even though tax e-filing system have improved [15], gained significant response and existed many years in most of the countries including in Malaysia, issues regarding information quality such as whether information acquired by the system is relevant for users, complete and easy to understand and technical difficulties which forced the users to queue in the system still exist and this caused user dissatisfied and weaken overall users' perception towards the system [20].

## II. THE DELONE & MCLEAN (D & M) IS SUCCESS MODEL

The exploration of IS (Information System) continuous intention has been shaped significantly by DeLone and McLean's (1992) IS Success Model. The model introduced six major variables of information system continuous intention; System Quality, Information Quality, Information System Use, User satisfaction, Individual Impact, and Organizational Impact. In the D & M IS Success model "System Quality" measures technical success, "Information Quality" measures semantic success and "Use, User satisfaction, Individual Impact and Organizational Impact" measures effectiveness success.

In 2003, DeLone & McLean extended their model and added service quality as an important indicator of success measure. Instead of adding more success measures, DeLone and McLean (2003) combined the different impact measures and categorized them as a net benefit in their extended model. The model includes six success dimensions, and holds that the constructs of information quality, system quality, and service quality individually and jointly affect the factors of use and user satisfaction. The model further states that there is a reverse relation between the amount of system use and user satisfaction. User satisfaction and use jointly affect net benefit.

This study only focused on information quality and how it relates with the continuous intention to use e-filing. Information quality is defined as the extent to which the information provided best fits customer needs [21], usually based on measures on how accurate, relevant, timely, and complete the information is to address such needs [22]. Information quality deals with the character of the real information that is produced by the IS and the extent to which the information produced meets the expected needs of the users [23]. Continuous intention is ones intention to continue using or long term usage intention of a technology [8]. In this study, eight (8) items were selected to measure information quality in areas that covered completeness, timely and precision as the main characteristics of information quality.

## III. METHODOLOGY

The unit of analysis chosen for this study is the individual taxpayers in Malaysia who have used the e-filing system to file their tax online at least once. Based upon IRBM's annual report [24], there are 2,922,229 millions individual taxpayers population throughout Malaysia who have used the e-filing system in year 2015. Sekaran (2003) suggests that for a population of over 1 million, a sample size of 384

is acceptable [25]. The present study targets sample of 2,000 respondents, approximately 143 taxpayers from each branch of the 14 states' capital city of Malaysia. The Malaysian e-filing service <http://ez.hasil.gov.my> is considered an application area for this study.

The research process designed to achieve the aims and answer the questions [26] was conducted in quantitative method using structured, closed item surveys. Simple random sampling [27] will be used in this research study. Simple random sample is chosen from a larger set of a population. A simple random sample is a subset of a statistical population [26] in which each member of the subset has an equal probability of being chosen. A simple random sample is meant to be an unbiased representation of a group.

Data analysis for this quantitative phase of the research was done using the SEM approach [26]. PLS path modeling becomes more appropriate for real world applications and more advantageous to use when models are complex [28]. The soft modeling assumptions of PLS technique (i.e., ability to flexibly develop and validate complex models) gives it the advantage of estimating large complex models [29]. Measurement model was used to explain or assess constructs' reliability and validity [26] of the current study. Secondly, structural model was used to conduct bivariate correlation analysis and simultaneous regressions analyses to establish correlations, and relationship effects among constructs under investigation. Additionally, using the PLS mechanisms of algorithm and bootstrapping to examine the moderating effects. Partial least squares (PLS) is now well-known as the alternative to SEM method – this includes AMOS, LISREL, and other programs [30].

## IV. FINDING

The purpose of this study is to investigate [26] the relationships among latent variables; therefore the latent analysis technique was the suitable option. Total of 406 surveys were complete and returned and additionally decidedly usable giving a reasonably worthy rate. In this way, the example scope of 406 for the review was remain adequate to execute different measurable assessments and give dependable yield with arrangement [31].

Table 1 summaries the characteristics of the 406 respondents in the sample from e-filing user samples of individual taxpayers in Malaysia. In total, from the 406 respondents, the respondents are 183 male respondents (45.07 percent) and 223 females (54.93 percent). The majority numbers of respondents were in an age group of 30-39 totalling 170 (41.87 percent). The lowest numbers of respondents were in an age group of 60 or above totalling 9 (2.22 percent). In a response to the question about how frequent one uses the internet, 95.07 percent of the respondents chose the option of everyday.

**Table 1: Profiles of respondent characteristics**

Profiles of E-filing User Samples		
Respondent Characteristics	Responses	Percent
<b>Gender:</b>		
Male	183	45.07

Female	223	54.93
<b>Total</b>	<b>406</b>	<b>100.00</b>
<b>Age:</b>		
29 years and below	106	26.11
30 – 39 years	170	41.87
40 – 49 years	93	22.91
50 – 59 years	28	6.89
60 years and above	9	2.22
<b>Total</b>	<b>406</b>	<b>100.00</b>
<b>Frequent Use of Internet:</b>		
Everyday	386	95.07
3 times a week	13	3.20
Once a week	5	1.23
Twice a month	1	0.25
Once a month	1	0.25
<b>Total</b>	<b>406</b>	<b>100.00</b>

This examination embraced internal consistency reliability [26]. This sort of unwavering quality is utilized to survey a scale whereby a few things are summed to frame an aggregate mark to be develop [31]. Subsequently, the interior reliability unwavering quality was legitimate correlation information of this review in the survey questionnaire [26]. The Survey questionnaire are in the pattern of a Likert scale.

To guarantee that the instrument created delivered exactly and precisely regarding estimations [26], Cronbach's coefficient alpha was chosen as a proper factual test for evaluating the dependability and legitimacy of the survey questionnaire. These results are reported in Table 2.

**Table 2: Cronbach's Alphas, rho\_A, Composite Reliability and Average Variance Extracted(AVE)**

Measurement Item	Item	Cronbach's Alpha	rho_A	Composite Reliability	(AVE)
Information Quality	8	0.888	0.901	0.912	0.571

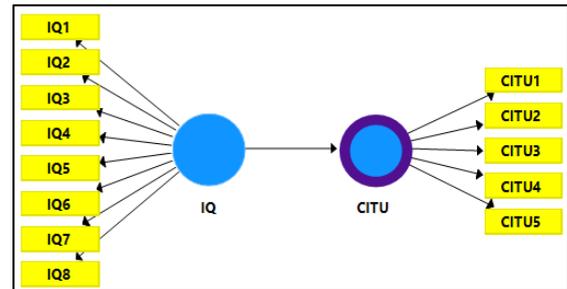
Discriminant validity evaluation has turned into a for the most part acknowledged essential for investigating connections between dormant factors. For difference based auxiliary condition demonstrating, for example, halfway slightest squares, the Fornell-Larcker paradigm and the examination of cross-loadings are the predominant methodologies for assessing discriminant legitimacy.

By method for a reenactment contemplate, we demonstrate that these methodologies don't dependably recognize the absence of discriminant legitimacy in like manner research circumstances. Therefore researcher propose an alternative approach, based on the multitrait-multimethod matrix, to assess discriminant validity: the Heterotrait-Monotrait ratio of correlations. These results are reported in Table 3.

**Table 3: Discriminant Validity: Heterotrait-Monotrait Ratio**

	Continuous Intention To Use	Information Quality
Continuous Intention To Use	1.000	
Information Quality	0.879	1.000

As illustrated in Figure 1, Information Quality (IQ) as a latent construct was measured by eight items comprising of IQ1 to IQ8. In addition, the endogenous variable is the continuous intention to use (CITU) e-filing. This was measured in five items (indicators).

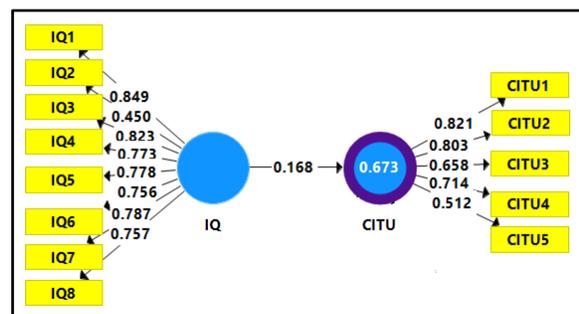


**Figure 1: The Establishment of the Constructs**

**Table 4: The Establishment of the Constructs**

Construct	Item	Loading	T Value	R Square	R Square Adjusted
Information Quality (IQ)	IQ1	0.849	49.712	0.673	0.668
	IQ2	0.450	9.413		
	IQ3	0.823	41.066		
	IQ4	0.773	34.289		
	IQ5	0.778	29.150		
	IQ6	0.756	26.570		
	IQ7	0.787	42.508		
	IQ8	0.757	24.636		

Once the goodness of the outer model has been confirmed (Table 4), the next stage was to test the hypothesized relationships among the variables. By running PLS Algorithm (Figure 2) and bootstrapping (Figure 3) using SmartPLS, the hypothesized model was tested.



**Figure 2: Path Model Result**

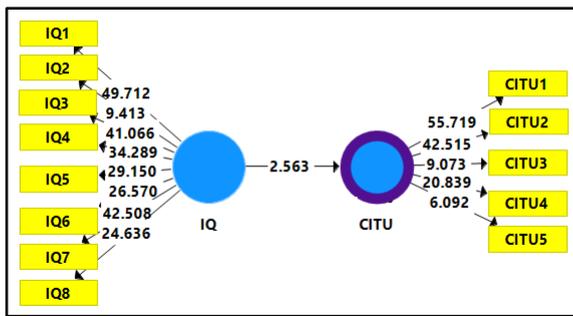


Figure 3: Path Model Significance Result

For the purpose of concluding whether the path coefficients are statistically significant or not, bootstrapping techniques embedded in this study with SmartPLS 3. As reported in Table 5, the T- Values with each path coefficient were generated using bootstrapping technique and P-Values subsequently were generated.

Table 5: Bootstrapping Result: Hypothesis Testing

Hypothesis	Relation-ship	Std. Beta	Std. Deviation (STDEV)	T Statistics	Decision
H	IQ -> CITU	0.168	0.066	2.563	Supported

The results showed that Information Quality (IQ) has significant effect on the continuous intention to use e-filing system ( $\beta = 0.168$ ,  $t^* = 2.563$ ,  $p < 0.05$ ). Therefore, the hypothesis of the effect of Information Quality (IQ) on continuous intention to use e-filing system was supported. From the PLS model, it has been exactly and hypothetically found that the best miserly model was accomplished with no changes [32]. The basic model was in this way acknowledged as the final model.

The finding proposed that information quality shows critical components that impact continuous intention to use e-filing system. What's more, it was found that information quality variables were imperative elements influencing to e-filing system adoption at a critical level of 0.05.

In this study, the aftereffects of hypotheses testing research address as real discoveries are presented. In this section, the research questions below can be answered by testing hypotheses.

**Research Question:** What is the relationship between Information Quality and continuous intention toward using e-filing system?

**Hypotheses:** There is a positive relationship between Information Quality and continuous intention toward using e-filing system.

## V. THEORY AND PRACTICES IMPLICATIONS

This study identifies an important determinant of information quality impact toward continuous intention of using tax e-filing system. From the results it was found that information precision, information timeliness and sufficiency or completeness of the important information characteristics were used to evaluate continuous intention of using tax e-filing system. The implication of the results indicates that information presented should be more precise and should cater to the citizen's needs, they should also provide information at the right time and information

should be sufficient for the citizen to complete the tax-related activities. According to Chen [33], information quality is the important characteristic of online tax web sites. Chen [33] measures information quality of tax web sites, focusing on accuracy, timeliness, and completeness of information presented in the web sites. To retain the current users, the tax authority needs to simplify the interface design to make the system easier to use. They should try to maintain easy design and functionality of the web site where citizens can get fast access to the information, get anywhere on the web site very easily and find the necessary information. They need to provide a well-organized web site that will help citizens to complete their tax related task with a minimal effort.

Along with the theoretical contributions, there are some practical implications of the research findings. It is important for the practitioner such as IRBM and other government organizations that are involved with the delivery of e-services, to be aware of the factors that contribute towards the future maintenance of the quality of the e-government services. The results can help IRBM to identify the key quality criteria for the e-filing web site that are valued by citizens, thus can improve its service delivery process. Additionally, IRBM can use the results to retain the current users and, along with that, they can use them to create new users. Both of these are important in making the service successful.

## VI. LIMITATIONS AND EXTENSIONS

Significance of any examination is to understand its impediments[34]. This study makes a commitment to the level of advancement appropriation writing, however despite the fact that this review has given pertinent and intriguing bits of knowledge into the continuous intention of using tax e-filing system, it is vital to perceive its restrictions. There are a few constraints that should be recognized. Information technology has changed quickly.

The first limitation of the current study is that it was not possible to collect individual online taxpayers' addresses from the tax authorities. Because of personal confidentiality concerns, the tax authority was unwilling to provide the addresses of online taxpayers. Walk-in taxpayers that were dealing at the IRBM's service counter at all branches within Malaysia who were experienced with the e-filing system were selected as a sample for the data collection. The external validity of the research results thus may be limited to Malaysia.

Another limitation lies in the fact that the items used to measure information quality were selected from different studies. These constructs were measured directly with items, and dimensions were not included in this study. In the empirical analysis, trace of multidimensionality was not found within the items treated in the model. However, there can be additional items used to measure the variables, and it is proposed that further research may be conducted including additional items to judge the dimensionality as well as possible extension of the model even further.

Within the present study, information quality criteria was proposed in the context of tax e-filing services, and tested in Malaysia. Further testing is proposed to test the applicability of the quality criteria in different

geographical locations and within their respective tax e-filing or similar comparable services.

## VII. CONCLUSION

This research explored an important area of e-government particularly in the online tax system. It focused on the Malaysian online tax system and evaluated Malaysian tax information-related web sites to find out the impact of information quality criteria on the continuous intention of using such web sites. A citizen survey was conducted to identify the impact of information quality criteria from a user's perspective. Results indicate that information preciseness, timeliness, and completeness were found to have an impact on the continuous intention of using government e-services.

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# The Effect of Picture Media and Learning Style on Social Study Learning Outcomes

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DOI: 10.29322/IJSRP.8.8.2018.p8051

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8051>

**Abstract:** *The purpose of this study is to determine the effect of picture media and learning styles on social study learning outcomes. The study was conducted in SDN 1 Sindangkasih with a sample of VA class students as many as 30 people as an experimental class and VB class as many as 30 people as a control class conducted in the academic year 2017/2018. This Research is using design treatment by level 2 x 2. Data analysis technique used two way analysis of variance (ANOVA) technique. The result of the research shows that (1) there are differences in social study learning outcomes between students learning to use serial picture media with students learning to use flipchart media; (2) there are differences in social study learning outcomes between students who have a tendency of visual learning style with students who have a tendency of auditorial learning style; (3) there is interaction between instructional media and student learning style to social study learning result; (4) student learning outcomes that have a tendency of visual learning styles that learn to use serial picture media higher than those learning to use flipchart media; (5) student learning outcomes that have a tendency of auditorial learning style that learn to use flipchart media higher than those who learn to use serial picture media.*

**Keywords:** *Serial Picture Media; Flipchart Media; Learning Styles; Social Study Learning Outcomes.*

## INTRODUCTION

Basic education is the first step for students to initiate the formal education process. The process of learning in basic education is very important, because the knowledge gained in basic education is a provision that can be used as the initial foundation to follow a higher level of education. One of the basic forms of education is elementary school.

Basically, the learning process conducted in elementary school is oriented to provide basic skills include reading ability, ability, writing, and numeracy skills. In addition, students are also taught to review a set of events, facts, concepts and generalizations related to social issues. It aims to make students able to become democratic Indonesian citizens, responsible, and become citizens who love peace (BSNP, 2006: 575). One means to study it is through the subjects of Social Sciences Social Study.

Defined by the National Council for Social Studies (NCSS), social studies are integrated study of the social sciences and humanities to promote civic competence. ...social studies provide coordinated, systematic study drawing upon such disciplines as

anthropology, economics, geography, law, history, philosophy, political humanities, mathematics and natural sciences (Seefeldt, et.al., 2014: 2).

That is, social studies are an integrated study of social science and humanities to promote citizenship competence. Social studies provide a coordinated and systematic study of disciplines such as anthropology, economics, geography, law, history, philosophy, political humanities, mathematics and Natural Sciences. "See the office of the office of citizen" and to integrate knowledge, skill, and attitude within and across disciplines (Seefeldt, et.al., 2014: 2). Skeel (in Sriyanto, 2016: 112) explains that social study aims to help develop self-concept well, how to be a part of global and multicultural society, and build knowledge about the past and the present as the basis for decision making. In addition, social study is designed to build and reflect students' skills in an ever-changing and evolving community life (Team Dosen Pengajar IPS, 2013: 6). Bounded on the social study goals that have been described, it can be seen how important to study the social study. Through social study subjects, students are taught about the history of how the state of Indonesia became

independent. It is intended that the students know the struggle of independence leaders in fighting for Indonesia to become an independent country. By knowing the history, students are expected to have a high patriotism, love of the homeland, and responsible as citizens of Indonesia.

But in fact, social study subjects less desirable by students. Most social study materials require memorization, so students are less interested. This is reinforced by the results of research conducted by Team Doesen social study in elementary schools in 2013 which showed some erroneous assumptions about social study, among others:

1. Social study lesson is a mere teaching lesson delivered by the teacher in a lecture and tell the story in front of the class. Thus the students will be bored and tired of learning social study.
2. In social studies can not use concrete tools that can be manipulated (tampered with) students, so they are passive in learning.
3. With social study lessons can not be used as benchmarks of students' intelligence, in contrast to the exact lessons such as science and mathematics.
4. Social study learning does not guarantee the future of the students unless the lessons are exact (2013: 7).

Referring to the above description, in general, social study learning in primary school is delivered by conventional (just conventional) course, and the lack of use of props or media that can attract students' attention. Submission by way of lecturing is not wrong, but teachers tend to rarely use media and props, so that will lead to the existence of verbalism. That is, explaining too much with words without concrete examples feared to misunderstand what is being said. Submission by way of lecture will also make passive students, because the more active role in the learning process is the teacher (teacher centered), so the interactivity between teachers with students only walk in one direction. Therefore, learning media have a very important role in conveying social study materials.

The use of media in learning is very important to note, because in any form of learning is needed the role of media to further improve the level of effectiveness of achievement goals/ competencies. This is supported by Gagne (in Datuarruan, 2016: 178) which states that the media "... can stimulate students to learn". In line with Gagne, Briggs (in

Indriana, 2011: 14) also argued that the media is a tool to provide incentives for learners to occur in the learning process.

Thus it can be said that with the media, students will be helped to learn better, as well as aroused to understand the subjects being taught in the form of communication delivery of messages more effective and efficient. The right media and in accordance with the purpose of learning will be able to improve the learning experience so that students can enhance learning outcomes. This is inline with the opinion put forward by Edgar Dale with the theory of "*Cone Experience*", which became the basis of media use in learning. Bruner (in Daryanto, 2013: 13) suggests that in the process of learning should use the sequence of learning by picture or film (iconic representation of experiment) and then to learn by symbol, that is using with words (symbolic representation).

The results of research conducted by Datuarruan (2016) with the title " Peranan Media Gambar IPS terhadap Hasil Belajar Siswa Kelas III SD Inpres Pedanda Kecamatan Pedongga Kabupaten Mamuju Utara " shows that the use of image media done in two cycles repeatedly can improve the learning result of social study.

Based on the results of these studies, it is known that the results of learning social study students have increased with the use of image media. In addition, the results of research conducted by Tsai *et. al* (2018) entitled "Learning Under Time Pressure: Learners Who Think Positively Achieve Superior Learning Outcomes from Creative Teaching Methods Using Picture Books" shows that the use of images positively affects the effectiveness of learning, both for teachers and for students. Furthermore, the research results Tomita (2018) with the title "Does the Visual Appeal of Instructional Media Affect Learners' Motivation Toward Learning?" Showed that the visual appeal of Instructional media not only the design but influences learners' self reported motivation to engage with the handout.

Based on the results of the above research, it is known that the image media can affect the effectiveness of learning. Therefore, the use of image media in learning is expected to affect student learning outcomes so that better.

The media used in this research is a series of image media for experimental class and flipchart media for control class.

According to Putra (2015: 233), the common drawing media series is called a flow chart. Arsyad (in Putra, 2015: 233) suggests that the series drawing is a series of events or stories presented in sequence. The drawing series will be difficult to understand when it stands independently and has not been sorted. Serial drawings will have meaning after they are sorted by specific patterns or in the order of a story (Putra, 2015: 6). Based on the definition of drawings that have been described series, can be explained that the drawing series is a series of images of activities or stories presented separately from one to another but has a unity sequence of stories and will have meaning if it has been arranged in sequence. at once. This refers to the Gestalt theory developed by Max Wertheimer, Kurt Koffka, and Wolfgang Kohler (in Hernawan et al., 2010: 47) with the experimental results that an object or event will give meaning if the individual is able to see the relationship between one element and the element the other in one whole. In addition, according to Darmadi (2017: 72) in general elementary school students still see everything as a whole (think holistic) and understand the relationship between concepts in a simple way.

According to Hernawan, et al. (2007: 131), flipchart media is an album or calendar-sized paper sheet measuring 50 × 75 cm or smaller size 21 × 28 cm as a flipbook, arranged in a sequence tied to the top. Flipchart media in this study is a collection of images of independence proclamation events are arranged to resemble an album or calendar. Unlike the series image media, the images on the flipchart media do not show the order of a story.

The results of research conducted by Nuswantoro (2013) with the title " Penggunaan Media Gambar Seri untuk Meningkatkan Kemampuan Menulis Karangan dengan Tema Lingkungan pada Siswa Kelas III SDN Krembangan Utara III/606 Surabaya " shows that the use of series drawing media can improve student learning outcomes on writing materials simple essay. In addition, the results of a study by Koc-Januchta *et al* (2017) entitled "Visualizers versus Verbalizers:

Effects of Cognitive Styles on Learning with Texts and Pictures-an Eye-Tracking Study" show that

visualizers 'and verbalizers' way of learning is active but mostly within the fields providing the source of information in line with their cognitive style (pictures or text). Verbalizers tended to enter non-informative, irrelevant areas of pictures sooner than visualizers. The comparison of learning outcomes shows that the group of verbalizers on a comprehension test.

Referring to the results of these studies, another thing that must be considered is the learning style of students.

Learning style is the process of how one absorbs and organizes and processes the information obtained. Pashler *et.al* (in Tulbure, 2012: 65) describes the learning style refers to the idea that there are many different types of instruction. Kamboj and Kumar (2015: 290) suggested that "understanding learning styles and the role of learning styles in the teaching / learning process is a key component in effective teaching. Teaching can not be successful without knowledge of learning styles". It can be said that understanding the learning style and the role of learning styles in the teaching and learning process is a key component of effective learning. Learning can not be successful without knowledge of learning styles.

Each student has a different learning style. May (2005: 3) states that "pupils may adopt different styles as they first explore and understand, and then rehearse and apply, each new concept". This means that students can use different learning styles in their first experience and understanding, and then train and apply them in other new concepts.

DePorter and Hernacki (2013: 112) reveal that there are three learning styles, namely Visual, Auditorial, and Kinesthetic (VAK). Visual learning style is more emphasis on the sense of sight in capturing information (Darmadi, 2009: 2). While the style of auditorial learning prioritizes the sense of hearing in menangkap information (Darmadi, 2009: 2). As with the kinesthetic learning style, this learning style prefers the sense of touch, or involves the limbs in capturing information (DePorter and Hernacki, 2013: 112). Students tend to have all three learning styles, but there is one learning style that is more dominant than others. In this study focuses on visual and auditorial learning styles.

Results of research conducted by Siwi and Yuhendri (2016) with the title "Analysis Characteristics of Learning Styles VAK (Visual, Auditory, Kinesthetic) Student of Banks and Financial Institutions Course" indicates that the characteristics suitable for students learning the visual is to motivate students to describe the information, by creating a diagram, symbol and color images in visual student records. While the results of research conducted Chen (2014) with the title "Differences Between Visual Style and Verbal Style Learners in Learning English" showed that:

LCR (Learning Content Representation) with pictorial annotation (Type A) help participants with lower verbal abilities and higher visual ability (Q2) to have better performance than other three quadrants, because type A participants feel it is easy to learn content presented in a visual form than in a verbal form. Providing LCR with both written and pictorial annotation (Type C) helps learners best with higher verbal abilities and higher visual abilities (Q1) in the recognition test. Providing redundancy learning content lead a higher cognitive load and result of Cognitive Load theory. It implies that providing simple learning materials (only written annotation, Type B) is useful to participants with lower verbal abilities and lower visual abilities (Q3). The research results show that instructors should provide suitable learning materials to their learners in accordance with their STM abilities.

Other research conducted by Khoeron *et. al* (2014) entitled "The Influence of Learning Styles on Student Learning Achievement in Productive Subjects" indicates that learning styles have a relationship to learning achievement and have a significant effect on learning achievement. Based on the problems and various research findings that have been presented, this research is intended to know the results of social study learning on the material proclamation of independence that can be influenced by the use of learning media and the tendency of learning styles held by students.

The learning outcomes referred to in this study are the results of social study learning on the material proclamation of independence. Indicators of learning outcomes social study students must achieve in this study refers to the cognitive dimensions according to Anderson and Krathwohl (in Krathwohl, 2002: 214) which is the development of Bloom's Taxonomy include: knowledge of the

terminology (states), knowledge of specific details and elements (understand), knowledge of classifications and categories (analyze), and knowledge of principles and generalizations (describe).

## RESEARCH METHODS

Method used in this study is the experimental method with the design *Treatment by level 2 X 2*. Experimental research methods can be interpreted as research methods used to find the effect of certain treatment against others in controlled conditions. This study contains three research variables, namely independent variables, dependent variables, and moderator variables. The independent variable in this research is the serial picture media. The dependent variable is the social study learning outcomes. The moderator variable is the learning style.

The experiments were conducted on two classes (experimental class and control class) with two groups of students in each class (groups of students who had a tendency of visual learning style and group of students who had a tendency of auditorial learning style). In the experimental class were treated using serial picture media and in the control class were treated by using flipchart media. The design description that will be used in this research is as follows.

Table 1  
Design Research  
*Design Treatment by Level 2 x 2*

Learning Style \ Instructional Media	Serial Picture Media (A <sub>1</sub> )	Flipchart Media (A <sub>2</sub> )
Visual (B <sub>1</sub> )	A <sub>1</sub> B <sub>1</sub>	A <sub>2</sub> B <sub>1</sub>
Auditorial (B <sub>2</sub> )	A <sub>1</sub> B <sub>2</sub>	A <sub>2</sub> B <sub>2</sub>

Sampling in this research using *random sampling technique*, that is a way or sampling technique from population by way of random or simple random. (Soewadji, 2012: 137).

The sample of this research is the students of Grade V of SD Negeri 1 Sindangkasih with the sample unit selected VA class as many as 30 students as the experimental class

given treatment using serial picture media, while the VB class as many as 30 students are selected as control class which learn to use flipchart media.

Furthermore, all students were asked to fill out the learning style questionnaire to find out the learning styles of each student. Then 33% of students who have visual learning style and 33% of students who have auditorial learning style. The calculation of 33% is taken from the total number of students in each class.

The data analysis in this research uses two way analysis of variance (ANOVA) technique, then Tuckey test if the test is done further. But beforehand, in order to test the hypothesis can be done, it is necessary to test the requirements analysis of the normality test and homogeneity test. Data obtained from research activities are processed to have meaning useful to answer the problems in research and to test the hypothesis.

## RESULTS AND DISCUSSION

Table 2

Variiances Analysis Summary Results The Interaction between Instructional Media and Learning Styles on Social Study Learning Outcomes

Source Variance	Db	JK	RJK	F <sub>count</sub>	F <sub>table</sub>
Shuttle Column	1	60,02	60,02	16,31	4,11
Interlinear	1	46,22	46,22	12,56	4,11
Interactions	1	148,23	148,23	40,27	4,11
In	36	132,50	3,68		
Total Reduced	39	386,97			

### 1. The differences of social study learning outcomes between groups of students learn by using serial picture media (A<sub>1</sub>) is higher than group of students who learn by using flipchart media (A<sub>2</sub>)

The result of variance analysis (anova) in table 1 obtained value of F<sub>count</sub> = 16,31 bigger than F<sub>table (0,05)</sub> = 4,11. Based on the results of the calculation then H<sub>0</sub> rejected, meaning there are differences of social study learning outcomes between students who learn to use the serial picture

media (A<sub>1</sub>) with students who learn to use flipchart media (A<sub>2</sub>). The mean score of the group of students who learn to use the serial picture media (A<sub>1</sub>) is  $\bar{X}_{A1} = 23$  and the students learning to use flipchart media (A<sub>2</sub>) is  $\bar{X}_{A2} = 20,55$ . Thus, it can be concluded that the average score of social study learning outcomes between groups of students learning to use the serial picture media (A<sub>1</sub>) is higher than the social study learning outcomes the group of students who learn to use flipchart media (A<sub>2</sub>).

### 2. The differences of social study learning outcomes between groups of students who have a tendency of visual learning style (B<sub>1</sub>) is higher than group of students who have tendency of auditorial learning style (B<sub>2</sub>)

The result of variance analysis (anova) in table 1 obtained F<sub>count</sub> = 12,56 bigger than F<sub>table (0,05)</sub> = 4,11. Based on the results of the calculation then H<sub>0</sub> rejected, meaning there are differences of social study learning outcomes between students who have a tendency visual learning style (B<sub>1</sub>) with students who have tendency auditorial learning style (B<sub>2</sub>). The mean score of the student group has a tendency of visual learning style (B<sub>1</sub>) is  $\bar{X}_{B1} = 22,85$  and the mean score the average group of students who have a tendency of auditorial learning style (B<sub>2</sub>) is  $\bar{X}_{B2} = 20,7$ . Thus, it can be concluded that the mean score of social study learning outcomes between groups of students who have a tendency of visual learning style (B<sub>1</sub>) is higher than group of students who have tendency of auditorial learning style (B<sub>2</sub>).

### 3. Interaction between instructional media and learning styles on social study learning outcomes

The results analysis of variance (anova) in table 1 obtained value of F<sub>count</sub> = 40,27 more than F<sub>table (0,05)</sub> = 4,11. Based on the results of these calculations then H<sub>0</sub> rejected, meaning there is a significant interaction between instructional media and learning styles on the social study learning outcomes. For more details can be seen in the picture below.

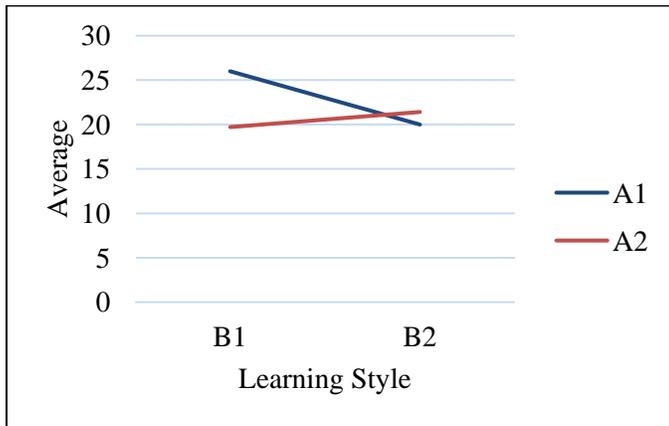


Figure 1

Graph of Interaction between Instructional Media and Style on Social Study Learning Outcomes

The interaction between instructional media and learning style on social study learning outcomes is required further testing. The advanced test used is the Tukey test, because the number of subjects in each group is the same.

**4. The differences of social study learning outcomes between student groups who learn to use serial picture media with students who learn to use flipchart media in groups of students who have a tendency of visual learning style.**

Testing the differences of social study learning outcomes of students who learn using serial picture media with students who learn to use media *flipchart* in groups of students who have a tendency of visual learning style done by using the Tukey test. Tukey test calculations show that  $Q_{count} = 10,384$  and  $Q_{table} = 2,228$ . Thus  $H_0$  is rejected, meaning that there are significant differences of social study learning outcomes between students who learn using serial picture media with students who learn to use flipchart media in groups of students who have a tendency of visual learning style.

The average value of students who learn to use serial picture media with a tendency of visual learning style is  $\bar{X}_{A1B1} = 26$  and the average value of students who learn using flipchart media with a tendency of visual learning style is  $\bar{X}_{A2B1} = 19,7$ . It show  $\bar{X}_{A1B1} > \bar{X}_{A2B1}$

The results of the calculations show that the social study learning outcomes in the group of students who learn to use the serial picture media is higher than group who learn to use flipchart media for groups of students who have a tendency of visual learning style.

**5. The differences of social study learning outcomes between groups of students who learn to use serial picture media with students who learn to use flipchart media in groups of students who have a tendency of auditorial learning style.**

Testing the differences of social study learning outcomes of students who learn using serial picture media with students who learn to use flipchart media in groups of students who have a tendency of auditorial learning style to be conducted by using the Tukey test. Tukey test calculation results show that  $Q_{count} = 2,308$  and  $Q_{table} = 2,228$ . Thus  $H_0$  is rejected, meaning that there are significant differences of social study learning outcomes between students who learn to use serial picture media with students who learn to use flipchart media in groups of students who have a tendency of auditorial learning style.

The average value of students who learn to use the serial picture media with a tendency of auditorial learning style is  $\bar{X}_{A1B2} = 20$  and the average value of students who learn to use flipchart media with a tendency of auditorial learning style is  $\bar{X}_{A2B2} = 21,4$ . It show  $\bar{X}_{A2B2} > \bar{X}_{A1B2}$ .

The results show that social study learning outcomes in groups of students learning to use flipchart media are higher than group who learn to use serial picture media for groups of students who have a tendency of auditorial learning style.

**CONCLUSION**

Based on the results of research and discussion of the effect of instructional media and learning styles on social study learning outcomes in the material proclamation of independence in the class VA and VB in SDN 1 Sindangkasih District Ciamis obtained the conclusion that:

1. Social study learning outcomes in groups of students who learn using serial picture media more higher than groups of students who learn using flipchart media;
2. Social study learning outcomes in the group of students who have a tendency of visual learning style is higher than groups of students who have a tendency of auditorial learning style;
3. There is an interaction between instructional media and learning styles on social study learning outcomes;

4. Social study learning outcomes in the group of students who have a tendency of visual learning styles that learn using serial picture media is higher than group of students who have the tendency of visual learning styles that learn to use flipchart media;
5. Social study learning outcomes in the group of students who have a tendency of auditorial learning styles that learn using flipchart media is higher than group of students who have the tendency of auditorial learning styles that learn to use serial picture media.

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# The Effect of Concept-Rich Instruction on the Ability of Mathematical Study School Students Under reviewed from Math Anxiety

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DOI: 10.29322/IJSRP.8.8.2018.p8052

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8052>

**Abstract :** *purpose of this study is to determine the effect of learning approach Concept-Rich Instruction to the ability of mathematical understanding in terms of math anxiety of elementary school students. The study was conducted in SD Negeri 1 Sindang kasih with a sample of third-grade students A and III B 45 people an experimental class and class III C and III D with a sample of 45 students as a control class conducted in the academic year 2017/2018. Research using treatment by level 2 x 2. Data analysis technique is a two-lane variance analysis (ANOVA). The result of the research shows that (1) there is a difference in students' mathematical understanding ability which learn by using concept-rich instruction approach with students using conventional learning approach; (2) there is an interaction between learning approach and math anxiety to the ability of mathematical understanding; (3) students' mathematical comprehension ability with low math anxiety level learning using approaches concept-rich instruction is higher than that of learning using conventional learning approach; (4) the mathematical understanding of students with high levels of math anxiety who learn to use the learning approach concept-rich instruction is lower than those learning using conventional learning approaches.*

**Keywords:** *learning approach, concept-rich instruction, mathematical understanding ability, math, math anxiety.*

## INTRODUCTION

Mathematics is one of the most important disciplines in human life. Freudenthal in Alfiah reveals "*Mathematic is a human activity*" (Alfiah, 2014, pp. 418). Various activities in everyday life require the process of thinking mathematically. In line with that Valsa C Paul Ernest and Roy Casey stated: *What is mathematics? Mathematics includes the learning of facts, skill and concept, the building of conceptual structure, and the development of the mathematics of the mathematics.* (Sumantri, 2012, p.44) Learning mathematics contains an important element that must be mastered is the "mathematical concept". The concept of mathematics is an abstract idea that can be used to classify or classify a set of objects. "*Mathematics is a logically organized conceptual system*" (Godino, 1996, p.3). Therefore, the concept of mathematics can be said as the initial foundation in building students' mathematical abilities.

The idea of constructivism holds that learning is an active activity to form a knowledge. Immanuel Kant argues that the mind is an active organ and the teacher is responsible for providing learning experiences to students in building concepts that can determine the success of learning on an ongoing basis (Benhur, 2006, pp. V). Learning activities are described as an active process undertaken by students in organizing, constructing, and reconstructing concepts based on learning experiences. Meanwhile, students' mathematics learning outcomes are influenced by several factors such as students' attitudes toward math and learning environment (Sumantri and Puspita, 2014, p.8). Thus, it is clear that mastery of mathematical concepts can not be obtained if the learning activities are limited to the transfer of subject matter from teacher to student.

A learned concept is not merely memorizing but comes to a thorough and profound understanding. Understanding mathematical concepts is directly related to students' mathematical abilities. *Conceptual understanding is an important component of proficiency* (NCTM, 2000, p. 20). Conceptual understanding is an important component needed to improve mathematical ability. One of the objectives of learning mathematics in elementary schools listed in the curriculum is that students understand the concepts of mathematics, explain the interconnection between concepts, and apply the concept or algorithm in a flexible, accurate, efficient, and appropriate in solving problems (BSNP, 2006, p.148) . The demands of the curriculum must be poured in the learning process that can facilitate students in achieving that goal. Achievement of the objectives of mathematics learning is the responsibility of the teacher as the implementer of the curriculum. Standard processes mathematics education according to the *National Council of Teachers of Mathematics* (NCTM), namely: solving problems (*problem solving*), reasoning and evidence (*reasoning and proof*), communication (*communication*), connections (*connections*), and representation (*representations*) (NCTM, 2000, p.29). Holmes states that problem solving is the *heart of mathematics* or the heart of mathematics (Zainuri, 2016, p .394). This is because in the course of problem solving mathematics knowledge needed about mathematics, problem solving strategies, and effective self-monitoring, and productive attitude in addressing and solving a problem. Mathematical problem solving can be mastered if students have a mathematical understanding of a learning material thoroughly and profoundly. Some

studies by international institutions show that Indonesian students' math skills are still low compared to other countries. One of them is the result of the *Program for International Student Assessment 2015(PISA)* initiated by the *Organization for Economic Cooperation and Development (OECD)*, Indonesia received a score in the 396 math literacy category and was ranked 63 out of 70 countries (OECD, 2015, pp .5). This is in line with the results of a study by *Trends in International Mathematics and Science Study (TIMSS)* initiated by *The International for The Evaluation of Education Achievement (IEA)* in 2015, indicating that Indonesia's score in Mathematics is 397 of the average international level of 500. The overall Indonesian math score is ranked 44th out of 49 countries (Mullis, 2015, p.14). Therefore, the development of mathematical competence of students need to be improved one of them using the appropriate learning approach with regard to the characteristics of students.

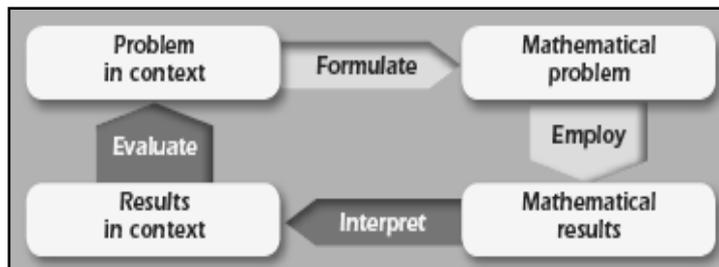


Figure 1.1  
*PISA's Model of Mathematical Literacy in Practice*

*Mathematical literacy* examined by PISA promotes the ability of mathematical understanding that is oriented to the context of the problems of everyday life. Based on the analysis of the results of studies that have been done by PISA, one of the factors of low mathematical ability of students is due to Indonesian students are not accustomed to facing the questions of open questions that are contextual in everyday life. It becomes a challenge for teachers to develop mathematical understanding skills and present contextual math problems in everyday life.

The ability of mathematical understanding is one of the most important things teachers need to consider in determining the learning objectives. Mathematical understanding becomes the basis for students in solving various mathematical problems because students will be able to link and solve mathematical problems through conceptual understanding and procedural understanding that has been owned. In addition, the ability of mathematical understanding also becomes very important in improving various other mathematical abilities such as mathematical connection ability, mathematical communication ability and mathematical reasoning ability.

The principle in learning implies that learning with understanding is a very important thing that can ensure students overcome the problems it faces. In understanding not only understand an information but also includes objectivity, attitudes, meaning contained from an information. In other words a student can change the information that is in his mind into another form that is more meaningful. The understanding stage is more complex than the knowledge stage.

Understanding means building meaning from learning messages. *Determining the meaning of instructional messages, including oral, written, and graphic communication* (Krathwohl, 2002, p.215). The cognitive process of understanding dimensions in Bloom's taxonomic revision includes the following processes.

- a. *Interpreting* (Interpreting)  
Interpret that change from one form to another form or from one representation to another representation.
- b. *Exemplifying* (Exemplifying)  
Exemplifying that is, finding a specific example or illustration of a concept or principle.
- c. *Classifying* (Classify)  
Classify is to define something that belongs to a category or specify that an instance belongs to a concept category or not.
- d. *Summarizing* (Generalizing or Summarizing)  
Summarizing or generalizing is the abstracting of common themes or main points or making statements that represent some of the information presented.
- e. *Inferring* (Inferring or Concluding)  
Concluding is the representation of the logical conclusion of the information presented or determining the pattern or understanding of some examples.
- f. *Comparing* (Compare)  
Compares is looking for a relationship between two ideas, objects or similar things. Determine the similarities and differences between two or more objects.
- g. *Explaining* (Explain)  
Explain that construct causal models of a system or build and use the causality of a concept (Kristiono, 2016, hlm.2).

The results of research conducted by Krista Meier in 2015 with the title *"Overcoming Math Anxiety: How Does Teaching Math Conceptually Impact Students Learning Math?"* Shows that *math anxiety* is related to the ability of mathematical conceptual understanding that affects the way students learn mathematics (Meier, 2015) . In addition, another research conducted by Ramirez under the title *"On The Relationship Between Math Anxiety and Math Achievement in Early Elementary Schools: The Role of Problem Solving Strategies"* shows that mathematics achievement in lower grade primary schools is related to *math anxiety* held

by students (Ramirez, 2016).

Anxiety comes from an anxious base word that means no peace or anxiety for fear or fear of something. In line with that, Page and Thomas argued that "*Anxiety can be defined as a complex emotional response, often unconscious in origin, with fear or dread as its most notable characteristic*" (Haylock, 2007, p. 17). Anxiety is defined as a complex emotional response, often unconscious with fear as a characteristic characteristic of anxiety. This definition illustrates that anxiety as an emotional response that can inhibit the ability of individuals in optimizing their potential.

Anxiety can occur in any situation and condition, one of them in the learning activities of mathematics. Math anxiety is commonly referred to as *math anxiety*. Perry reveals that mathematical anxiety can be experienced by students at various levels of education, but it usually begins in elementary education (Sevey, 2012, p. 4). "*Math anxiety is a person's negative affective reaction to situations involving numbers, maths, and mathematics calculations.*" (Ascharft & Moore, 2009, p.197) Mathematical anxiety is related to the affective response of a person in the form of fear or anxiety when dealing with and resolving issues related to numbers, mathematical symbols, or mathematical calculations.

*Math anxiety* is an emotional response of tense or fearful feelings to a mathematics lesson that affects a person's life in various conditions with respect to mathematics. Freedman defines mathematical anxiety as "*an emotional reaction to mathematics based on past experience that arms future learning.*" So mathematical anxiety is an emotional reaction of students based on previous unpleasant experiences, which interfere with further learning. Hercraft and Kirk argue that anxiety about mathematics exacerbates performance in two ways. First, it leads to avoidance, which leads to downward competence. Secondly, it inhibits temporary work of memory capacity, possibly by failure to inhibit attention when the mind is disrupted (Haylock, 2007, p.17). They argue that the findings they may explain why the most effective intervention for mathematical anxiety is cognitive-behavioral people. So teachers should help students want to learn to manage the anxiety itself. In addition, Cavanagh and Sparrow divide the indicator *math anxiety* into 3 domains including, *attitudinal indicators*, *cognitive indicators*, and *somatic indicators*. The following is an overview of the indicator *math anxiety* on each domain.

*Math anxiety* needs to be minimized through learning activities in accordance with students' mathematical competence. This is in line with the results of research done by Sevey in 2012 with the title *Mathematics Anxiety, Working Memory, and Mathematics Performance: Effectiveness of a Working Memory Intervention on Reducing Mathematics Anxiety*. Based on the result of this research, it can be concluded that *math anxiety* can be reduced through intervention of strengthening *working memory* in students. Strengthening *working memory* one of which can be done by doing learning that focuses on the reinforcement of conceptual mathematics. A learning approach that focuses on the cultivation of comprehensive and profound mathematical concepts is the approach *concept-rich instruction*.

*Concept-Rich Instruction* (CRI) is a learning approach that takes into account conceptual, cognitive, and metacognitive thinking in learning as well as in the process of mathematical thinking (Benhur, 2006, p.vii). *Concept-rich instruction* is a mathematical learning approach based on constructivist understanding, meaningful learning theory, and problem-solving approach. The purpose of the use of this learning approach is that students can understand a comprehensive and thorough mathematical concept.

The learning process using the approach *concept-rich instruction* includes five components: *practice*, *decontextualization*, *meaning generalization*, *recontextualization* and *realization*. These five components are simultaneously carried out in an effort to instill a comprehension of the concept thoroughly and profoundly.

Relevant research related to the use of *concept-rich instruction* has been done by Rochyani under the heading "Increasing Strategic Competence, Adaptive Reasoning, and Student's Productive Disposition Through *Concept-Rich Instruction*". The results of this study indicate an increase in strategic competence, adaptive reasoning, and productive disposition by using the learning approach *concept-rich instruction*.

Based on the problems and the findings of this research, this research is intended to know the ability of mathematical understanding which can be influenced by the use of learning approach in *concept-rich instruction* terms of differences in *math anxiety* owned by students. Thus, the title raised in this study is "The Influence of *Concept-Rich Instruction* to the Traffic of Mathematical Understanding in terms of *Math Anxiety*".

## METHOD

Method used in this research is the experimental method with the design *Treatment by level 2 X 2*. Experimental research methods can be interpreted as research methods used to find the effect of certain treatment against others in controlled conditions. This study contains three research variables, namely independent variables, dependent variables, and moderator variables. The independent variable in this research is *concept-rich instruction*. The dependent variable is the ability of mathematical understanding (*mathematical understanding skill*). The moderator variable is mathematical anxiety (*math anxiety*).

This study uses two types of learning approach. Experiments were conducted on two groups of students that groups of *math anxiety* low and group. *anxiety math* high Students are treated with the use of *concept-rich instruction* learning approach and conventional learning approach The design description to be used in this research is as follows.

Table 3.1  
Design Research  
*Design Treatment by Level 2x2*

approach to <i>Math Anxiety</i>	Approach <i>Concept-Rich Instruction</i> (A1)	approaches conventional (A2)
Low (B1)	(A <sub>1</sub> B1)	(A <sub>2</sub> B1)
Height (B2)	(A <sub>1</sub> B <sub>2</sub> )	(A <sub>2</sub> B <sub>2</sub> )

Sugiyono (2010: 215) suggests that the sample is part of the population. Sampling technique in this study using *simple random sampling* according to Soewadji (2012: 137) is a way or sampling technique from the population in a random or simple random. The sample of this research is the third grade students of SD Negeri 1 Sindangkasih with the sample units selected class III A and III B as experimental class which will be given treatment by using approach *concept-rich instruction* as many as 45 students, while class III C and III D is chosen as control class who learn to use approach of learning as many as 45 students.

Furthermore, using questionnaire *math anxiety*, all students measured the *math anxiety* they had with 33% of the scores *math anxiety* lowest entered into the group *math anxiety* low and 33% of the scores *math anxiety* highest entered the group *math anxiety* high. Data analysis in this research used two way analysis of variance (ANOVA) with *design treatment by level 2x2*. But beforehand, in order to test the hypothesis can be done, it is necessary to test the requirements analysis of the normality test and homogeneity test. Data obtained from research activities are processed to have meaning useful to answer the problems in research and to test the hypothesis.

### RESULT AND DISCUSSION

#### 1. Differences in the ability of mathematical understanding between groups of students learning with the approach to learning *Concept-Rich Instruction* (A<sub>1</sub>) are higher than the students' mathematical comprehension ability of the students learning with the conventional approach (A<sub>2</sub>).

Result of analysis of variance (anova) in table 4.9 obtained value of  $F_{arithmetic} = 13,68$  more than  $F_{table (0,05)} = 4,11$ . Based on the results of the calculation then  $H_0$  rejected, it means there are differences in the ability of mathematical understanding of elementary school students who study with the approach of learning *Concept-Rich Instruction* (A<sub>1</sub>) and students learning with conventional learning approach (A<sub>2</sub>). Adapun the average value of the group of students who are learning with the approach of learning *Concept-Rich Instruction* (A<sub>1</sub>) and the average the average group of students studying with a conventional learning approach (A<sub>2</sub>) are  $X_{A1} = 30$  and  $X_{A1} = 27.4$ . Thus, it can be concluded that the mean value of the mathematical understanding ability between the learning group and the approach *Concept-Rich Instruction* (A<sub>1</sub>) is higher than the mathematical ability of a group of students learning with the conventional approach (A<sub>2</sub>).

#### 2. The influence of interaction between learning approach and *math anxiety* toward students' mathematical understanding.

The result of analysis of variance (anova) in table 4.9 obtained value of  $F_{count} = 46,61$  more than  $F_{table (0,05)} = 4,11$ . Based on the results of the calculation then  $H_0$  rejected, meaning there is a significant interaction between the learning approach with *math anxiety* to students' mathematical understanding ability. The existence of interaction between learning approach used with *math anxiety* of elementary school student hence required further test. The advanced test used is the Tukey test because the number of subjects in each group is the same. Through Tukey test can be expressed the influence of interaction between the use of learning approach and *math anxiety* of elementary school students. This can be seen from the following graph.

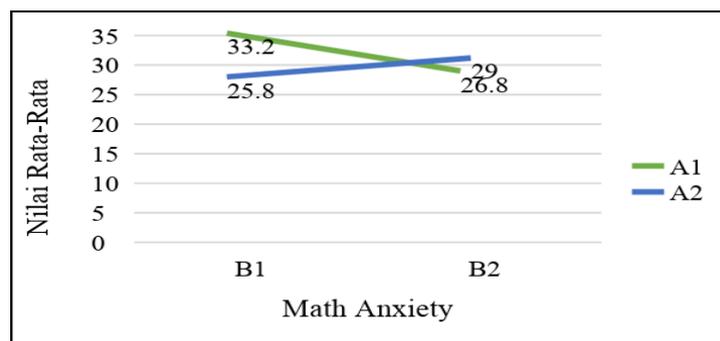


Figure 4.6

Interaction Chart between the Learning Approach and *Math Anxiety* to Student Mathematical Understanding Ability  
 Description:

- A1 : *Concept-Rich Instruction*
- A2 Approach: Conventional Learning Approach
- B1 : *Math Anxiety* Low

B2 : *Math Anxiety High*

**3. Differences in the ability of mathematical understanding between students learning using approach *concept-Rich instruction* with students learning to use conventional learning in groups of students with *math anxiety low*.**

Testing of differences in mathematical understanding of elementary school students learning with *Concept-Rich Instruction* learning approaches with students learning with Conventional learning approaches in groups of students with *anxiety math* was low conducted using the Tukey test. Tukey test calculation results show that  $Q_{\text{count}} = 10.525$  and  $Q_{\text{table}} = 2.228$ . Therefore,  $H_0$  rejected means that there is a significant difference in the ability of mathematical understanding of students learning with *Concept-Rich Instruction* learning approaches with students learning with Conventional learning approaches in groups of students with *anxiety math* low.

The average score of students learning with *Concept-Rich Instruction* learning approach with students learning with Conventional learning approach in groups of students who have *anxiety math* low is  $X_{A_1B_1} = 33.2$  and  $X_{A_2B_1} = 25.8$  or  $X_{A_1B_1} > X_{A_2B_1}$ . The results of these calculations show that the ability of students' mathematical understanding between groups of students who are studying with learning approach *concept-rich instruction* which has a *math anxiety* low is higher than the ability of mathematical understanding of students learning with conventional learning approaches which have *math high anxiety*.

**4. Differences in the ability of mathematical understanding between students learning using approach *concept-rich instruction* with students learning to use conventional learning in groups of students with *anxiety math high*.**

Testing of differences in mathematical understanding of elementary school students learning with *Concept-Rich Instruction* learning approaches with students learning with Conventional learning approaches in groups of students with *anxiety math* was high conducted using Tukey test. Result of Tukey test calculation show that  $Q_{\text{count}} = 3,185$  and  $Q_{\text{table}} = 2,228$ . Therefore,  $H_0$  rejected means that there is a significant difference in the ability of mathematical understanding of students learning with *Concept-Rich Instruction* learning approach with students learning with Conventional learning approach in groups of students who have *anxiety math* high.

The average value of students who study with the approach of learning *Concept-Rich Instruction* than students who learn with the approach of Conventional learning in groups of students who have *anxiety math* high namely  $X_{A_2B_2} = 29$  and  $X_{A_1B_2} = 26.8$  or  $X_{A_2B_2} > X_{A_1B_2}$ . The results of these calculations show that the ability of students' mathematical understanding between groups of students who are studying with learning approach *concept-rich instruction* which has *math anxiety* high is lower than the ability of mathematical understanding of students learning with conventional learning approaches that have *math low anxiety*.

DISCUSSION

**1. Differences in the ability of mathematical understanding between groups of students learning with learning approaches *Concept-Rich Instruction* ( $A_1$ ) are higher than the students' mathematical understanding of students learning with conventional approaches ( $A_2$ ).**

Students who use problem based learning model show activity in learning process. Students show interactive and communicative behaviors among students one at another in the process of problem solving. This is in accordance with what Muiz expressed (2017, p.5) that through PBL learning, students have the ability to communicate scientifically in their discussions or presentations of work.

**1) Interaction between learning model and learning metacognition students to the ability to solve mathematical problems. (INT AXB)**

The application of model *Problem Based Learning* has an effect on improving math problem solving ability. Through the model of *Problem Based Learning* in the learning process to make students learn actively, interactive and communicative kratif.

Students with high learning metacognition exhibit interactive learning activities, better manage and solve problems and demonstrate a more critically active and well-controlled mindset when dealing with problems. Furthermore, students who have high metacognition in PBL learning process can control the learning activities and be able to understand the problem accompanied by problem-solving strategies. In contrast, students who have low learning metacognition show difficulties in controlling learning activities and difficulties in understanding and solving problems encountered.

**2) Differences in mathematical problem-solving abilities between students learning to use the model *Problem Based Learning* with students learning to use expository methods in groups of students with high learning metacognition.**

PBLs can encourage students to have problem-solving skills in real-life situations, their ability to build knowledge through learning activities, scientific activities in students through group work and have the ability to communicate scientifically in discussions or presentations of their work. Students with high metacognition can more quickly take action in each learning activity because it has a prior preparation, whereas in students with high metacognition through expository methods less able to regulate learning activities due to the activities regulated by the teacher.

Metacognition of students with the application of expository method can only show interaction through question and answer process only without any learning strategy which gives the students opportunity to be more active in the process of solving mathematical problems. Basically the application of expository methods is only done by the teacher without giving full opportunities to the students to find their own solution to solving mathematical problems. Furthermore, with high metacognition through PBL learning model, students are able to understand problems quickly, able to analyze problems, use fast and appropriate

strategies in the problem solving process, make quick decisions, always reflect on the answers, show problem solving skills either with the use of strategy problem solving over and over, and can conclude the solution of the existing problem.

### 3) Different mathematical problem-solving abilities between students learning to use the model *Problem Based Learning* with students learning to use expository methods in groups of students with low learning metacognition.

Mathematics learning activities conducted with PBL learning model is a learning with student-centered activities through group stages in solving contextual problems in learning controls are fully student-centered learning. While expository learning is learning with verbal activity that is implemented by the teacher to the students through lecturing strategy and assignment, which means the control of the learner becomes the task of the teacher completely, so that students with low metacognition can control the learning activities better. As the characteristics of Trineke (in Setyadi, Subanji and Muksar, 2016, p.2) to students with low metacognition, showing inadequacy in problem solving, lack of understanding of the context of the problem, difficulty in determining steps and problem-solving strategies, and not taking action reflection in determining the answers so that teachers need guidance and direction in doing problem solving math. On the other hand, through PBL learning model with low metacognition, it is less able to step the problem strategy by itself by doing self reflection action on problem solving.

## CONCLUSION

This research uses experimental method involving independent variable, that is model *problem based learning*, expository method and metacognition study, while as dependent variable is the ability of problem solving of mathematics students of District 1 Elementary School Cieurih Cipaku.

Based on the results of data analysis, the results of hypothesis testing and the results of research discussions that have been obtained are explained some conclusions as follows:

1. model *Problem-based learning* has a higher value influence from expository methods to the ability of solving mathematical problems.
2. There is an interaction between learning models and learning metacognition on mathematical problem-solving abilities.
3. Students who have high learning metacognition, mathematical problem solving skills between groups of students who taught the model *problem based learning* is higher than the group of students who were taught using expository methods.
4. Students who have low learning metacognition, mathematical problem-solving skills between groups of students taught using models *problem-based learning* are lower than in the group of students taught using the expository method.

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# The Distribution of Posterior Segment Abnormalities in Sufferers of Moderate and Severe Myopia at Sumatera Utara University Hospital and Network Hospital in Medan

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DOI: 10.29322/IJSRP.8.8.2018.p8053

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8053>

**Background:** Abnormalities in the posterior segment of the eyeball affect the vision of the patient with myopia. Posterior segmental abnormalities in myopia may affect peripheral (peripheral degeneration) and posterior pole (posterior pole degeneration).

**Methods:** The observational analytic study was conducted at Eye Clinic of Sumatera Utara University Hospital and network Hospital. The subjects of the study were moderate and severe myopia patients who fulfilled the inclusion criteria with a total of 32 subjects or 64 eyes.

**Results:** Distribution of posterior segment abnormalities in moderate myopia seen more found Tigroid fundus image on the left eye as much as 16 eyes (51.6%), and the right eye as much as 15 eyes (48.4%), while the image of myopic crescent + tigroid fundus found only 1 eyes in the left eye. Severe myopia found tigroid fundus on the right eye as much as 8 eyes (57.1%) and the left eye of 6 eyes (42.9%), while the image of myopic crescent + tigroid fundus found in the right eye and the left eye respectively as many as nine eyes (50.0%). Posterior segment abnormalities are 31 (68,9%) tigroid fundus, while severe myopia is 14 (31,1%), posterior segment abnormalities are Tigroid fundus + Myopic crescent of moderate myopia 1 (5,3%) while in severe myopia as many as 18 (94.7%).

**Conclusion:** There is correlation between posterior segment abnormalities distribution with moderate and severe degree of myopia.

**Keywords:** posterior pole, moderate myopia, severe myopia

## I. INTRODUCTION

Myopia is one of the public health problem and the most common eye disorder in the world. Myopia is one of the most common causes of low vision in the world even leading to blindness. Causes of low vision and blindness is one of them because of the posterior eye segment of the eyeball that occurs in the peripheral retina and posterior pole. This problem if not resolved properly will lead to permanent loss of vision. The World Health Organization (WHO) is introducing a global initiative to eliminate blindness by 2020, known as "Vision 2020". Five priority conditions are cataract, trachoma, onchocerciasis, childhood blindness and refractive abnormalities. Refractive disorder is one of the five priority areas for vision 2020 chosen because refractive error are a very common and correction of spectacles are cheap treatment, effective, and provide functional improvement.<sup>1,2,3</sup>

The prevalence of refractive disorder in Indonesia are in first position eye disease and found amount of people with refractive disorder in Indonesia almost 25% of the population or about 55 million people. The greater prevalence of myopia is found in Asian races, Jews and Arabian. This problem are unknown cause, it is thought to be influenced by genetics and the environment. The

incidence of myopia in the United States is 25% of the population, while 1% of the Japanese population (about 1.25 million are pathological myopia patients). Research conducted in Beijing on 4,409 individuals aged 40 years and older shows that myopia is the second most common cause of low vision and blindness.<sup>4,5</sup>

Myopia patients should get attention so as not to fall into the stage of low vision or blindness. Abnormalities in the posterior segment of the eyeball have a tremendous impact on the vision of the patient with myopia. Posterior segmental abnormalities in myopia may affect peripheral (peripheral degeneration) and posterior pole (posterior pole degeneration). This peripheral and posterior pole degeneration may cause myopia patients to become low vision or even blind, but this is still poorly understood by patients with myopia and some medical personnel, resulting in many incidents of myopia who come to the hospital with some complications caused by the degeneration process which occurs in the peripheral and in the posterior pole, therefore it is important to check on the posterior segment to determine abnormalities in the posterior segment that includes the peripheral and posterior pole so that immediate precautions can be taken so that complications that will bring the patient fell into low vision and blindness does not happen.

Research on the degree of myopia that includes moderate and high myopia with posterior segment abnormalities in the world this research still rarely done and data on the spread of posterior segment abnormalities in varying degrees of myopia in hospital of USU and networking hospital Medan are still missing. This research is expected to provide data on the spread of the degree of myopia with the posterior eye segment of the eyeball at USU hospital and networking hospital Medan.

## II. METHOD

This was an analytic observational study conducted cross-sectionally in patients with moderate and high myopia at Eye Clinic at USU Hospital and networking hospital Medan. from April to May 2018, age of study sample is  $\geq 18$  years and meeting inclusion criteria (signed an informed consent, the magnitude of refractive abnormalities used in this study were patients with myopia with moderate degree of myopia ( $> 3.00$  Diopters to  $6.00$  Diopters) and severe ( $> 6.00$  Diopters) and exclusion criteria from this study are Myopia patients with cloudy optical media, with history of cataract surgery, with a history of retinal detachment surgery, with history of LASIK (Laser Assisted Insitu Keratomileusis), with abnormal retinal disorders outside myopia, for example AMD (age related macular degeneration), retinitis pigmentosa, posterior inflammation of the posterior segments of both active and inactive inflammation.

## III. RESULT

This research is descriptive observational conducted in eye clinic of outpatient installation of USU hospital and networking hospital Medan from April to May 2018. This research was followed by sufferer of moderate and severe myopia who fulfill inclusion criteria with total of research subject counted 32 people or counted 64 eyes. Based on research subjects can be obtained data shown in tabulation form.

**Table 1.1. Characteristics of Age with varying degrees of myopia**

Characteristics	n	%
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10-20 y.o	10	31.3
21-30 y.o	22	68.8
>30 y.o	2	6.3
<b>Total</b>	<b>32</b>	<b>100.0</b>

In table 1.1. The above shows that the most age distribution of the data of this study is the age group of 21-30 years as many as 22 people (68.8%) and at least in the age group > 30 years as many as 2 people (6.3%).

**Table 1.2. Characteristics of Sex with varying degrees of myopia**

Characteristics	N	%
Man	10	31.3
Women	22	68.8
<b>Total</b>	<b>32</b>	<b>100.0</b>

From table 1.2. It is shown that the sex characteristics of the respondents' data were mostly 22 women (68.8%) and men (10,3%).

**Table 1.3. Characteristics Family history with varying degrees of myopia**

Characteristics	n	%
Hereditary	24	75.0
Not hereditary	8	25.0

Total	32	100.0
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From table 1.3. it can be seen that family history characteristic from respondent data of most research have family history of myopia as many as 24 people (75.0%) compared with those without family history of 8 families (25.0%).

**Table 1.4. Intraoculi Pressure Characteristics with varying degrees of myopia in the right eye**

Degrees of myopia	Intraoculi pressure		<i>p</i>
	N	$\bar{x} \pm SD$	
Moderate myopia	15	15.64 ± 1.778	0.975
Severe myopia	17	16.44 ± 1.738	

\*chi-square test, significant < 0.05

From table 1.4. Above seen by using independent t-test found no difference between intraocular moderate pressure of moderate myopia with severe myopia myraloid pressure in the right eye (p = 0.975).

**Table 1.5. Intraoculi Pressure Characteristics with varying degrees of myopia in the left eye**

Degrees of myopia	N	$\bar{x} \pm SD$	<i>p</i>
Moderate myopia	17	16.84 ± 2.052	0.554
Severe myopia	15	16.45 ± 1.69	

\*t-test, significant < 0.05

From table 1.5. Above seen by using independent t-test found no difference between intraoculi pressure moderate myopia with severe myopia pressure in the left eye ( $p = 0.554$ ).

**Table 2. DIFFERENT DISTRIBUTION DEGREE OF MODERATE AND SEVERE MYOPIA**

**Table 2.1. Differences in the degree distribution of myopia between the right eye (OD) and left eye (OS)**

Degrees of myopia	Eyes				Total		p.
	OD		OS		n	%	
	N	%	N	%			
- Moderate myopia	15	46.9	17	53.1	32	100.0	0.617
- Severe myopia	17	53.1	15	46.9	32	100.0	

\*chi-square test, significant < 0.05

The distribution between the right eye and the left eye is shown in Table 2.1. in which severe myopia is found in the right eye of 17 eyes (53.1%) and in moderate myopia is also seen more frequently in the left eye as much as 17 eyes (53.1%). The results of the statistical test explain that there is no difference of moderate and severe median distribution between right eye and left eye, ( $p = 0.617$ ).

**Table 2.2. Posterior segment abnormalities in moderate and severe myopia**

Degrees of myopia	Posterior segment abnormalities	Eyes				Total		P
		OD		OS		N	%	
		N	%	n	%			
Moderate myopia <sup>a)</sup>								
	- <i>Tigroid fundus</i>	15	48.4	16	51.6	31	100,0	1.000
	- <i>Myopic C. + Tigroid F.</i>	0	0	1	100.0	1	100,0	
Severe myopia <sup>b)</sup>								

- <i>Tigroid fundus</i>	8	57,1	6	42,9	14	100,0	
- <i>Myopic C. + Tigroid F.</i>	9	50,0	9	50,0	18	100,0	0.688

- a) Fisher's Exact test
- b) chi-square test

Table 2.2. shows the posterior segment abnormalities based on the degree of dystyopia between the right eye and the left eye, in moderate myopia seen more Tigroid fundus found on the left eye of 16 eyes (51.6%), and in the right eye as many as 15 eyes (48.4% ), while the image of myopic crescent + tigroid fundus was found only 1 eye in the left eye.

In severe myopia found tigroid fundus in the right eye as much as 8 eyes (57.1%) and in the left eye as much as 6 eyes (42.9%), while the image of myopic crescent + tigroid fundus found in the right eye and left eye respectively 9 eyes (50.0%).

**Table 2.3. The correlation posterior segment abnormalities and degrees of myopia**

Posterior segment abnormalities	Degrees of myopia				TOTAL		<i>p.</i>
	Moderate		Severe		N	%	
	n	%	n	%			
- <i>Tigroid fundus</i>	31	68,9	14	31,1	45	100,0	
- <i>Myopic C. + Tigroid F.</i>	1	5,3	18	94,7	19	100,0	0,0001*

From table 2.3. posterior segment abnormalities in the form of tigroid fundus on the degree of moderate myopia as much as 31 (68.9%) whereas in severe myopia as much as 14 (31.1%) then in the posterior segmental abnormalities fundus tigroid + Myopic crescent in moderate myopia as much as 1 (5.3%) while in severe myopia as much as 18 (94.7%). Chi-square test showed the results there was correlation between posterior segment abnormality and degrees of myopia ( $p < 0.05$ ).

#### IV. CONCLUSION

From the statistical in this study there is a correlation of posterior segment abnormalities with moderate and severe degree of myopia and there is no difference intra-ocular pressure either in the right eye or left eye in the degree of medium and severe myopia.

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# Analysis on the Effects of Organizational Communication Climate and Career Development toward Employee Performance with Job Satisfaction As an Intervening Variable (Study on HRD and General Division of Pt Pusri Palembang)

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DOI: 10.29322/IJSRP.8.8.2018.p8054  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8054>

**Abstract-** *The purpose of this research is to analyze direct and indirect effects of organizational communication climate and career development toward employee performance, where the job satisfaction as an intervening variable toward the organizational communication climate and career development of employee performance at Human Resource Department and General Division of PT Pusri Palembang. This research was explanatory research approach and used 120 respondents. The primary data were questionnaires. Data analysis method was Structural Equation Model (SEM). Research findings showed that organizational communication climate had no significant effect on employee performance while career development had a significant effect on employee performance. In addition, the study also found that job satisfaction as the full mediation influenced the organizational communication climate toward employee performance while job satisfaction as the partial mediation influenced the career development toward employee performance at Human Resources Department and General Division of PT Pusri Palembang.*

**Index Terms-** *Communication Climate, Career Development, Job Satisfaction, Employee Performance*

## I. INTRODUCTION

Human resource is an object as well as a subject to realize the successes of goal and as a main power resource in shaping corporate management practices. All company expects high performance from their employees, even under uncertain conditions of change to to their employees. Therefore, management needs more attention and be able to develop the role of human resource in a company, so they can produce not only individual performance but also optimize company performance (Pushpakumari, 2008). Employee performance must be supported by the company's environmental factors such as clear job descriptions, adequate work facilities, respectful and

dynamic work climate, career opportunities and effective communication.

Communication activities within organization become one of the indicators of organizational growth. Ali and Haider (2012) suggest that communication as the key to bring people in the organization together to work toward a specific goal. The results of Bikson and Gutek's research in Verma (2013) states that failure in companies, 90% caused by failure in the communication process. In addition, according to Sanusi (2012) communication will be functioning properly if there are healthy communication climates; the existence of mutual trust, mutual supporting and strengthening, mutual unity, understanding, openness and honesty. Falcione et al. in Sanusi (2012) defines communication climate as a subjective quality of experience that arises from employee perceptions of characteristics within the organization. The organizational communication climate plays an important role in creating an effective organization (Redding in Pace and Faules, 2002).

Performance can also be influenced by employee career development. Individuals join the organization for a rewarding of job experience opportunity as well as a career rewarding. Career prospect in a company provides motivation for employees to improve their work effort in achieving job satisfaction, as the result, they can provide optimal results. According to Odembo (2013) career is an activity undertaken for a significant period of individual life with opportunities for progress. Sunyoto (2012) argues that career development is a personal enhancement activity in the self-development efforts pursued by a person to realize a career plan. According to Nugroho and Kunartinah (2012), the development of a prospect career in a company will increase employees' work motivation, thus creating a sense of satisfaction in carrying out their work.

Ivancevich et al. (2007) defines job satisfaction as an attitude that workers have as a result of their perception toward job as a whole

whether or not it can facilitate the achievement value of work considered important for them. Rofiq (2014), Ahmad et al. (2010) and Pushpakumari (2008) argue that job satisfaction is an important consideration for company because workers with high levels of satisfaction tend to be willing to defend themselves on job, being motivated to exist in organization and working best towards performance, and tend to improve overall performance organization. Job satisfaction is one of the performance measurement tools (Robbins, 2005).

Several findings based on direct observation and interviews conducted by the writer from some workers of PT Pusri were obtained, as follows:

1. The legal entity change of PT Pusri Palembang (Pusri) into a private company as a subsidiary company seems to have an impact on the changing of communication climate within the company. As expressed by Pace and Faules (2002) that changes in a work system can affect the perception of organizational communication climate.
2. Some records of the results of the survey on job satisfaction in 2016 conducted by PT Pusri Palembang:
  - a. There was an indication of lack of superior and subordinate communication, due to the lack of information received by employees about their performance. It can be seen from the employee's *down* attitude and immediately resigned when the counseling work unit conducts summons and counseling for employees whose achievements are rated below the average (under).
  - a. 22.09% of the workers complained about the issue of "employee placement" (filling position, rotation / mutation, recruitment). Rotation policies are less acceptable to employees and cause less satisfaction.
  - b. Career progress indicators were low scores
  - c. Employees age of 25 - 30 years, achieving the lowest level of satisfaction. According to Bagus (2010) age between 25 - 34 years old are the age that can cause feelings not satisfied with their job. There was 24.95% of employees of PT Pusri Palembang were within those ages.
3. Minimum number of prioritized employees to be promoted as rising grade because priority is for employees who have high performance while most of them are performing normally.
4. At each period of employee assesment as high group is a group that is prioritized for up grade. Meanwhile, most of the assessment results of employees are in the normal group. So that there are few number of employees prioritized to raise their grade.

Regarding to previous research on the relationship of communication climate and performance conducted by Yoanne (2013), Ahsanul (2013), and Nordin et al. (2014) find that the communication climate has an influence on company performance and effectiveness. However, it is not in line with a research conducted by Brahmasari and Suprayetno (2008) which shows a significant negative influence between bottom-up communication on job satisfaction. Bianca & Susihono's (2012) research also shows that organizational climate has a

negative effect on job satisfaction. While Kamasak & Bulutlar (2008) which examine the role of the communication climate as mediation between job satisfaction and PEP concluded that the communication climate does not have a moderate effect.

## II. LITERATUR REVIEW

**Organizational Communication Climate.** Communication Climate is a subjective quality of experience arising from employees' perceptions of characteristics within an organization (Falcione et al., In Sanusi, 2012). The communication climate is perceptions of messages and events related to what happens within the company (Pace & Faules, 2002). The ideal organizational communication climate is very important in an organization, because it can affect the performance of the organization through its influence on employees' work motivation (Noordin et al., 2010 and Verma, 2013).

**Career development.** Career development is a process of increasing individual work abilities achieved in order to achieve the desired career (Handoko, 2008). Career development is expected by every worker, because they will get better rights than before both material and non-material. Although the primary responsibility for career planning lies in individuals, organizational career planning must be in accordance with individual career planning if the organization wants to retain the best employees (Moondy in Rande et al., 2014). Through career development programs, companies can improve employee performance and productivity, lower labor turnover, and increase employee promotion opportunities.

**Job satisfaction.** Job satisfaction is an attitude that workers have as a result of their perception on jobs as a whole whether or not it can facilitate the achievement of the important job value for them (Ivancevich et al., 2007). Companies are expected to meet employee job satisfaction because companies with more satisfied employees tend to have higher productivity than companies with less satisfied employees (Rofiq, 2014). Job satisfaction is one of the performance measurement tools (Robbins, 2005).

**Performance.** Performance is defined as what an individual or an employee has produced, and is influenced by organizational performance (Cash and Fischer in Thoyib, 2005). Every company expects high performance to be generated by every employee, even under uncertain conditions of change to employees. A company still requires employees to survive and perform high to maintain sustainable values.

**Previous Research.** There are several researches that have been conducted by academics in studying the relationship organizational communication climate and career development toward employee performance. For example, researches conducted by Suryanata and Laksemama (2016), Istiqomah and Suhartini (2015) and Pangumpia (2013) their researched found that organizational communication climate has a significant positive effect on improving employee performance. Furthermore, researches by Sopi (2017), Sofyan et al (2016), Jusuf et al (2016), Rande et al (2014), and Adekola (2011), showed that career development has a direct influence on job

satisfaction and performance. However, there are differences in the findings of research conducted by Mabruroh et al (2017) which conclude that career development has no significant effect on job satisfaction. The findings of this research were also supported by Tobing (2016) and Kaya and Ceylan (2014) which found that there was no significant influence between career development on job satisfaction. Furthermore, researches by Bianca & Susihono's (2012), Brahmasari and Suprayetno (2008) which found that organizational climate has a negative effect on job satisfaction.

In addition, some researchers have previously conducted research on the influence job satisfaction on employee performance. For example, a study conducted by Pushpakumari (2008) found that job satisfaction had a significant influence on employee performance. Meanwhile, research conducted by Taurisa and Ratnawati (2012) obtained the findings that the satisfaction of co-workers as a dominant indicator of job satisfaction in influencing employee performance

### III. RESEARCH METHODS

**Research Design.** This research is explanatory study with causality research design that is to find out the effects of organizational communication climate, career development, and job satisfaction on employee performance of Human Resources Department and General Division of PT Pusri Palembang. There were four variables in this study, namely organizational communication climate variable (X1) and career development variable (X2) as exogenous variable, job satisfaction variable (Y1) as an intervening variable, and performance variable (Y2) as dependent variable or endogenous variable. The variable organizational communication climate was measured using six aspects: trust, joint decision making, honesty, openness in top-down communication, bottom-up communication, and focusing to high performance goals. Career development variable was measured by five aspects: achievement opportunities, career clarity, predictable career level, career planning, and career management. Job satisfaction variable was measured by four aspects: job interest, Job comfortability, high enthusiasm, and chance to develop. The performance variable was measured by five aspects: quality, quantity, punctuality, working attendance, and cooperative attitude. The numbers of indicators used in this study were 48 indicators. This study used primary data through questionnaires using likert scale measurement 1 to 5 (1 = strongly disagree to 5 = strongly agree).

**Population and Sample.** The population in this study were employees at Human Resources Department and General Division of PT Pusri Palembang total 126 employees. The questionnaires were distributed to 126 employees, but only 120 questionnaires returned, so the final samples were 120 respondents.

### IV. RESULTS AND FINDINGS

The estimation of the SEM model as shown in the following figure:

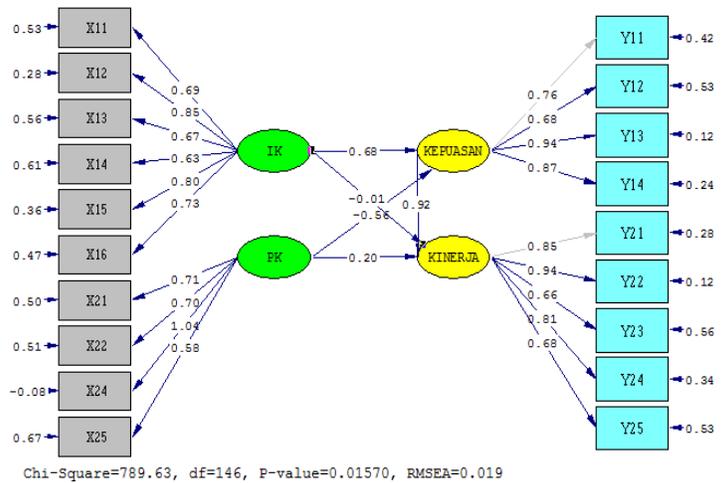


Figure 1. SEM Results Estimated

Based on Figure 1 above, the result of evaluation for the whole SEM model is as follow:

Table 1. The Results of Goodness of Fit Index

GOF	Values	Cut off Value	Notes
<b>Chi-Square Probability</b>	789,63	$< \alpha . df$	Marginal Fit
	0,016	$> 0,05; 0,01 - 0,05$	Marginal Fit
<b>RMSEA</b>	0,019	$\leq 0,08$	Good Fit
<b>TLI atau NNFI</b>	0,96	$\geq 0,90$	Good Fit
<b>CFI</b>	0,91	$\geq 0,90$	Good Fit
<b>GFI</b>	0,89	$\geq 0,90$	Marginal Fit
<b>AGFI</b>	0,96	$\geq 0,90$	Good Fit

Source: Results of Research Data (2018)

The results of the analysis show that the criteria of Goodness of fit are met. It meant that all structural models are fit model.

**Hypothesis Test.** Hypothesis test was conducted by looking at the full model estimation based on *t-value* and loading standard.

Table 2. The coefficient values and t-value with significance level of 5%

	Coefficient	t-value (> 1,96)	Note
IK - ->Satisfaction	0,68	5,06	Significant
PK - ->Satisfaction	-0,56	-4,52	Not Significant
Satisfaction - ->Performance	0,92	8,43	Significant
IK - ->Performance	-0,01	-0,12	Not Significant
PK - ->Performance	0,20	2,57	Significant

Source: Results of Research Data (2018)

Based on the table above, the equation was obtained as follows:

- Sub-Structural Equation:  
SATISFACTION = 0.68 \* IK - 0.56 \* PK
- Structural Equation:

$$\text{PERFORMANCE} = 0.92 * \text{SATISFACTION} - 0.01 * \text{IK} + 0.20 * \text{PK}$$

**Table 3.** Direct and Indirect Effects

Independent Variables	-->	Dependent variable	Direct Effect	Indirect Effect	Total Effects
Communications Climate	-->	Performance	-0,01	1,60	1,59
Career development	-->		0,20	0,36	0,56

Sumber: Results of Research Data, 2018

**The Effects of Organizational Communication Climate on Job Satisfaction.** The results shows the t-value of the Organizational Communication Climate variable on job Satisfaction is = 5.06 at significant level of 0.05%, it means that there is a positive influence between the organizational communication climate and employees' job satisfaction at HRD and General Division of PT Pusri Palembang (H1 Hypothesis, accepted) . The results of this study indicates that the better communication climate in the company so the employees' job satisfaction is increasing. These results support the opinion of Kamasak & Bulutar (2008: 141) that "the communication climate is an important predictor of job satisfaction." In line with the results of the research conducted by Ali & Haider (2012: 43) find a significant positive influence on internal organizational communication consisting of communication climate, formal communication and informal communication on employees' job satisfaction.

**Effect of Career Development on Job Satisfaction.**The result of research shows that t-value of Career Development variable toward Satisfaction is = -4,52 at significance level of 0,05%, it means there is insignificant value between career development variable and job satisfaction at Human Resources Department and General Division of PT Pusri (Hypothesis H2, rejected) . The results of this study indicate that the bigger opportunities of the employees' career development, the employees will tend to not working optimally, because career development in the company tend to do job mutation or transfer of tasks at the same level, so the career development program of the company has no effect on increasing employee job satisfaction. The result of this study is in line with the research conducted by Mabrurroh et al (2017) which conclude that career development has no significant effect on job satisfaction, because the existing indicators on career development is not the reason of employees to have high job satisfaction at the company. While the research of Nugroho and Kunartinah (2012) and Adekola (2011) have the opposite conclusion that higher employee career development opportunities have an impact on high job satisfaction because employees are motivated to attend the organization, try to work as well as possible, and more stable and productive to achieve a career that has been planned.

**The Effects of Organizational Communication Climate on Employee Performance.** The result of this research shows that t-value of Organizational Communication Climate variable to Performance is -0.12 at significant of 0,05%. It means that there is insignificant value between organization communication climate and employee performance at Human Resources

Department and General Division of PT Pusri Palembang (Hypothesis H3, rejected). In this study, the organizational communication climate has no significant effect on employee performance. Related to descriptive analysis, it was concluded due to lack of employee attention on high-performance goals. It is because the employees considered the lack of management attention to employee welfare. However, it is a very important aspect that motivates employees to perform well. According to Hasibuan (2001) welfare is a complete remuneration that aims to maintain and improve the physical and mental conditions of employees so that their productivity increases. The result of a research conducted by Murti's (2014) concludes that aspects of organizational communication climate which consist of six indicators can improve and reduce employee performance. In her research, the aspects of joint decision making, openness in top-down communication, openness in Bottom-up communication proven to decrease employee performance. Yet based on the theory of organizational communication climate by Pace and Faules (2002) shows that these three aspects have a positive impact on work environment and can improve employee performance. The same opinion based on the results of the research by Suryanata and Laksemana (2016), Istiqomah and Suhartini (2015) and Pangumpia (2013) which show that the organizational communication climate has a significant positive effect on improving employee performance.

**The Effect of Career Development on Employee Performance.** The results shows that the t- value of Career Development variable on Performance is = 2.57 at significance level of 0.05%, which means that there is a positive effect between the career development variable and employee performance in at HRD and General Division of PT Pusri Palembang (Hypothesis H4, accepted). According to Handoko (2008) career development is a process of increasing individual work abilities achieved in order to achieve the desired career. Rivai (2009) states that "career development is the result of interaction between individual career and institutional career management processes." While Samsudin (2010) defines career development as a formal and sustainable effort with focus on improving and adding one's capabilities. Thus, the process and achievement in career development have high goal of work performance or high performance.

**The Effect of Job Satisfaction on Employee Performance.** The result of the research shows that t-value of Job Satisfaction variable on Performance is = 8.43 at significant level of 5%, it means that there is a significant effect between job satisfaction and employee performance at Human Resources Department and General Division of PT Pusri Palembang. (Hypothesis H5, accepted). This result proves the theory of job satisfaction by Robbins (2005) which states that employees who are satisfied with their work have a greater chance to talk about positive things about their organization, help others, and do their job performance beyond the normal estimate.

The results of this study are in line with the research conducted by Inuwa (2016), Indrawati (2013), Taurisa and Ratnawati (2012) which concludes that the presence of good attention from the company towards employee job satisfaction would be able to improve employee performance. This is in

accordance with the result of descriptive statistics of respondents' perceptions on job satisfaction. The aspect of being attracted to their jobs has the highest assessment score, it means that employees who were attracted to their jobs have job satisfaction. According to Spector (1997), job satisfaction will produce perceptions and ultimately will produce the behaviors needed to produce performance, where individuals who are satisfied with their job will do good behavior and vice versa. More specifically, according to Herzberg in Hasibuan (2005) states that the characteristics of satisfied behaviors are employees who have high motivation to work, and are willing to do their jobs.

**The Effect of Organizational Communication Climate on Employee Performance with Job Satisfaction as Intervening Variable.** The results show that the direct effect of communication climate on employee performance (-0.01), indirect effect of (1.60) and total effect of (1.59) (Hypothesis H6, received). Based on results above, in this study obtained the value of path coefficient from independent variables to significant intervening variable is significant, and path coefficient of the independent variable to the dependent variable controlled by the intervening variable is not significant. It can be concluded that the intervening variable of Job Satisfaction fully mediates the organizational communication climate and employee performance on HRD and General division of PT Pusri Palembang (fully mediated). It means that the organizational communication climate must be through mediation of job satisfaction to affect the performance of employees at Human Resources Department and General Division of PT Pusri Palembang.

**The Effect of Career Development to Employee Performance with Job Satisfaction as Intervening Variables.** The results show that the direct effect of communication climate to employee performance (-0.01), indirect effect of (1.60) and the total effect of (1.59). Direct influence of career development performance is (0.20), indirect effect is (0.36) and total effect is (0.56) (Hypothesis H5, accepted). From the results above, in this study the path coefficient value of the independent variable to the intervening variable is significant, the path coefficient of the intervening variable to the dependent variable is significant, and the path coefficient of the independent variable to the dependent variable controlled by the intervening variable is significant. It can be concluded that the intervening variable of Job Satisfaction is partially mediated. It means that job satisfaction variable as mediation variable contributes to some (not all) relationships between career development and employee performance.

## V. CONCLUSION

The purpose of this research is to determine the direct and indirect influence of organization communication climate variable and career development on employee performance with job satisfaction variable as intervening variable. Based on the results of this research indicate that the direct climate of organizational communication has insignificant effect on employee performance, while career development has significant effect on employee performance at Human Resources Department and General Division of PT Pusri Palembang. In addition, the variable of Job Satisfaction was proven as a fully mediated

relationship between organizational communication climate and employee performance and as partially mediated career development to employee performance at Human Resource Department and General division of PT Pusri Palembang.

## ACKNOWLEDGMENT

Our thanks would be addressed to all employees in HRD and General Division of PT Pusri Palembang assisting our research, all the related institutions that provided the needed data and information, and also all of people who contributed to this research.

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# Assessing Argumentation in Nigeria's 2015 election-related news editorials

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DOI: 10.29322/IJSRP.8.8.2018.p8055

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8055>

**Abstract-** The success of Nigeria's 2015 general elections was unanticipated, judging by the tense political and security atmosphere in which the polls were conducted. It is against this backdrop that this study explores the contribution of four Nigerian newspapers (The Guardian, Vanguard, Independent and Leadership) and, in particular, their editorials, to the reasonably peaceful and mostly credible 2015 general elections in Nigeria. This qualitative study, located within the interpretivist tradition, draws on textual analysis of selected editorials to explore three strands of appeals: – violence-free polls, rational voting and credible electoral process made by these editorials. Drawing from the theories of argumentation, the research suggests that three kinds (forensic, epideictic and deliberative) and three modes of argumentation (logos, pathos and ethos) were used by editorial writers to advance their arguments. These newspaper editorials made moral and ethical appeals urging “supra-national” and patriotic attitudes as well as process interventions. This study thus argues that in view of the range of issues discussed and the level of persuasion, the editorials played a positive role in the peaceful outcome of 2015 polls in Nigeria.

**Index Terms-** editorials; rhetorical analysis; argumentation; election; Nigeria

## I. INTRODUCTION

Elections are integral part of any democratic process, providing a mechanism for leadership succession and change. Election is seen as a means towards the attainment of political power in democracies as it (democracy) is founded on aggregation and articulation of people's interest (Awopeju, 2012). In developed democracies, citizens use their vote or lobby (Becker, 1983) to advance their interests (Collier and Vicente, 2014; Adebayo and Omotola, 2007). However, in many new democratic states, especially in low-income countries of Africa, elections are still considered a do-or-die affair (Tar and Zack-Williams, 2007). Ideally, elections should be heralded by a period of campaigning characterised by peaceful and persuasive discourse wherein candidates vie for popular vote by advancing reasoned arguments as to why they are the best suitably qualified candidates for the elective position (Bratton, 2008). It is to be noted, however, that elections in Africa represent struggle over access to state resources (Bratton, 2008; Lindberg, 2006). Within Nigerian political milieu, elections are seen by politicians as zero-sum game in which the winner takes all (Dode and Edet, 2015). In view of these high stakes, politicians employ several

means – by hook or crook – to achieve electoral victory (Bratton, 2008). As Collier and Rohner (2008) suggest, low levels of democratic development significantly increases the propensity for civil conflict. This cannot be truer than in Africa which has witnessed rising cases of political intimidation and violence at elections as exemplified in Kenya, Zimbabwe and Nigeria.

Since the return of democracy in 1999, Nigeria has had five general elections with varying degrees of successes and failures. However, the 2015 general election marked a watershed in Nigeria's democratic development. It was the first time the then ruling party, the Peoples Democratic Party (PDP) and the then opposition party, All Progressives Congress (APC) mustered relatively equal political strength. Two events culminated in boosting the political strength of the opposition party. First, the formation of All progressives Congress (APC) through a merger of five political parties namely the Action Congress of Nigeria (ACN), Congress for Progressive Change (CPC), the All Nigerian People's Party (ANPP) and a faction of the All Progressives Grand Alliance (APGA) led by Rochas Okorochoa, the Imo State governor to rival the then ruling party (Owen and Usman, 2015). The second event was the defection of five PDP governors to the newly-formed APC (Owen and Usman, 2015). The dominance which the PDP previously enjoyed was significantly undercut. In their race for electoral victory, the two main political parties threatened the peace of the nation. Far from issue-based campaigns, the two parties deployed “negative campaign tactics involving fierce personal attacks on the candidates and prominent party members” (Orji, 2015:77). Besides, long term political rivalry between the north and south was revived during this time. The contest took on ethno-religious coloration as PDP fielded President Goodluck Jonathan, a Christian from the south as her presidential candidate while the Muhammadu Buhari, a Muslim from the north was APC's standard-bearer (Dode and Edet, 2015). Disturbing levels of unguarded statements pervaded the political space while violent attacks from the two main political parties increased (NHRC, 2015). The 2015 polls in Nigeria were held in the midst of simmering political tension between the two dominant political parties. It should be borne in mind, however, that the Nigerian newspapers did not watch the nation descend into anarchy without doing anything. Instead, they made spirited interventions through their editorials to stem the spate of violence and ensure a free and fair poll this paper, therefore seeks to appraise how newspaper editorials persuaded relevant stakeholder to toe the path of peace and ensure credible election. This study is particularly interested in examining how Nigerian editorials

argued for free and fair polls 2015 elections in Nigeria. What kinds of argumentation did they employ to make their case persuasive? What are the rhetorical strategies mobilised in these editorials to make their arguments persuasive? This work proceeds by discussing editorials and argumentation, an overview of rhetorical analysis, data presentation and analysis.

### Editorials and Argumentation

Newspaper editorial is the serious analysis of important, often current, issues so that the paper's "ideal reader" will, either, be informed, influenced or entertained (Kriehbaum, 1956). It is the newspaper's considered opinion on an issue which it judges as important. Editorials have, over the years, enjoyed a prominent place in a newspaper. In fact, it is only newspaper content that is attributed to the paper as its own opinion on any given matter. As a corporate citizen, newspapers use the agency of editorials in assisting other citizens to contribute meaningfully to communal progress (Ukonu, 2007). They achieve this purpose by incorporating investigative, interpretive, hard news reporting and advocacy skills into their editorials (Ukonu, 2007) to the end that the reader may be educated, entertained or influenced. The editorial remains the only newspaper content through which a newspaper can exert influence in shaping public discourse on a given subject. The need for newspaper editorials, Ukonu (2007) argues, is highest in times of crisis, tension or uncertainty as readers turn to them for guidance to negotiate complexities of modern life.

For editorials to exert such influence as stated above, it must be persuasive. As Perloff (2003) points out, persuasion entails a deliberate effort at influencing the other party, along with an accompanying understanding that the persuadee possesses a mental state that is amenable to change. Though persuasion and argumentation do not have the same meaning, Ukonu (2007) argues that they are better used interchangeably because they have a common function which is to convince the audience to accept certain perspectives. This view is underpinned by different ways in which editorial is used. For instance, editorials, according to Bal and Saint-Dizier (2009), fall under persuasive texts. Such types of texts, they explain, seek to persuade the reader in regard to certain kinds of topics. For his part, van Dijk (1995) notes that editorials are argumentative in language and structure. This study, therefore, applies both terms in this sense. Ben (2012) posits that the act of arguing performs two main functions which are critical to humans as rational and social beings. First, argumentation provides a way of knowing because it is the means through which we justify our claims. In doing this, we try to demonstrate that our views are correct in certain respects and it is within the purview of an audience to accept it or not. Again, argumentation is equally a means for interaction among individuals, a mechanism with causal powers: not only does the rhetor place a commitment on the addressees to accept his views for which he advanced good reason; it is also through the agency of logic that the rhetor, at times, causes certain beliefs in the addressees (Ben, 2012).

Scholars (Bal, 2009; Bal and Saint-Dizier, 2009; van Dijk, 1996a) contend that persuasive texts in general, and editorials in particular, exhibit the following argumentation structure: opening statement, support statement which could be either facts or opinions, and conclusion. According to Bal (2009) the opening

statement introduces the issue in focus even as support statements seek to persuade the readers on the issue in consideration. The concluding part, Bal (2009) explains, expresses promise or provides some recommendations to the audience. As Bal (2009) observes, the conclusion often reiterates the opening statement though in a slightly rephrased form geared towards driving home the points previously made. Likewise, Stonecipher (1979) and MacDougall (1973) made similar observation about the structure of editorials. Stonecipher (1979), for example, likens an editorial to an essay comprising an introduction, body and conclusion. In his categorisation, MacDougall (1973) identifies the three-part structure in an editorial to include the subject or news peg, the reaction and the reason. Taken together, an editorial aims at persuading the addressees to accept its own point of view. In doing this, editorials make different kinds of argument using several persuasive strategies.

The 2015 electioneering period represents such time of uncertainty and tension given the spate of political violence and inflammatory statements deployed by several political actors. Nigerian newspapers through their editorials did not stand aloof during these turbulent times in the nation's history. Instead it argued, made a case for free and fair polls through the agency of their editorials. The purpose of this study is to examine how Nigerian newspapers argued for free and fair election during 2015 general election in Nigeria.

### Rhetorical Analysis

As established in the previous section, editorials sometimes take on an argumentative posture with the sole aim of persuading the reader to accept its own position. Prinsloo (2009) notes that media text draws intertextually on other texts in order to convey its message. For this reason, Prinsloo (2009) advises that a media text needs to be studied in terms of the way it is crafted. According to her, "it needs to be analysed as a social act that mediates the substance of the text and is therefore also a rhetorical act" (Prinsloo, 2009: 211). Rhetoric basically relates to an effort at persuasion carried out by the writer or speaker via the choices made in the production of the text (Prinsloo, 2009). Aristotle in Richardson (2007: 156) defines rhetoric as "the faculty of observing in any given case the available means of persuasion". Seen as a political tool, rhetoric's goal is not only to achieve persuasion but to find the persuasive facts in each piece and present them convincingly so as to engender action. The rhetor or arguer takes into account existing social patterns of the period and place in the construction of the text.

As Richardson (2007) explains, the identification of rhetorical discourse used is a vital first stage when approaching rhetorical analysis. In rhetorical practice, there are three kinds of argument: forensic, epideictic and deliberative argument (Richardson, 2007). As Richardson (2007) observes, every kind of persuasive discourse has exact rhetorical objectives it wants to achieve and, as a result would adopt special topics in realising the stated objectives. Forensic rhetoric relates to the type of argumentative discourse where the arguer either denounces or defends someone's past deeds. Focused on the past, forensic rhetoric has as its modes of operation accusation and defence bordering on issues of justice and injustice committed by the defendant (Richardson, 2007). In epideictic rhetoric, the rhetor

is preoccupied with demonstrating that someone or something is worthy of admiration or condemnation. Concerned with the present, epideictic rhetoric either praises or censures while addressing issues such as honour and dishonour. Intricately tied to the character of those referred to, the arguer tries to make the audience esteem those referred to on account of their goodness or hate them due to their badness (Richardson, 2007). A positive rhetoric, Richardson (2007) explains can be categorised as a eulogy while a negative rhetoric is termed an invective. A deliberative rhetoric is employed when a rhetor is discussing the desirability or otherwise of a decision, especially political decision (Richardson, 2007). With its means as inducement and dissuasion, deliberative rhetoric which deals with the future, has as its special topic the advantageous and disadvantageous nature of issue at hand (Richardson, 2007).

Central to rhetoric, Richardson (2007) notes, is the mode or strategy the arguer adopts in persuading the audience. Every argument presupposes the presence of what Prinsloo (2009: 244) referred to as “rhetorical triangle”. This consists of the argument (logos), the audience (pathos) and the arguer (ethos). The strategy for persuasion an arguer employs can be identified by the emphasis placed on any point of the triangle (Richardson, 2007). An ethotic argument is one which depends on the establishment of the credibility of the author or speaker (Leach, 2000). Here, it is believed that the audience will likely be convinced based on the character or ethos of the arguer. For instance, the audience is likely to be persuaded by the views of a medical doctor than a legal practitioner on any health matter. Through a pathotic argument, the arguer appeals to the emotions of the audience (Leach, 2000). Prinsloo (2009) explains that the arguer employs pathos in an argument in order to move the audience to pity, fear, remorse or rage where the audience will be open to his argument. A logetic argument, Prinsloo (2009) points out, is contingent upon the logic or evidence offered. Richardson (2007) notes that through the logic and structure of the argument an audience can be persuaded. A logetic argument can be made deductively and inductively (Prinsloo, 2009). According to her, “In a deductive argument an assertion is made by making a series of statements” (Prinsloo, 2009: 247). Conversely, an inductive argument uses a particular case to support a general conclusion (Richardson, 2007). There are three ways an inductive argument can be made: symptomatic, analogy or comparison and causal relationship argument (Richardson, 2007; Prinsloo, 2009). A symptomatic argument is one in which a particular instance is used to exemplify a bigger state of affairs. Prinsloo (2009: 247) observes that words like “characteristic”, “typical”, demonstrate this form of inductive argument. When argument by analogy or comparison is made, the arguer compares a specific case to something which the audience is conversant with or supports or strongly opposes (Richardson, 2007). Terms like “equally”, “similarly”, “so too”, “any more than”, “accordingly” are a common feature (Richardson 2007; Prinsloo, 2009). Causal relationship argument are marked by words that are suggestive of consequences like “creates”, “makes”, “gives rise to” feature prominently (Richardson, 2007: 164). Prinsloo (2009: 248) observes that in argument by causal relationship, “chronology is confused with cause and effect and other factors are consequently ignored”.

## Discussion

In this section, the researcher seeks to analyse the rhetorical strategies employed in the editorial coverage of 2015 elections in Nigeria. As Prinsloo points out, the “particular choices made to construct a text draw on the various social patterns or social orders of their time and place” (2009:211). For this reason, she explains that when texts are analysed as a rhetorical act, the analyst is seeking to establish how the worlds of experience are fashioned for texts to effectively engage and interpret the worlds which they refer to (Prinsloo, 2009). In engaging the issues that were firmly entrenched in the rhetorical arguments used in the editorials, I will first interrogate the use of the word “we”. I will then show how argumentation was mobilised in the sampled editorials to appeal to three key issues: calls for violence-free polls, credible electoral process and rational voting. In modes of argumentation, “we” relates to ethotic mode of argumentation in which the character of the arguer enhances or diminishes the acceptability of its argument.

### The Editorial “we”

The editorial is seen as an institutional opinion of a newspaper on any issue (MacDougall, 1973). This is why it is unaccompanied by any bye-line. As Hulteng (1973) explains, editorials are usually written with the word “we” which could represent the editorial board or the policy makers of the publication. This indicates that the editorial is not presented as the opinion of a particular person. The word “we” was severally used in some of the editorials chosen for this rhetorical analysis. In relation to the modes of argumentation, “we” relates to ethos which is personal character of the arguer. The credibility of a newspaper, to an extent, determines the level of impact its editorial makes in a given society. Below are some of the examples of the use of the word “we” in the editorials:

**We** however appeal to the officers in national interest to refrain from embarking on strike and toe the path of discipline and patriotism which is the hallmark of their calling and pursue their demands through official channels (*Independent*, March 9, 2015)

This list, **we** must say, is by no means exhaustive, but should serve as a take-off point, if the political class is serious. (*Leadership*, December 13, 2014)

Hulteng (1973) however points out that the use of the word “we” can bring about confusion to the editorial style. The use of the word, “we”, Hulteng (1973), posits can be used in an editorial to refer to the citizens of a country while it can also be used in the same piece to mean the paper. The extract below exemplifies this point:

**We** believe that INEC has a moral right as a regulatory commission to screen, sanitise, monitor and sanction the amorphous bodies that call themselves political parties...**We** will only be dignifying frivolous people by allowing under-aged voters and candidates to become a cog in the wheel of our democratic progress (*Leadership*, January 23, 2015).

Here, the first “we” refers to the paper while the second was actually made in reference to Nigerians. To avoid the confusion cited above, *Independent* newspaper uses the word “Newspaper” alongside the word “we” to refer to the newspaper. An example of this is shown below:

**This Newspaper** has severally called on the political class to stop heating up the polity in the face of the on-going political engineering ahead of the 2015 general elections. In line with that position, we find the statements credited to the Octogenarian (Clark) as unfortunate as it is quite provocative and capable of heating up the polity (*Independent*, December 12, 2014).

While some publications have stuck to using “we” to refer to the paper with its attendant confusion, others have adopted the use of the word, “Newspaper” to achieve greater clarity in their editorials. Interestingly, *The Guardian*, in particular, does not use any words to refer to itself. This is in keeping with its writing style. On this, *The Guardian* style guide counsels, “Keep yourself in the background. Readers are not interested in your personal history. Over-personalised or autobiographical journalism has no place in *The Guardian*” (Style: A Guide for Journalists, 1983:11). The import of projecting their ethotic value in these editorials through the use of the word “we” is put in proper perspective when the mission statements of these papers are analysed. For instance, *Guardian* newspaper positions herself as a medium whose duty to the state is not only to protect and defend the citizens, but also to create the necessary conditions, political, social, economic and cultural in which all citizens may realise their full potentials as human beings (*Guardian* 2016). Equally, *Vanguard* newspaper aspires to serve the people through a stated commitment to the ideals of free enterprise, the rule of law and good governance (*Vanguard* 2016). *Independent* newspaper claims that the paper shall be independent on all matters, but never neutral on any matter especially those pertaining to the well-being of the people of Nigeria. With these self-confessed mission statements aimed at serving the interest of the Nigerian people, these dailies have positioned themselves in the minds of the reader as standing with Nigeria and her people. This finds expression in Louis M. Lyons’, former curator of the Nieman Foundation (a foundation for journalism at Harvard) justification for an editorial page cited in Stonecipher (1979: 31) in which he averred that:

... if one needed an excuse for an editorial page, or to try to define the primary role of the page, I think it would be to express the tone of the paper. This is even more than the policy of the paper. It’s a chance to represent the institution itself, as a civilised and civilising force, as a concerned and considerate citizen, as a moderate and moderating influence, as a thoughtful person, a good neighbour, one who cares.

Thus, their views on any national matter should be read from the prism of patriotism and unflinching desire to preserve the nation’s democratic experience. Therefore, the mobilisation of “we” in these editorials is a persuasive strategy designed to make their argument believable.

Having discussed how editorial “we” was mobilised by editorial writers to further their argument, the next section discusses how the three kinds of argumentation (forensic, epideictic and deliberative arguments) and three modes of argumentation (pathotic, ethotic and logetic arguments) were deployed by editorial writers to persuade the audience towards achieving free and fair polls.

### **Call for violence-free polls**

The 2015 electioneering period was marked by violence which necessitated calls for violence-free elections. In one of its

editorials “No to Pre-election violence” published on March 13, 2015, *The Guardian* made an epideictic argument in which it flays politicians over the worrying spate of violence in the lead-up to the election. In so doing, it used an inductive symptomatic argument to argue that the death of six persons at a political rally in Rivers State is reflective of what took place in other parts of the country.

The eruption of violence, with its trail of explosions, gunshots and intimidation that marred the All Progressives Congress (APC) gubernatorial campaign in Okrika, Rivers State, the other day, is a bitter reminder that elections are still a ‘do or die’ affair in many parts of the country... This is very regrettable given the assurance of a violence-free election promised by politicians during publicised peace pacts amongst parties (*The Guardian*, March 13, 2015)

Using logetic argument, the editorial wondered “what kind of elections and leaders are these warring politicians engendering?” It maintains that the problem could be solved if the law is allowed to take its course on those who foment trouble during election.

Addressing the problem of violence demands more than just advisory submissions to the deaf; it demands courageous deployment of the cudgel of the law. Both Section 227 of the Constitution and Section 81 of the Electoral Act 2010 (as amended) which prescribes punishments for contravention of Section 227 of the Constitution, are legal provisions addressing electoral violence (*The Guardian*, March 13, 2015).

In a similar editorial published in the *Vanguard* on March 16, 2015, headlined, “Thugs – Well, Alive”, the paper makes an epideictic argument by criticizing the ignoble role thugs play in exacerbating the spate of violence in the political arena. The editorial uses logetic mode of argumentation in contending that, “Thugs are in the business because violence is profitable”. While employing an inductive argument by causal relationship, the paper averred that:

Thugs are growing in numbers and in the intensity of their actions. They adorn an air of invincibility because society permits them, dreads them, and sometimes adores them (*Vanguard*, March 16, 2015).

Still on its use of logetic strategy of argumentation, the paper, applying an inductive argument by causal relationship, further contends that thugs have grown from the peripheral role they played during elections to a more central one because they have never been punished for their evil deeds instead, it appears they are rewarded.

From humble beginnings that saw thugs on the fringes of elections, they have assumed commanding positions in our politics. The growth and importance of thugs are sustained by willingness of most candidates to use them, protect them, and reward them (*Vanguard*, March 16, 2015).

The editorials not only addressed issues of violence but also condemned anything that could lead to violence during the electioneering period. An example of this is the editorial titled “E. K. Clark’s Outburst” published in *Independent* on December 12, 2014. It is equally an epideictic discourse as well as an invective rhetoric in that it censures Chief Edwin Clark for alleging that APC could poison President Jonathan in their quest to take over the reins of government. Employing ethotic mode of

argumentation that evidences consistent stance against inflammatory statement, the paper submitted that:

This Newspaper has severally called on the political class to stop heating up the polity in the face of the on-going political engineering ahead of the 2015 general elections. In line with that position, we find the statements credited to the Octogenarian (Clark) as unfortunate as it is quite provocative and capable of heating up the polity (*Independent*, December 12, 2014).

Invocation of its stance against provocative utterances places the paper above charges of being partisan or selective in its actions. Thus the paper assumes a disinterested arbiter whose views should be received within the lense of patriotism and fairness. The editorial equally used logetic mode of argumentation to show the inappropriateness of Chief Clark's assertion.

Clark needs to be reminded that Jonathan is not an Ijaw president, but that of the Federal Republic of Nigeria. We share the sentiment that Jonathan is his political godson and that should be the off-limit, as such unguarded utterances will do the nation no good...

All of these are, regrettably, statements that heat up the polity at a time Nigeria is saddled with her worst kind of insecurity as never seen before... we admonish Clark to be a father of the nation, irrespective of his political loyalty or ethnic nationality. At over 85 years of age, we expect no less from him, as the younger generation of Nigerians look unto him and other elder statesmen for their wealth of experience and wisdom. (*Independent*, December 12, 2014).

The admonition by this editorial to Chief Clark to be "a father of the nation" is a deployment of pathotic mode of argumentation designed to evoke the feeling of fatherhood which confers on him the values of restraint, tolerance and responsibility.

### Call for Credible Electoral Process

A major theme that emerged from this study is that the newspapers, whose editorials were selected for this study, were unequivocal in their insistence on credible electoral process. Expectedly, they added their voices to a number of contentious issues that dominated the electioneering period, all aimed at engendering credible electoral process. One of them was the postponement of election. The editorial, "Don't Mess With February 14 Date" published in the *Leadership* newspaper on January 26, 2015, advances a deliberative argument by emphasizing the undesirability of election postponement. The editorial likened the call for election to be postponed to "Coteries of voices ...converging, once more, on a road to damnation". The paper while using logetic mode of argumentation contended that:

INEC has had four years to prepare for this year's polls. A storm foretold cannot take the cripple by surprise. The National Assembly has had four years to put in place enabling legislations that could have removed all hurdles to free, fair, transparent and credible elections. The executive and judiciary arms have had four years to do what is right.

The nation faces a far greater danger in postponing the polls than in trying to right all wrongs before calling for polls. Shifting of the polls is bound to put the democratic structure in serious threat (*Leadership*, January 26, 2015).

Hence the call for election postponement was misplaced. Through an inductive argument by analogy, the editorial reminded "Nigerians that the current hysteria is a throwback to 1993" in which similar calls for polls shift were made that year. The comparison of the call for election postponement to the annulment of June 12, 1993 elections was designed to evoke all the negativities that are the legacy of that botched poll. It thus argued:

Now, they have come again – those who thrive only in crisis but would not hesitate to migrate to safer climes after waging war on their nation. After nearly 23 years, they are pushing the country, once again, to the precipice. Unnecessarily. Wickedly (*Leadership*, January 26, 2015).

Any Nigerian or someone conversant with Nigerian politics knows that the June 12, 1993 crisis was one of Nigeria's darkest moments in her political history which no-one wants a repeat. Therefore, comparing election postponement to drive the nation to a repeat of June 12 saga was a powerful way of persuading political actors against it.

Also, *Independent* published an editorial on January 30, 2015 with the headline, "Why elections must hold" in which it highlighted the undesirability of election postponement. Advancing its position through deliberative rhetoric, the editorial used a logetic mode of argumentation to counter the claim by the National Security Adviser to the President, Col. Sambo Dasuki, that 30 million Nigerians were yet to collect their PVCs.

The figure is however questionable as groups like the Conference of Nigerian Political Parties (CNPP), a coalition of opposition parties have faulted the claim, arguing that over 60% PVCs have been collected nationwide by anxious Nigerians. Figures from the electoral commission indicate that 42.7 million PVCs have been distributed (*Independent*, January 30, 2015).

From the above, the editorial punctured the claim by Col. Sambo Dasuki that 30 million Nigerians had not received their PVC by citing two authorities – CNPP and INEC – who gave a contrary assessment of the level of PVC distribution. Drawing from inductive argument by comparison, the editorial noted, "Available records had showed that out of the 73,528, 040 registered Nigerian voters in 2011, only 21, 074, 621 representing just about 28.66% actually cast their votes." Hence the claim that the election should be shifted on account of incomplete distribution of PVC cannot stand, as it has been evidenced by history that not all who collect their PVC will eventually vote. The paper also employed pathotic mode of argumentation when it averred that, "INEC must know that the fate of 170 million Nigerians is in its hands. Prof. Attahiru Jega must be on top of his game by discharging the responsibilities reposed on him creditably." The use of pathotic mode of argumentation, it could be argued, was designed to appeal to the emotions of INEC chair and entire staff to come to terms with the fact that the future of Nigeria depended on the conduct of the election.

An *Independent* editorial, "The looming Police strike" published on March 9, 2015 used a deliberative argument to argue against the proposed strike. Employing logetic mode of argumentation, the paper built its argument on two premises: one, that the date for the strike was ill-timed, "it is ominous why the Police officers chose that date which is potentially ruinous to the deferred election"; two, that the law does not permit police

officers to go on strike, “Obviously, the Police Act forbids officers and men of the Nigerian Police Force from unionizing and going on strike considering the essential nature of their job.” A pathetic mode of argumentation was also used to appeal to the officers.

We however appeal to the officers in national interest to refrain from embarking on strike and toe the path of discipline and patriotism which is the hallmark of their calling and pursue their demands through official channels (*Independent*, March 9, 2015)

The editorial, “Disqualify Under-Aged Candidates Before Polls” which appeared in *Leadership* newspaper on January 23, 2015 is a deliberative argument. The paper contends that allowing under-aged candidates to stand for election could “leave room for politicians to latch on to technicalities to wrest from people a mandate that was freely given by the electorate.” Applying deductive argument, the editorial cited legal provisions which spelled out age requirements of candidates, as well as the possible circumstances (typographical errors) that could have led to the emergence of those under-aged candidates. The editorial insisted that:

INEC’s role in this democracy is not that of a rubber stamp agency for frivolous politicians and parties. It should weed out unserious candidates and parties. We believe that INEC has the moral right as a regulatory commission to screen, sanitise, monitor and sanction the amorphous bodies that call themselves political parties (*Leadership*, January 23, 2015).

The editorial made use of pathetic mode of argumentation by asserting that “INEC has a moral right as a regulatory commission to screen, sanitise, monitor and sanction the amorphous bodies...” This is an appeal to INEC’s sense of judgment geared towards getting INEC to act morally on the under-aged candidates, even when they have no legal powers to do so.

### Call for Rational Voting

Newspaper editorials selected for this study made a strong case for rational voting. It firmly believes that the electorate can only make significant impact in an electoral process if they vote with appreciable degree of understanding of the implications of their decisions. This is particularly true for a young democracy like Nigeria where people’s voting decisions are usually not based on the overall good of the country but on ethnic, parochial and selfish gains. Thus, the editorials made concerted efforts at encouraging the electorate to vote based on full information about the candidates and their views on issues affecting Nigeria. These editorials also reminded the electorate that current difficulties Nigerians are experiencing are a consequence of voting for unprepared leaders. This editorial, “Now that Candidates have Emerged” published in *Leadership* newspaper on December 13, 2014 was written to make a case for rational voting. It is the opinion of the editorial that the electorate cannot vote wisely without the knowledge of where the candidates stand on key issues confronting the nation. For this reason, the paper highlights some issues candidates must address. Making a logetic argument, the paper posited that the need for the electorate to vote rationally was due to the sorry state of the economy. To say that the nation’s economy is indescribably directionless would be being charitable, because, in our opinion, not much is

going on to give the people hope of a better tomorrow. With inflation on the gallop, existence for many Nigerians has become drudgery. Unemployment that politicians talk about glibly must be made the centre of national political discourse and measures designed to bring the scourge within acceptable limits through programmes that are statistically measurable clearly defined (*Leadership*, December 13, 2014).

It also employed forensic rhetoric to explain why the private sector has not been able to generate jobs as expected.

Ordinarily, one would have expected the private sector to be the engine room of efforts to generate jobs, but the nation’s experience in the last four years is such that with all the incentives put in place not much has been achieved, simply because the private operators see such policies as avenues to recoup investments in the political arena (*Leadership*, December 13, 2014).

For this reason, the editorial insisted that “Henceforth, Nigerians must say no to such fraudulent disposition.”

A *Vanguard* editorial on March 26, 2015 titled, “For Votes to Count”, using a deliberative rhetoric, argued in favour of Nigerians voting with high degree of thoughtfulness. While making a forensic argument, it warned that “if Nigerians do not approach the elections with circumspection, 2015 would produce the same unsatisfying outcome we have had since 1999.” Applying a logetic mode of argumentation, the editorial counselled that:

It is important too that those who we are electing would lead Nigeria out of economic gloom. Candidates we are electing should have clear milestones for assessing how they would redirect Nigeria from further drifting (*Vanguard*, March 26, 2015).

While making an inductive argument by causal relationship, the paper submitted that:

Nigerians’ dissatisfaction with our current political system stems from two points, the near total neglect of the welfare of the people and the aversion of public office holders to accountability (*Vanguard*, March 26, 2015).

A similar editorial, “Nigerians, Their Future” was also published in the *Vanguard* on February 16, 2015. In the editorial, the paper argued for the election of leaders who will retrieve the nation from its current sorry state. The paper made an inductive argument by causal relationship when it claimed that incompetent leadership has resulted in the scandalous performance of government.

The scandalous performance of governments, with very rare exceptions, should be one of the issues to be judged as Nigerians vote for their future that exceptional incompetence has suspended in the past 16 years.

Nigerians have endured unnecessary hardship since 1999 because state governments with the connivance of the powers in Abuja elected backwardness, and at best a blurred future, for the country. Ravaging poverty has reduced the people to helplessness never seen in the past (*Vanguard*, February 16, 2015).

The editorial equally employed forensic argument in denouncing past performance of politicians in governance.

Either through surrogates, who are promising a freshness alien to them, or directly by themselves, they want to consign the

future of Nigerians to the inattentive treatment it receive since 1999.

All those who have abused their offices, neglected the people, created communal conflicts to feather their interests, must be denied the chance to continue the waste of our people and their opportunities.

The search is on for leaders who will retrieve Nigeria from the precipice many of those in power condemned it to since 1999 (*Vanguard*, February 16, 2015).

Using a logetic mode of argumentation, the editorial cited how some candidates emerged as party flag-bearers as a foretaste of what some politicians have in stock for the populace.

The overbearing conduct of our leaders saw many of them breaching laws to have their ways in appointing their successor, and foisting on us future parliamentarians who belong to the same retrogressive past (*Vanguard*, February 16, 2015).

In this section, the study examined the kinds of argument and modes of argumentation used by editorial writers to make these editorials persuasive.

## Conclusion

This study sought to examine how four Nigerian newspapers, through their editorials, argued for free and fair 2015 elections in Nigeria. Editorials are identified as very critical during tense periods such as elections because the audience rely on their reasoned opinions to make informed decisions. As a responsible citizen, newspapers using their editorials argued for what it considered to be in the best interest of the society. In the performance of this duty, Nigerian editorials employed argumentation to make three kinds of calls during the 2015 poll namely: calls for violence-free polls, call for credible electoral process and call for rational voting. These arguments represented three important aspects of the nation's electoral system which makes addressing them not only important but central to achieving free and fair polls. In doing this, the editorials employed pathos, logetic and ethos modes of argumentation. On ethos mode of argumentation, the practice of non-endorsement of any political party, at least publicly, puts these newspapers in good stead serve as disinterested umpire whose views will not be read as having partisan undertone. The papers tried to enhance the credibility of their argument by emphasizing the consistency of their stance as well as their even-handedness in dealing with different political actors. Logetically, most of the arguments advanced in these editorials were premised on the provisions of the law as evidence to support whatever view they hold. By doing this, the editorials sought to convince the reader to accept their point of view based on the evidence adduced. For instance, in making a case that the electorate vote rationally, a *Vanguard* editorial pointed out that the scandalous performance of Nigeria's political leaders was a consequence of ethnically-based voting pattern. With respect to pathos, these editorials appealed to the emotions of the addressees (Prof. Attahiru Jega, INEC staff, E.K Clark, members of the Nigeria police force etc.) to engender acceptance of the views. A case in point is the appeal to officers and men of the Nigeria Police Force against their planned industrial action during the polls in which *The Independent* urged them to reconsider their decision in national interest. Similar appeal was made to INEC by *The Independent* in which they were told that the fate of the nation depended on

them. These editorials used forensic, epideictic and deliberative kinds of argumentation in arguing diverse positions. For instance, editorials advocating for rational voting made use of deliberative kind of argumentation as it warned that the nation would still face the problem of poor governance if the electorate voted without a measure of wakefulness or thoughtfulness. There was a preponderance of deliberative argument because the editorials were written preparatory to the polls. Hence the editorials argued against the undesirability of certain aspects of the electoral process in the hope of changing the views of the electorates, government or electoral umpire with respect to the elections. These arguments were made with the sole purpose of persuading the addressees to accept particular kind of arguments. Taken together, these editorials made these arguments in the hope of achieving credible, free and fair polls.

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# The Potential of Smart-phones as a Portable Diagnosis Tools

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DOI: 10.29322/IJSRP.8.8.2018.p856

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8056>

**Abstract:** Mathematical algorithms of smart phone applications have rapidly growing, transforming smart phones into optical readers to quantify and measure colorimetric changes occurred at different type of colorimetric test strip as well as portable lens or lens free microscope . Making it an inexpensive and accessible alternative diagnostic tool to replace more costly commercial systems. This paper presented the global trend of using smart-phone platform based on optical theory.

**Keywords:** Smart-phone algorithm, lens free microscope, colorimetric detection, POCT, optical biosensor.

## 1. Introduction

The wide utilization of smart phone has been growing rapidly in the last five years, the global subscriptions raised up to 70% reaching around 6.8 billion at the end of 2013 [1]. Therefore, exploiting the available smart phone mobile's infrastructure in health care management will accelerate health procedures toward disease monitoring and diagnosis. As well as reduce the cost of health care management for existing and emerging diseases. Smart phones camera's have been suggested to be use as diagnosis tool based on their ability to work as image sensor and visible-light spectrometer. These principles are utilized in a wide field of medical application including chemical analysis for laboratory tests [2]. Recently, smart phones applications have been showed a great potential for point of care diagnostics, which can be coupled with dipsticks, lateral-flow strip and colorimetric tests in solution that are typically read by spectrophotometers or micro plate readers [3]. Many studies demonstrated the utilization of smart phone's algorithm to achieve quantitative measurement of point of care strips through quantifying pathological indicators or concentration of biomarkers in samples such as urine sample, blood sample or saliva sample. Yetisen et. al 2014 showed the potential of smart phone algorithm to quantify the concentration of protein, glucose and pH in artificial urine samples. Resulting high sensitive and reproducible measurements [4]. The capability of smart phone functioning as spectrophotometer was reported by Gallegos et. al 2013, customized software application was developed to convert smart phone camera image's into photonic spectrum in the visible wavelength rang in combined with curve fitting to detect the immobilized protein [5]. Moreover, JUNG et. al 2015 showed the potential of smart phone to detect alcohol in saliva sample by developing an integrated optical attachment based on smart phone camera. Enzyme reaction producing a gradient of color intensity at test kit from light to dark green proportional to ethanol concentration, matching the concentration of alcohol with light intensity by curve fitting, then an algorithm used to calculate the concentration of alcohol and display the result by Smartphone along the web according to geo-location at which the test was made [6]. Connecting the smart phone to the internet via telecommunication network enable the user to share their test result with consultant centre or hospital which play a significant role in health care management especially for patients at remote area.

## 2. Methodology and Principle of Operation

The utilization of smart phone application as portable clinical diagnostic tools based on point of care test (POCT) has been rapidly increasing and become a global trend. However, there are many platforms used by Smartphone application to detect different biological indicators such as enzymes, cells, nucleic acids, antigen-antibodies and microorganisms. The detection methodology could vary depending on the biological derived materials including optical-based testing methods such as optical reader, imaging, absorbance, reflectance, fluorescence and colorimetric analysis.

### 2.1 Smart-phone based microscope

Generally, many diseases can be diagnosed in laboratory under the utilization of microscopes such as bacterial infections, blood-borne diseases and tumor cell detection. The obtained image by microscope is magnified by a series of lenses enabling the operator to see clearly small microorganism by naked eye. In 2007, Frean et al showed that mobile phone camera's has the

potential to capture images from the eyepiece lens of a microscope and can be used for bio-detection of microorganisms. Inspired by Frean's work, many research groups began to use imaging systems based on smart-phones camera for bio-detection such as Zhu et al.2013 and Meng et al.2017 [7,8]. The smart-phone based microscope has an extra attachment consists of a series lenses and other optical components coupled with CMOS components working as microscope which obtain an image of analytes. More advanced effort have been developed to improve the image quality of smart-phone based microscopes. Breslauer et al. 2009 developed a smart-phone based microscope with long lens system as an attachment to phone camera. The attached lens system shown in figure-1 simulates all typical components of microscope including a light-emitting diode (LED) as a light source, condenser lens, a sample stage, an objective, an eyepiece and several filters which are used for fluorescent detection of microorganisms [9].

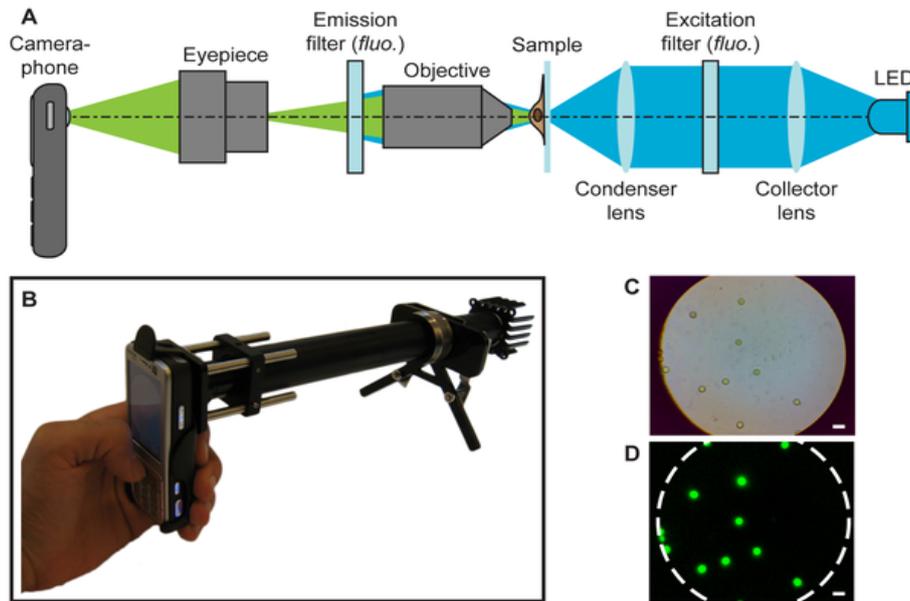


Figure 1: Mobile-Phone based Microscopy

Part (A) of figure-1 shows optical system of mobile-phone based microscopy which is necessary for fluorescence imaging and consist of optical eye piece, filter, objective, excitation filter and LED light source. Part(B) is the developed prototype device by Breslauer and his coworkers where the sample is adjacent to the focusing knob. Parts (C and D) represent bright field and fluorescent image. The prototype device was characterized for clinically relevant applications by using bright field illumination to capture high-resolution images of both thin and thick smears of malaria-infected blood samples, as well as of sickle cell anemia blood samples [9].

Oh the other hand, many researchers have performed studies on mobile-phone based lens free microscopes to reduce the cost, size and the weight of diagnostic tool. Tseng et al. 2010 demonstrated the use of lens free microscope shown in figure 2, where the samples are loaded from the side and are vertically illuminated by incoherent LED light coupled with lens free imaging platform. The scattered incoherent light from each micro object in the sample area interfere with background light, enabling lens free hologram of each object to be detected at an array detector at platform. The holographic signatures captured by phone camera's to reconstruct microscopic image of tested object. Clinically, Tseng et al. utilized mobile-phone based lens free microscope successfully in various size micro-object such as red blood cells, white blood cells, platelets and water born microorganisms such as *Giardia lamblia* [10].

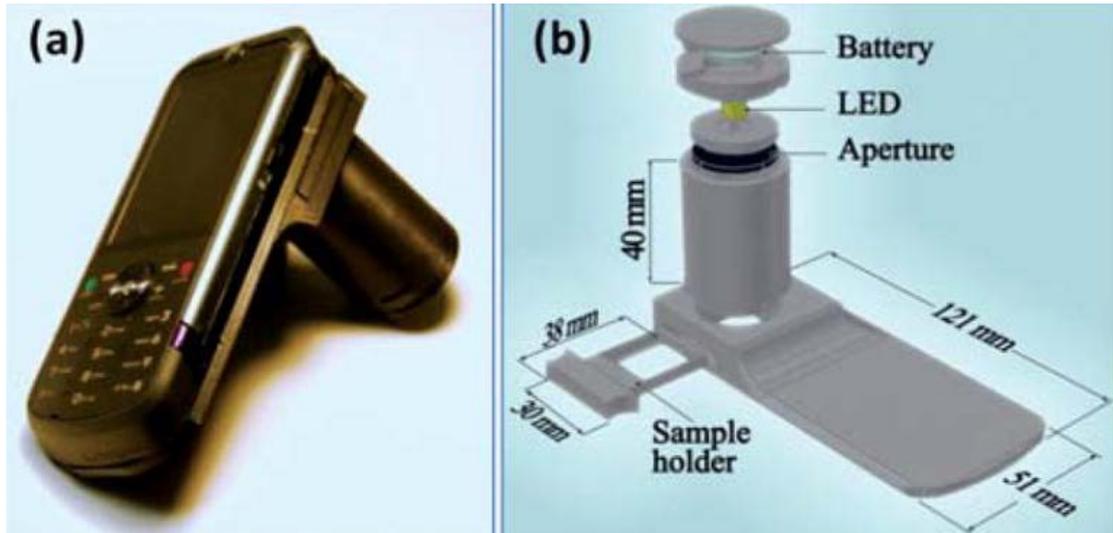


Figure 2: a- Mobile-phone based lens free microscopes, b- Schematic diagram

Tseng and his colleges found that computing power of old mobile phone not compatible to proceed calculation algorithm for mobile-phone lens free microscope and reported that as a significant limitation. Therefore they used a desktop PC to achieve calculation and analysis. Other study used a smart-phone with high processor efficiency to develop mobile lens free microscope and overcome the previous limitation as shown in figure 3. Lee and Yang et al. 2014 who used a technique based on replacing lens module and placing the sample directly at image sensor to obtain direct shadow image of object under ambient light source such as lamp, LED or sun light. Then, multiple images at various angle of illumination were captured to improve image reconstruction. This technique of smart-phone based lens free microscope improving imagining quality over a wild range field of view, and enabling image acquisition and reconstruction to be perform on smart-phone device by an algorithm compatible with commercial android system [11].

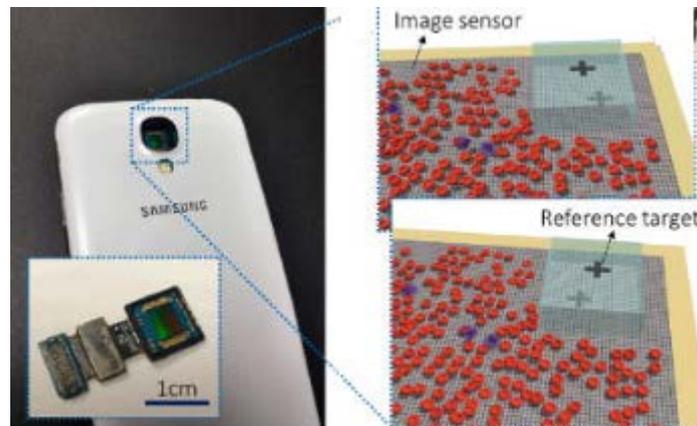


Figure 3: Smart-phone based lens free microscope, by Lee and Yang.

Clinically, Lee and Yang used the prototype smart-phone based lens free microscope to examine blood smear and fresh water microorganism for water quality monitoring. The obtained results demonstrated high capability of smart-phone based lens free microscope to capture high resolution images for microorganisms as well as image acquisition, analysis and reconstruction can be achieved by smart-phone processor coupled with certain mathematical algorithm.

## 2.2 Smart-Phone based Colorimetric Analyzer

Nowadays, Smart-Phone based colorimetric analysis is a global trend due to its simplicity and low cost. The innovating technology of smart-phone based colorimetric analysis mainly focusing in lateral flow immunoassay (LFIA), enzyme-linked immunosorbent assay (ELISA), chemiluminescence and electro-chemiluminescence as a detection method coupled with smart-phone's camera to obtain accurate results. The phone camera is significant part that used to capture images of the reference sample and the target sample, respectively. Comparing color changing between reference sample color and target sample color to obtain the test result. In fact, color in captured images is very sensitive to the light conditions and the quality of used camera, therefore the reference sample color should be obtained under that same condition as the target sample to avoid any effect of light. Colors with electromagnetic radiation wavelength between 380 to 780 nm can be seen by human eye. However, the light transmitted or reflected from the object depends on its spectral characteristics (light absorbed by an object at different wavelength) as shown in

figure 4. Regarding an image, each spatial point has its own color stimuli in the form of a spectral power distribution, color stimulus values produce the incoming or measured signal to the imaging device and then quantified as a numbers in digital imaging reconstruction system.

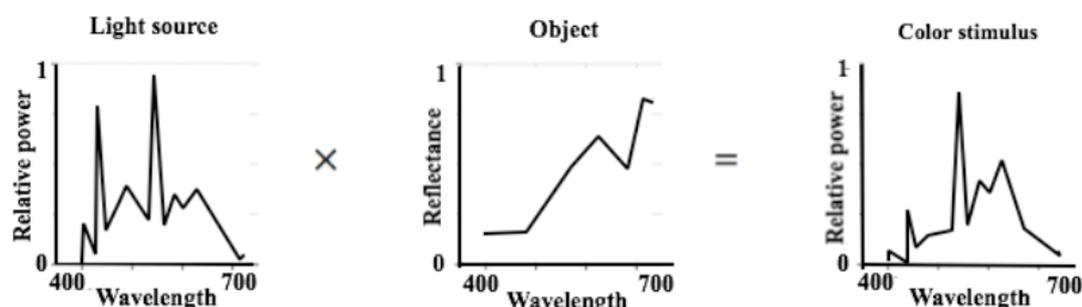


Figure 4: Color stimulus from an object and production of the relative power distribution

Smart-phone cameras made of complementary metal-oxide semiconductor (CMOS) which is consider as digital image sensors, detecting light as an arrays consisting of small detection sites (pixels), each pixel producing a signal proportional to the number of detected photons and generate only one of the three primary colors red, green or blue, enabling smart-phone cameras to work as digital image detector.

Jong II Hong and Byoung-Yong Chang et al. 2014 developed digital colorimetric detector using a smart-phone camera to report the result of urine test strips in term of color change. Urine test strips was examined visually by naked eye to determined abnormal level of leucocytes, specific gravity, pH, glucose, nitrite, protein, ketones, bilirubin and red blood cells (RBC) in urine. Then smart-phone camera used to obtain digital image of tested urine strip. The measured color at each pixels are digitalized using special correction algorithm, then the corrected color measurements converted into its related concentration value according to preloaded calibration curve. Finally, the results showed that ability of smart-phone camera to detect colorimetric change at urine dipstick and determined the abnormal value of tested pathological indicators [12]. In addition to that, Oncescu et al. 2013 suggested a rapid detection method for colorimetric changes based on smart-phone coupled with accessory strip to detect pH level in sweat or saliva samples. Reference strip was made of white plastic material, comparing the resulted capture image from pH test strip with reference one, showing the changes in white balance color on the camera during colorimetric detection [13]. Also, Shen et al. 2012 introduced a novel method to quantify colorimetric changes in assay by smart-phone coupled with disposable urine strips. Colorimetric reference values was used to obtain calibration curve that describes high accuracy pH measurement with linear response [14]. In addition to that Yetisen et al. 2017 showed a fluorescence biosensor based on point of care technology (POCT) to analyze tear significant components related to ocular disorder such as Na , K , Ca and pH. The POC micro-fluidic strip was placed at portable readout device consisting of series of LEDs illuminating at different wavelength to obtain fluorescence excitation. After that, smart-phone camera was used to capture fluorescence image for POC strip which were analyzed and digitalized by smart-phone application to obtain associated concentration value for quantitative test of tear fluid [15].

### 3- Conclusion

Smart-phone algorithms are playing a significant role in global trend to improve and develop new methodology of portable diagnostic tools. Smart-phones are showing a great potential as consistent and reliable diagnostic reader coupled with algorithms allowing smart-phone's camera to read quantitative measurement and detect analyte or microorganisms. The new technique platform has been widely used smart-phone based optical bio-sensing due to the high quality of the built-in camera serving as a detector, usually a spectrometer or a microscope in the laboratory applications. In parallel, the improvement of POCT has been an emerging subject in the medical field to reduce the cost and the working time, assisted by smart-phone algorithm to digitized values for more accurate and versatile measurements. Recently, global specialists believe that the utilization of smart-phone algorithms will become more and more convenient and usable in the near future. Especially, for the optical biosensors based on smart-phone platforms allowing rapid, low cost and portable diagnostic tool connected with telecommunication network to share the obtained results.

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# Analysis the Influence of Third-Party Funds, Return On Assets, And Non Performing Financing toward Total Financing Of Sharia Rural Bank in Indonesia

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DOI: 10.29322/IJSRP.8.8.2018.p8057

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8057>

**Abstract-** This study examines the Influence of DPK, ROA and NPF to Total Financing at Sharia Rural Bank (BPRS) In Indonesia. The independent variables in this research are DPK, ROA, and NPF while Variable in this research is Total of Sharia Financing. The data is the monthly data issued by the Financial Services Authority in the statistics of Islamic Banking Period 2011 - 2016. This research uses multiple linear regression model. The results of this study indicate that during the observation period the research data is normally distributed. This research uses multiple linear regression model. DPK positive, DPK previous year was negative, ROA of previous year was positive and NPF was negative to Total Financing at SRB in Indonesia. The value of the variable to the total loan amounted to 99.28 percent by the amount of Adjusted R2, while the remaining 0.72 percent by other factors not included in the research model.

**Index Terms-** Total financing, DPK, ROA, NPF

## I. INTRODUCTION

SRB operates in districts or municipalities with limited scope as well as relatively small capital. The initial capital of BPRS establishment starts from Rp. 500 million, which is the undertaking of the Good Corporate Governance (GCG). (Ascarya, 2007)

One aspect that plays an important role in bank performance is the bank's ability to collect third party funds, which can be in the form of savings, time deposits, or current accounts. In this case, Islamic banks use a profit sharing ratio in attracting customers to deposit their funds in sharia banks (Maslahah, 2011).

Return On Asset is a ratio that is able to measure the company's ability to generate profits in the past. If the ROA of a larger bank, the better of the bank's position in terms of asset security (Dendawijaya, 2000)

Internal factors of the bank should also be considered in providing financing to the public, one of which is related to liquidity risk that is non-current financing (Riyadi, 2004).

Based on the above description, the authors are interested in researching and developing a thesis entitled "The Influence of Third Party Funds (DPK), Return on Assets, and Non Performing Financing (NPF), to Total Financing provided by Sharia Rural Banks in Indonesia."

## II. IDENTIFY, RESEARCH AND COLLECT IDEA

The basic theory of financing is related to profit-sharing theory which explains the distribution of some parts of the profits to the employees of an enterprise and the funding theory which is the activity of placing money into investments or other types of reserve funds (Firdaus, 2012). The previous research by Wahyudi (2010) the results showed that there is a positive and insignificant influence between the DPK and ROA, to the outflow of funds BSM. Research of Jamilah (2016) the result of this research is DPK have a

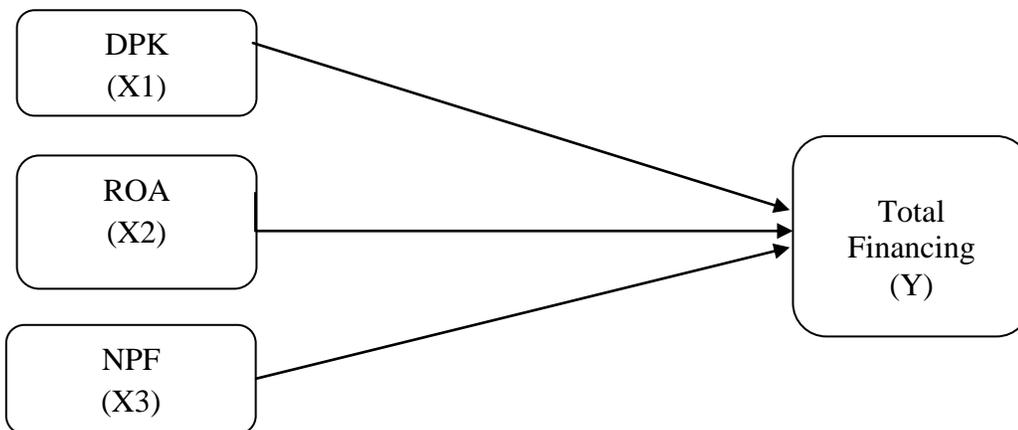
positive effect on mudharabah financing, ROA has negative effect on mudharabah financing, and NPF has no positive effect on mudharabah financing. Research of Mizan (2017) shows that third party funds and Non Performing Financing (NPF) to the distribution of murabahah financing, Capital Adequacy ratio (CAR), Return On Assets (ROA), Debt to Equity Ratio (DER) variables do not affect the murabahah financing in Syariah Commercial Bank in Indonesia. Differences in the results of this study that makes researchers interested in further research.

The type of data used in this study is secondary data. Secondary data used in this study is time series data, in monthly form in the period of January 2011 until December 2016. Data obtained from OJK.

## RESEARCH VARIABLE

1. Financing  
Financing is the growth in the total amount of financing disbursed by the SRB during the period January 2011 to December 2016 in the form of percent. The financing component consists of financing transactions using mudharabah and musyarakah contracts, ijarah transactions, murabahah transactions, salam, and istishna, and qardh transactions.
2. Third Party Fund (DPK)  
Third party funds represent the growth of funds gained from the public in the form of percent. Where third party funds consist of savings deposits in the form of savings, as well as unrestricted investment funds in the form of mudharabah savings, mudharabah deposits and other unrestricted investments during the period January 2011 to December 2016.
3. Return on Assets (ROA)  
Return on Assets (ROA) is the ability of the SRB to generate an overall profit. The calculation of ROA Ratio is the same as Profit before Tax in the last 12 months divided by Average Assets in the same period.
4. Non Performing Financing (NPF)  
Non Performing Financing (NPF) is the ratio between NPF with total financing channeled by the SRB. The NPF in this study is measured from Total Troubled Financing divided by total financing

## RESEARCH FRAMEWORK



Picture 1 Research Framework

Hypothesis in this research is formulated as follows:

1. Third Party Funds (DPK) affect the total financing
2. Return on Aseet (ROA) affect the total financing
3. Non Performing Financing (NPF) affects total financing
4. DPK, ROA, and NPF simultaneously have an effect on total financing

This research uses multiple linear regression model. Regression model to find out the independent variables (DPK, ROA, NPF) with independent variables (Total Financing), in general:

$$TP = f(DPK, ROA, NPF)$$

Furthermore, the econometric model used is:

$$TP = \alpha + \beta_1 DPK + \beta_3 ROA + \beta_4 NPF + e$$

The formula that formed in this research as follows:

$$TP_t = \alpha + \beta_2 DPK_{t-1} + \beta_3 ROA_t + \beta_4 NPF_t + \beta_5 TP_{t-1} + e$$

Where:

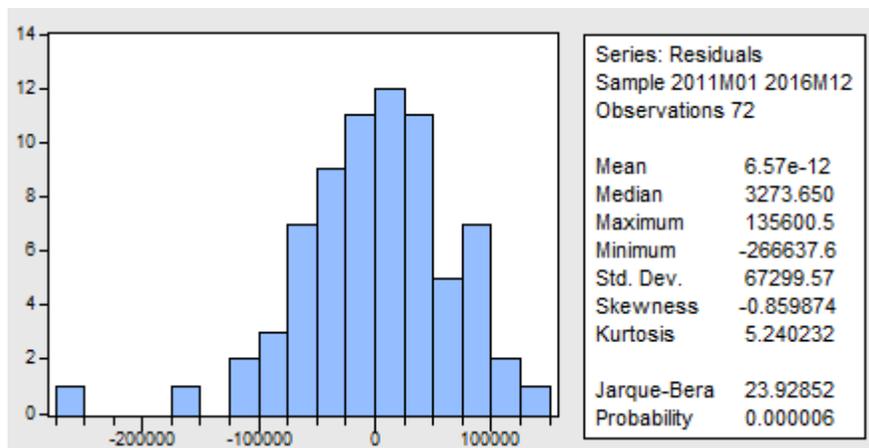
- TP : Total Financing
- DPK : Third Party Funds
- ROA : Return on Assets
- NPF : Non Performing Financing
- A : Constants
- B : Regression coefficient
- t : Time Period
- t-1 : previous time period
- e : Error (error term)

The magnitude of the constant is reflected by  $\alpha$  and the magnitude of the regression coefficients of each independent variable shown by  $\beta_1, \beta_2, \beta_3$ .

### III. FINDINGS

#### 1. Normality test

This normality test aims to test whether the dependent variable regression model, independent variable or channel is normally distributed or not. Good models are those that have normal distribution data



Picture 2 Normality Test

Jarque-Bera analysis result shows 23.92 value while  $\chi^2$  value with significant value 0,05 or probability 0,95 is 51,73. Because the value of Jarque-Bera  $< \chi^2$  then indicates that the data is normally distributed.

Table 1 Multicollinearity Test Results

	DPK	DPKT_1	ROAT_1	NPFT_1
DPK	1.000000	0.074473	-0.119721	-0.240088
DPKT_1	0.074473	1.000000	0.037224	-0.357833
ROAT_1	-0.119721	0.037224	1.000000	-0.078762
NPFT_1	-0.240088	-0.357833	-0.078762	1.000000

Source: Processed data, 2017

A model is said to meet the assumption of non-multicollinearity that a relationship variable that has a value greater than 0.9 Based on the above table, it can be concluded that the model has met the assumption of non-multicollinearity.

#### Autocorrelation Tests

Based on Table 4.3 the D-W value at the 0.05 significance level,  $k = 3$  and  $n = 72$  then obtained nine  $dl = 1.525$  and  $du = 1.703$ , whilst the Durbin Watson (DW) count is 2,104 and the value  $(4-du)$  is 2,297. Since  $DU < DW < 4-DU$  value indicates no autocorrelation

## Heteroscedasticity Test

Table 2 Heteroscedasticity Test Results

### Heteroskedasticity Test: Glejser

F-statistic	1.497837	Prob. F(5,66)	0.2025
Obs*R-squared	7.337424	Prob. Chi-Square(5)	0.1967
Scaled explained SS	8.031247	Prob. Chi-Square(5)	0.1545

Source: Processed data, 2017

Prob value. From F arithmetic and Chi-Square calculated from Glejser test results in this study is said to be free from heteroscedasticity because t-count value < t-table with probability significance above alpha 0.05.

## Hypothesis Test Results

### 1) Test Result F

F test results can be seen in Table 4.3. Prob value. F (Statistic) of 0.00000 is smaller than the 0.05 significance level so it can be concluded that the estimated regression model is feasible to be used to explain the influence of Third Party Fund, Return on Assets, and Non Performing Financing on the dependent variable of Total Financing.

### 2) Coefficient Test Results Determination (R2)

Based on the estimate equation, the value of adjusted R squared is 0.9928. This indicates that the variation of the change of variable Y can be explained together by the variables of Third Party Fund, X2 Return On Asset and Non Performing Financing of 99.28 percent while the remaining 0.72 percent explained by other factors not described in the model of this equation.

### 3) Partial Test Results (t test)

Based on Table 3 then t test results are:

The third party fund variable is obtained by t-count 90.01 and probability 0.00. This shows that the DPK has a positive and significant effect on total financing

Variable of third party funds in the previous year was obtained t-count -5.27 and probability 0.00. This indicates that the previous year DPK had a negative and significant effect on total financing

The variable return on asset of the previous year is obtained t-count 2.31 and probability 0.02. This shows that the previous year's ROA has a positive and significant effect on the total financing

The variable of net performing financing of the previous year was obtained t-count -2.07 and probability 0.04. This indicates that the NPF of the previous year had a negative and significant effect on total financing.

The total variable of previous year's financing is obtained t-count 3.49 and probability 0.00. This indicates that the total financing of the previous year had a positive and significant impact on total financing

From the data obtained then processed using the program Eviews 6.1. Results Model (equations) multiple linear regression that has been estimated in the table as follows

Tabel 3 Estimated Result

Dependent Variable: TP  
 Method: Least Squares  
 Date: 07/06/17 Time: 12:02  
 Sample: 2011M01 2016M12  
 Included observations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7042.173	20711.98	0.340005	0.7349
DPK	1.129417	0.012547	90.01282	0.0000
DPKT_1	-1.028458	0.194938	-5.275806	0.0000
ROAT_1	12358575	5328547.	2.319314	0.0235
NPFT_1	-4176118.	2010054.	-2.077615	0.0416
TPT_2	0.840842	0.240411	3.497519	0.0008
R-squared	0.992823	Mean dependent var		-28947.50
Adjusted R-squared	0.992279	S.D. dependent var		794389.2
S.E. of regression	69802.26	Akaike info criterion		25.22438
Sum squared resid	3.22E+11	Schwarz criterion		25.41410
Log likelihood	-902.0775	Hannan-Quinn criter.		25.29990
F-statistic	1825.945	Durbin-Watson stat		2.104994
Prob(F-statistic)	0.000000			

Source: Processed data, 2017

The multiple linear regression (equation) models that have been estimated below:

$$TP = 7042.173 + 1.129417DPK - 1.028458DPK_{t-1} + 12358575ROA_{t-1} - 4176118NPFT_{t-1} + 0.840842TPT_{t-2}$$

1. The Influence of Third Party Funds To Total Financing

Result of t test get statistical t value equal to 90.01 and value of probability equal to 0.00 (less than 0.05). This means that partial funds have a positive and significant effect on total financing.

Positive influence means that more DPKs make higher total costs. Vice versa, the lower the DPK then the total spending is also lower. Based on the regression coefficient, DPK yields a value of 1.129. This means that any increase in DPK by 1 percent will decrease the total financing by 1,129 percent.

The results of this study are Khatimah (2009) which states that the DPK has a positive and significant effect on financing. This analysis also shows that the amount of expenditure disbursed by an SRB in Indonesia depends on the funding factor that can be collected by an SRB from the community.

The positive effect of DPK on financing is also seen from the growth data every year. Where the growth of DPK rose from Rp. 1,640,651 million in January 2011 to Rp. 2.095.333 million in December 2011, this incident with an increase in financing which also increased from Rp. 2.084.220 million in January 2011 to Rp. 2.675.930 million as of December 2011.

As for the previous year DPK T test results get negative statistical t value and value of probability of 0.00 (smaller than 0.05). This means that third party funds is negative and significant to financing.

Negative influence means DPK year after making the total financing down. Vice versa, the higher the previous year DPK then the total cost is also lower.

2. Influence of ROA Against Amount of Financing

The result of t test gets the value of t equal to 2.31 and the value of probability is equal to 0.02 (less than 0.05). This means that the previous year's ROA has a positive and significant effect on total financing.

Positive influence means the higher the ROA of the previous year then the financing will also be higher. Vice versa, the more ROA makes the shopping lower. Based on the regression coefficient, the ROA of the previous year yields a value of 1235. This means that an ROA of 1 percent will increase total financing by 1235 percent.

The Research of Wahyudi (2010) which concludes that positive and significant ROA on mudharabah financing.

For example, in July 2011, financing rose to Rp. 2,501,869 million, and ROA also increased by 2.74 percent. In August 2013, the financing decreased by Rp. 4,240,623 million and ROA also decreased by 2.85 percent. Meanwhile, in January 2015 the financing decreased by Rp. 5.004.436 million, but the ROA of the increase of 2.31 percent.

### 3. The Influence of Non Performing Financing To Total Financing

The result of t test get statistical t value equal to -0,026 and value of probability equal to 0.04 (less than 0,05). This means that NPFs in the previous year partially have a negative and significant effect on total financing.

Negative influence means that higher NPFs make financing down. Vice versa, the lower the NPF will rise. Based on the regression coefficient, the NPF of the previous year has a value of -4176. This means that each NPF stream of 1 percent will reduce total financing by 4176 percent.

The results of this study are similar to the authors' hypothesis which is also in line with previous research by Maula (2009) which states that NPF is characterized negatively on financing. This analysis also shows that the amount of expenditure disbursed by an SRB in Indonesia depends on the funding factor that can be collected by an SRB from the community.

## IV. CONCLUSION

Based on the results of the research, it can be concluded that the DPK is positive and significant, DPK previous year is negative and significant, positive and significant ROA, and NPF have negative and significant effect to total financing in BPRS in Indonesia. The variable of variable Y is the variable that is adjusted to the variables of Third Party Fund, Return on Asset and Non Performing Financing equal to 99.28 percent while 0.72 percent by other factors not included in this model. Hopefully with this Research Sharia banking and practitioners can pay more attention to Sharia Financing Bank in Indonesia. In addition, the NPF rate of SRB is quite high above 5 percent need to be a concern in order to further improve productivity and effectiveness.

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# “The Spacio-Temporal Changes of Kiri Dam and Its Implications” In Adamawa State, Nigeria.

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DOI: 10.29322/IJSRP.8.8.2018.p8058  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8058>

## **ABSTRACT**

*This study focuses on the assessment of the spatial and temporal changes of Kiri lake between 1984 and 2016. The study used both geo-information techniques and field survey to carry out analysis on the spatial as well as the changes in the depth of the lake. Landsat TM and OLI of 1984 and 2016 respectively were digitized in order to determine the extent of surface area changes that has occurred. Field method was used in determining changes in the depth of the lake. The results revealed that the lake has reduced in both surface area and depth. The surface area of the lake in 1984 was 100.3 m<sup>2</sup> which reduced to 57.0 m<sup>2</sup> in 2016. This means that the surface area of the lake has reduced by 43% within the period of 32 years whereas the depth has reduced by more than half of its original depth. The original depth of which was 20 m has reduced to an average depth of 8.48 m. This revealed that an average siltation of 11.52 m has occurred within the period under study. The implication of this shrinkage will be devastating on the savannah sugar cane plantation that depends on the lake for its irrigation water thereby affecting the company and the economy of people that earn a living from it. The study therefore recommends that the lake should be dredged to remove silted materials that have accumulated over the years and for a long lasting solution, the catchment should be protected from erosion by planting and protecting vegetation cover in the area.*

**Keywords:** Lake, siltation, Landsat, water, irrigation, dam

## **Introduction**

Water is an important abiotic component of the ecosystem which is widely regarded as the most essential of natural resources that makes life possible on the Earth's surface. However, freshwater systems are directly threatened by human activities and stand to be further affected by anthropogenic climate change (Vorosmarty *et al.*, 2010). The global average lake surface water warming rate due to climate change shows a 20% increase in algal blooms and a 5% increase in toxic blooms over the next century as well as a 4% increase in methane emissions from lakes during the next decade (O'Reilly, *et al.* 2015). Increased evaporation associated with warming can lead to declines in Lake water level, with implications for water security.

Rivers are part of the hydrological cycle that connects the webs of life, bringing together freshwater, marine and terrestrial environments. They are critical natural processes that have shaped the diversity of life on earth, as well as human patterns of civilization. The world's rivers are facing numerous crises due to degradation mainly due to human use of the environment. Human dependence on freshwaters has contributed to habitat degradation in many places. Water pollution and biodiversity loss as a result of

changes in land use has altered water courses and led to invasion of new species (Malmqvist & Rundle, 2002; Dudgeon *et al.*, 2006; Martinuzzi *et al.*, 2014).

The planetary life cycle processes of rivers are affected by pollution in many ways thereby affecting the quality and functionality of the world's freshwater. Approximately two-thirds of the world's rivers have suffered impairment from the over 50,000 large dams that have been built over the past century (McCully, 1996). Many of the world's great rivers such as the Indus, the Colorado, and the Yellow river no longer reach the ocean, turning once-productive deltas into biological deserts. Marine environments and wetland ecosystems are experiencing the greatest loss of biodiversity, in large measure due to dam construction more than the losses experienced in tropical rainforests. Over the past 40 years, freshwater ecosystems have lost 50% of their populations and over a third of remaining freshwater fish species are threatened with extinction.

At the moment, the great river basins of the world are experiencing a new wave of damming and each of these rivers is outstanding in its contributions to planetary cycles, biodiversity and human livelihood dependence. However, these basins are threatened by impudent and narrow-sighted schemes that irreversibly disconnect rivers from their major functions thereby costing the planet billions in lost ecosystem services.

All rivers contain sediments which in effect, can be considered a body of flowing sediments as much as of flowing water (McCully, 1996). When a river is stilled behind a dam, the sediments it carries sink to the bottom of the reservoir. The proportion of river's total sediment load captured by a dam is known as its "trap efficiency" approaches 100 per cent for many projects, especially those with large reservoirs. As the sediments accumulate in the reservoir, so the dam gradually loses its ability to store water for the purposes for which it was built. Every reservoir loses storage to sedimentation although the rate at which this happens varies widely. Worldwide around 40,000 large reservoirs suffer from sedimentation and it is estimated that between 0.5% and 1% of the total storage capacity is lost per year (White, 2001). Despite more than six decades of research in reservoir construction and management, sedimentation has probably remains the most serious technical problem faced by the dam industry.

Water flowing in streams or rivers has the ability of scouring channel bed, carrying particles that are later deposited elsewhere. This phenomenon of sediment transport can affect substantially the design of reservoirs. Many cases have been recorded where reservoir siltation rendered water storage structures useless in less than 25 years. Sedimentation problems were observed predominantly with small to medium size reservoirs (with catchment area of less than 100km<sup>2</sup>). Even when dams are equipped with advanced structural features, the hydrology of the catchments and sediment transport processes must be properly taken into account in order to ensure its viability. Therefore, the study reservoirs must be holistic as a complete system, taking into account structural features, hydraulics, hydrology, sediment transport, catchments erosion and catchments management.

Reservoirs created by dams on rivers, get silted through river water. A significant proportion of the sediments settles down in the reservoir, thus reducing the space available for water storage and also produces structural damages to the dam in question and causing appreciable damage to any power generating turbine located within the area. Studies reveal that silts get deposited in all part of the reservoir. Siltation reduces the benefits from dams constructed with a huge amount of money by any nation. This could also have a number of impacts, including increased evaporation losses and could damage the power turbines in event where it is used in power generation (Mama and Okafor, 2011).

The economic importance of dams such as for use in irrigation, power generation, water supply recreation and fishing are determined by the size and volume of water in them. The importance increases with the increase in volume of water it is able to hold. However, anthropogenic sedimentation as a result of watershed disturbances has reduced the capacity of dams to accommodate sufficient water thereby resulting to threats on aquatic ecosystem (McIntyre *et al.*, 2005).

Throughout history, the negative impact of siltation on the efficiency and effectiveness of Dams have been increasing. Siltation reduces the amount of water a reservoir can hold thereby reducing the dam's capacity in meeting up with its objectives of providing continuous flow of water for either Irrigation, Flood Control or Hydro-electric Power Generation. Sediment movement is part of the natural function of freshwater ecosystems, when human activity significantly increases the amount of sediment through their activities, these changes the stream flow which can have significant effects on aquatic flora and fauna. Without significant changes to the current unsustainable use of water resources, future degradation of river, lake, and wetlands will jeopardize both biodiversity and critical ecosystem services relied upon by humanity. Indeed, in many parts of the world, increasing human population and development pressures, create a double squeeze on freshwater ecosystems from both cropland and urban expansion. The expansion of croplands increases the amount of sediments, nutrients, and pesticides entering freshwaters (Martinuzzi *et al*, 2014). Studies have shown that Nigeria is among the nations facing serious threats of water security and biodiversity (Vorosmarty *et al.*, 2010). Hence, this study intends to assess the spatial changes of Kiri Dam and the effects of these changes on the efficiency of the dam to meet its objectives.

## **Study area and methodology**

### ***Study Area***

Kiri Dam is situated in Shelleng Local Government Area (LGA) of Adamawa State. It is located on latitude  $9^{\circ} 53' 5''\text{N}$  and longitude  $12^{\circ} 0' 32''\text{E}$  on an elevation of 170m above sea level (Figure 1). It is located in Kiri village, Shelleng L.G.A in Adamawa State is approximately 35km upstream from the confluence of Gongola/Benue River at Numan L.G.A. Adamawa State. The dam was constructed between 1976 and 1981 and was commissioned in 1982. The catchments area is about 57, 200km<sup>2</sup> from Shere hills on the Plateau to Numan. However, the construction of Dadin Kowa Dam in Gombe State in 1987 has greatly reduced the size of the catchment.

The initial concept of the project is to impound sufficient water during the months of high river flow to meet the water requirements for the irrigation of 12,000 hectare of sugar cane plantation for the Savannah Sugar Company.

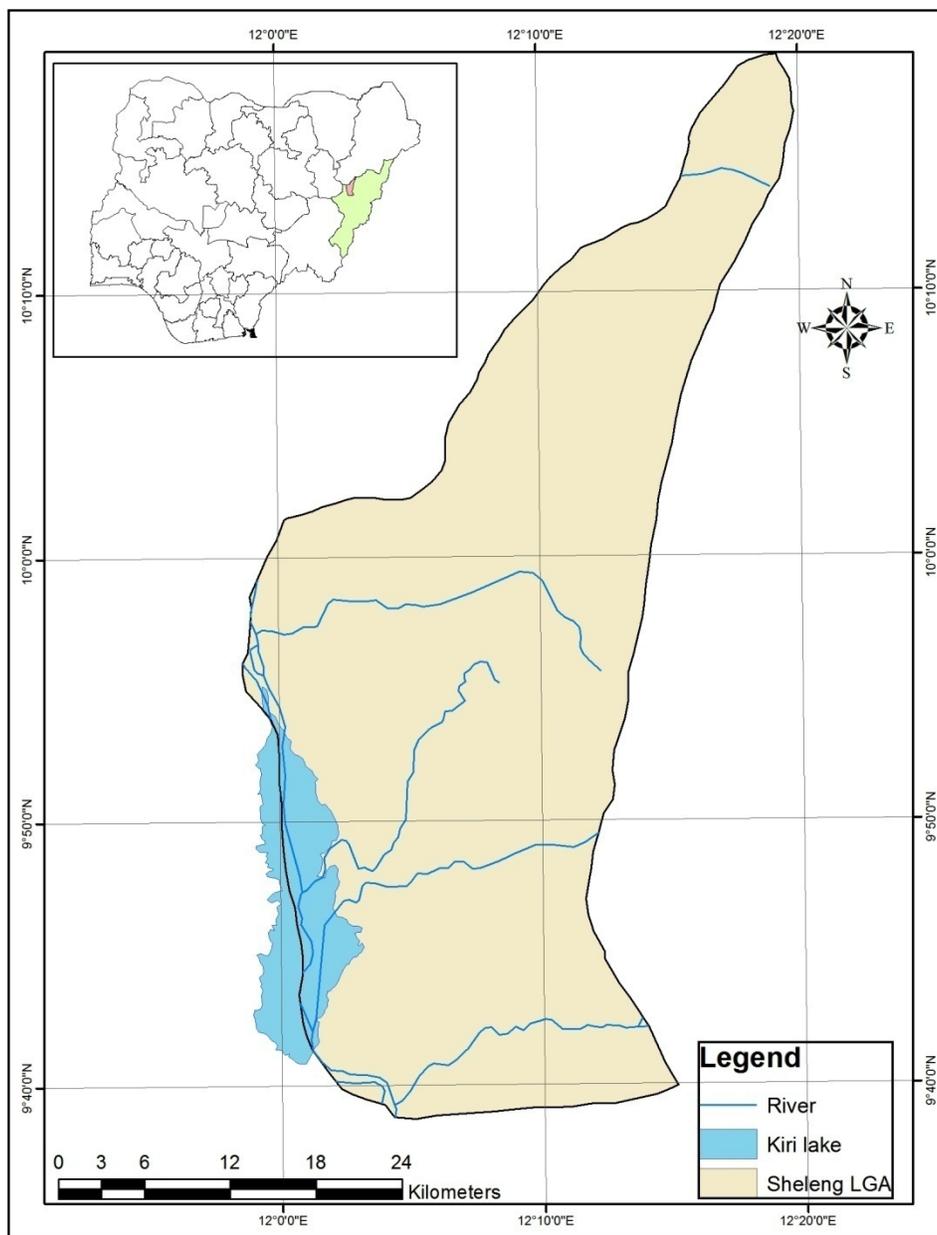


Figure 1: The Study Area

### Methods

Satellite images of 1984 and 2016 were acquired from USGS website (i.e., Landsat TM and Landsat OLI). ArcGIS 10.3 was used in carrying out the analysis. The materials used in measuring the reservoir depth include: suspension Derrick, fish weight (sinker weight), Gauging reel (winch) 35m, suspension cables and fish tail.

Information regarding the Dam was obtained from the Upper Benue River Basin Development Authority Yola (UBRBDA Yola).

The area of the lake was digitized from the satellite images collected in order to determine its spatial extent while sample points were systematically located for measurement and recording of the depth of lake within 20 meters apart. The instrument used for carrying out the measurement is called the suspension derrick.

## Results and Discussions

### *Spatial Extent of Kiri Lake*

Results from the digitized satellite images show that the lake has decreased from 100.8 km<sup>2</sup> to 57.03km<sup>2</sup> (see figure 2, 3 and 4). This revealed that the lake has reduced by 43.77km<sup>2</sup> (43%) of its original size after 32 years. This shows an annual reduction of 1.4 km<sup>2</sup>. Therefore, if the trend responsible for this shrinkage is not checked the reservoir may likely dry up in the next 41. Hence, there is the need to conserve the lake for the socio-economic benefits of the communities around the lake.

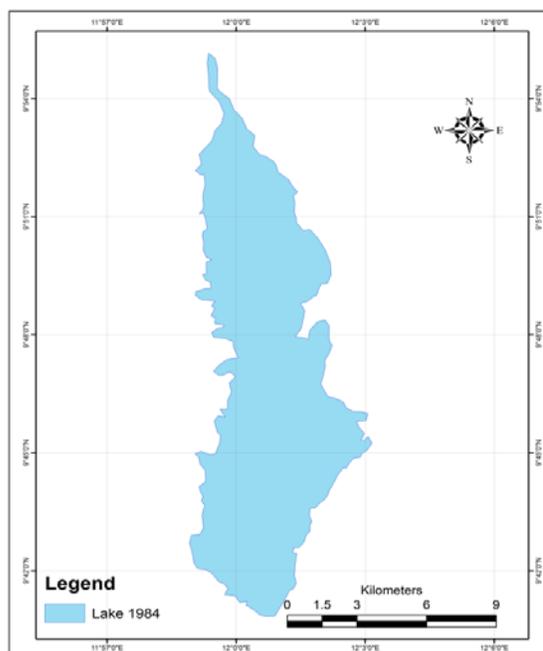


Figure 2: Spatial extend of Kiri Lake in 1984

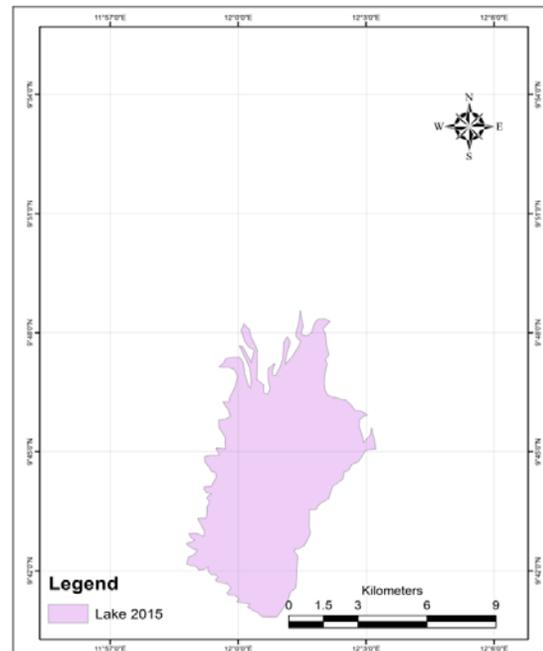


Figure 3: Spatial extend Kiri Lake in 2016

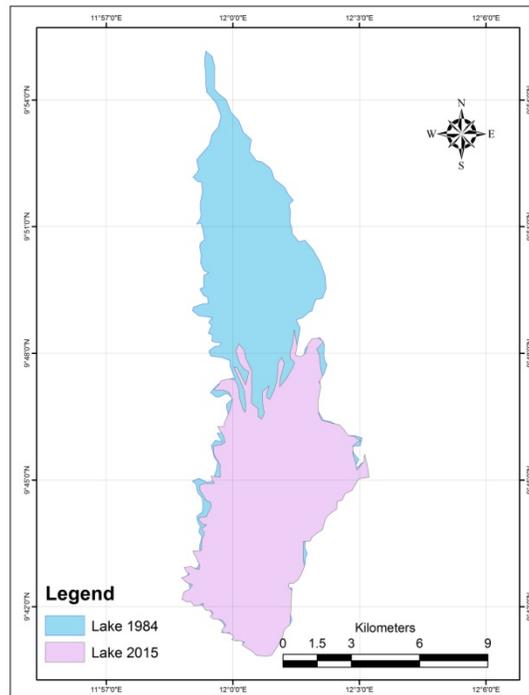


Figure 4: Extent of Spatial change of Kiri Dam between 1984 and 2016

***Changes in the Depth of Kiri Lake***

The depth at the bank of the reservoir is shallow due to the prevalence of mud and loosed materials. This therefore makes it difficult to get the correct depth of most part of the reservoir as the sinker weight usually sinks into the mud during measurement.

Water or reservoir level as at the time of measurement was 169.12 m above sea level which is different from normal reservoir level of the dam being 170.5 m. The initial depth of the reservoir at inception was 20 m deep (i.e., 150.5 m above sea level) which was subtracted from the normal water/reservoir level of 170.5m.

The siltation level therefore was calculated by subtracting the present depth from the initial depth.

Bench mark.....174.228 m above sea level

Normal water/reservoir level.....170.5 m

Initial reservoir depth.....150.5 m

Present water/reservoir level.....169.12 m

The level of water in the dam changes as a result of seasonal variations in rainfall. Hence, there is the need to get the difference in the lake’s level for an accurate assessment of the siltation that might have occurred.

$$\text{Diff} = \text{NRL} - \text{PRL} \tag{1}$$

Where;

NRL=normal reservoir level

PRL =present reservoir level

$$170.5M - 169.12 m = 1.38 m$$

To get the present depth (Pd) of the reservoir, the measured depth (Depth) taken during the fieldwork was adding to the result of the differences (Diff). The measurement taken at the deepest point of the lake was 11.7 m. Hence the present depth of the lake at its deepest point is:

$$Pd = \text{Depth} + \text{Diff} \quad (2)$$

$$Pd = 11.7 m + 1.38 m$$

$$Pd = 13.08 m$$

Reservoir siltation (S) was gotten by subtracting the present depth from the initial depth.

$$S = \text{Initial depth} - Pd \quad (3)$$

$$S = 20 m - 13.08 m$$

$$S = 6.92 m.$$

Therefore the siltation level at the deepest point of the reservoir is 6.92 m. However, the average depth is  $7.1 + 1.38 = 8.48$  m. This shows that the average siltation level of the reservoir is 11.52. It can be concluded from this result that the reservoir has lost averagely more than half of its depth in the past 32 years. The approximate current depth of the reservoir was interpolated using kringing method as presented in Figure 5.

The rapid siltation of the lake will consequently affect both water quality and quantity which will further limit the use of the lake for water supply, storage, recreational, habitat for fish populations, and will also affect the ability of the lake to meet the Irrigation needs of the savannah sugar cane plantation thereby affecting the socio economic activities of the people around the lake.

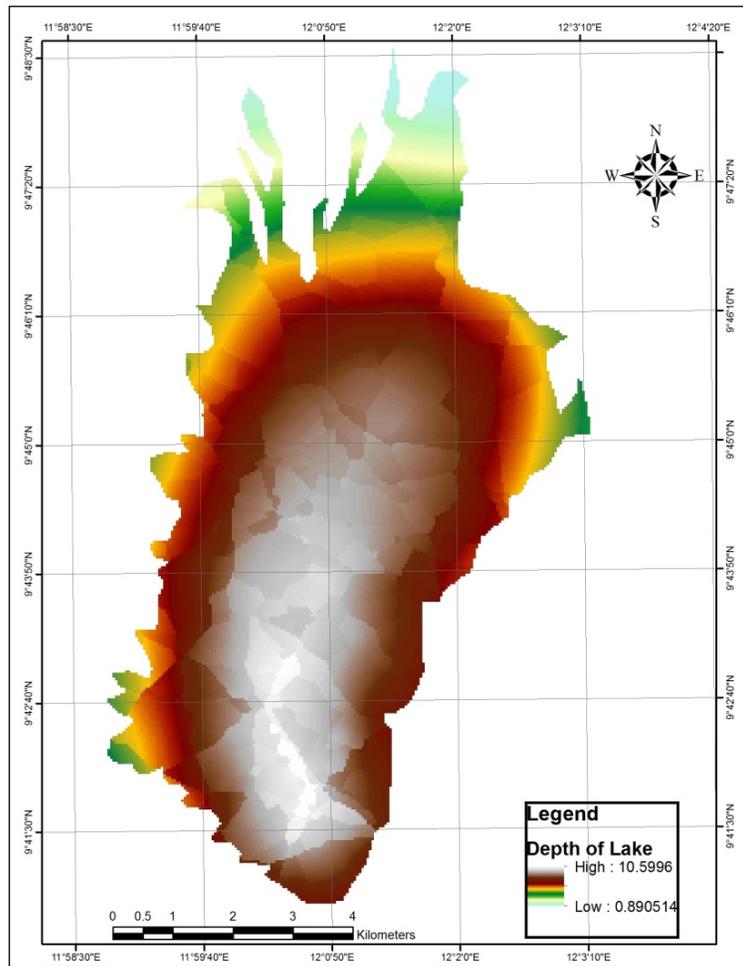


Figure 5: Present Depth of Kiri Lake

### Conclusion

Silting of Kiri Dam seems to come from both natural and human factor. From this study, it was discovered that the effect of the dam siltation among others is the reduction in its storage capacity. Therefore, reduction in the volume of water invariably leads to the reduction in the social and economic function of the dam. These factors have constrained irrigation, navigation and fishing activities which the dam provides. The implication of this shrinkage will be devastating to the savannah sugar cane plantation that depend on the lake for its irrigation water thereby affecting the company’s production and also will affect the economy of people that earn their living from it. Therefore, future development on the dam like hydro-electric power generation will not be very feasible unless measures are put in place to tackle the challenges posed by siltation of the reservoir.

### Recommendation

This study recommends that efforts should be made to restore the initial depth of the dam through dredging so as to bring back the original volume of water. Silt or filter fences should be constructed in rivers leading to the dam in order to protect the water against

pollution by sediment yield especially in storm water runoff. A buffer zone should be created around the dam check unsustainable human activities such as farming and building. Conservation activities such as tree planting and protection should also be encouraged within the buffer area. Furthermore the watershed that contributes water to the dam should be protected and well managed so as to reduce the rate of anthropogenic sedimentation of the dam. A yearly measurement of the dam should be encouraged in order to determine the rate of siltation of the dam for effective management.

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# Childhood Bereavement following Parental Death

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DOI: 10.29322/IJSRP.8.8.2018.p8059

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8059>

*Abstract-* Parental death is the most painful experience in one's life time. Children experience series of common emotional reactions such as shock, yearning, anger, sadness, guilt feeling and anxiety due to the parental death. Children demonstrate a range of behavioral and cognitive reactions too. Primary pattern of reactions depends on the age of the child. In therapy it should be considered non-malleable and Malleable Factors. Children who bereaved after parental death are more likely to have psychopathological problems in future. CBT with creative interventions is the more effective approach for childhood bereavement following parental death.

*Index Terms-* Childhood bereavement, Grief and Loss, Parental death, Prolonged Grief Disorder

## I INTRODUCTION

The most extremely painful experience that any individual being can suffer is the parent in his or her life (Bowlby, 1980, p.7). Certainly, it is a pain for a lifetime; only a few will escape. This essay aims to address background, grief reactions, psychological outcomes, short term and long term effects of bereavement from a psychotherapeutic point of view and theoretical approaches and interventions for bereaved children who have a parental loss. In this essay, the definition of childhood includes children up to seventeen. According to the statistics, 5% of children (1.5 million) in the United States lose one or both parents by age fifteen (Staff, Osterweis, Solomon, & Green, 1984). 4.7% or 1 in 20 children by the age of 16, experience the death of one or both parents (Ellis, Dowrick, & Lloyd-Williams, 2013). But, according to the lack of proven statistics, it's not clear precisely how many children in other countries are affected by the death of one or both parents.

## II GRIEF REACTIONS AFTER PARENTAL DEATH

In general, the grief reaction after parental death is not a set of symptoms that begin after the loss and slowly fall off. A strong emotional response to grief will convey the child's immediate reaction to the sudden trauma of his or her parental death. How significant of parents will influence many features of children's grief reactions to them, previous difficult situations they may have experienced, by their developmental level and maturity. So also children's grief reactions they express in more emotional and behavioral rather than verbal.

Clinical observations of children's grief reaction to parental death emphasize the series of common emotional reactions that these children experience. These emotional reactions concluded with shock, yearning, anger, sadness, guilt feeling and anxiety (Haine, Ayers, Sandler, & Wolchik, 2008). Shock is a common initial reaction to the news that apparent or both have died. This reaction sometimes reappear over the months afterward with reminders. Yearning is a longing emotion for the person who died and searching for them. It is accompanying by feelings of emptiness, wishes for the parent to return, necessitating, need of his or her loving touch, voice and to console them. Even though yearning is a major reaction of the normal grief, children may carry on yearning for a long time. Anger in itself is a normal reaction to grief and loss. For the duration of grief, anger can rise without any warning. The feeling of anger, often complains 'why me' and also it may focus at the parent who died, at other people such as other family members, friends, relations or at self or even to God. Child, who lost his parent, need to accept though he is working through feelings of anger. Otherwise, it may ultimately turn in to resistance against positive feelings. In therapy, it provides a safe place to express their anger and keeping in touch with their emotions and re-framing their perspective. Sadness also a major usual grief reaction to parental death and it can be reacted as a cathartic and relief to the child who lost his/her parent. Guilt feelings as grief reaction can be a thought that unable to do something for the parent who has died. Guilt feeling is one of the ways that child continues his/her love towards the died parent. Anxiety is a fear for the life without the parent who has died. Anxiety may occur due to the several components as the closeness of death and dependence on them. These anxieties can befall especially in the older children as they are mature enough to recognize being alone and the uncertainty of their future.

Besides the emotional reactions, children demonstrate a range of behavioral and cognitive reactions following parental death. Researchers who studied about child bereavement have found the loss of appetite and sleeping difficulties, inability to concentrate, social withdrawal, restlessness and learning difficulties as behavioral reactions (Staff, Osterweis, Solomon, & Green, 1984). Furthermore, as they mention, that the primary pattern of reactions depends on the age of the child. Children under age two are likely to demonstrate loss of speech or diffuse distress. Children age under five are possible to show eating difficulties, sleep disturbances, stomach pains, bowel and bladder disturbances; Children of school age may show phobic or hypochondriacal symptoms, socially withdrawn, overly caregiving and aggression. Adolescents respond more similar to adults, but sometimes they are reluctant to show their emotions as they are unwilling to appear different or abnormal (Staff et al., 1984).

### III NON-MALLEABLE AND MALLEABLE FACTORS

It is important to consider non-malleable factors when providing therapy for parentally bereaved children. According to many descriptive studies, there are several non-malleable factors that researchers have identified. (1) Children's developmental level; (2) Child gender; (3) Cause and type of parental death; (4) Time since the death; (5) Cultural background. When considering the developmental level, younger children have found more stressed by peers. Therefore, younger children are more expressive than older children (Silverman, & Worden, 1992). Studies have also distinguished that older children to act as more grown-up than younger children (Silverman, & Worden, 1992). Therefore, they needed more individual sessions consisting of added cognitive strategies. Since the period of birth, children begin to develop assumptions about the way of the world exist. In the lives of many children, these assumptions have positive and adaptive value, and they support them to predict the world. When children experience loss, their positive assumption which they have held about the world may be endangered and be more negative. The child who experienced the death of a parent can have the assumptions related to the security of the wrecked family.

As Worden (1996) stated, children do accept the reality of death when they able to understand the concepts of finality and irreversibility. As he emphasizes this can happen primarily at the stage of operational thinking even though some understanding will appear at cognitive stages. Worden revealed, if a child is experiencing parent loss before the operational stage, their grief may be last until they fully realize the loss or death. According to Worden, to understand the finality and irreversibility on some level children should be around five to seven years of age. But it depends on the ability of cognitive reasoning in children. Regarding the significant developmental stages in children's life, infants are at a vulnerable stage due to possible issues related to attachment when the parental loss. Such matters can create complications around trust, feeling of anger and depression as the child grows. Moreover, they have to face difficulty in attaching and intimating with others (Worden, 1996).

In regarding the gender, girls are showing more internalizing problems following the parental death and boys are showing more externalizing problems (Dowdney, 2000). Therefore, as research mentioned girls are highly vulnerable to persist their bereavement over time (Schmiege, Khoo, Sandler, Ayers, & Wolchik, 2006). It is significant to mention that girls hold more parental roles in bereaved families, in this manner it may disrupt their normal development. Thence, interventions should be directed to the restructuring of family roles, to restart their development inappropriately.

As some studies pointed out, cause and type of death alone is not a key predictor of mental health issues in childhood bereavement following parental death. Disclosing problems and concerns related to the cause of parental death will be significant to the direction of therapy. Causes of death need to address in specific therapeutic interventions. For example, children with a parent in a deadly illness as cancer, HIV/AIDS needed anticipatory interventions (Christ, Siegel, Mesagno, & Langosch, 1991). They are aiming to prepare the child for the new caregiver, making constructive daily activities with the family and helping child's coping process (Haine, Ayers, Sandler, & Wolchik, 2008).

Specific consideration needed to the children who have experienced the suicide of a parent or other shocking, traumatic deaths such as deadly accidents, natural disasters, human-made disasters, etc. Children are possible to show Post Traumatic Stress (PTSD) symptoms when the parental death caused by the more painful way (Dowdney, 2000). Research has done by Pfeffer, Jiang, Kakuma, Hwang, & Metsch (2002) on treatment and intervention for childhood bereavement after the suicide of a parent and relative. They have especially aimed the above discussed malleable factors with the suicide and activities that planned to assist children in coping their thoughts and concerns related to suicide. As a result, they have found, children who received intervention focusing on strengthening the coping skills, have shown positive changes in anxiety and depressive symptoms than non-intervention children.

According to Pfeffer et al. (2002), interventions aiming at supporting coping skills can reduce the anxiety and depressive symptoms of children bereaved following a parental suicide.

Time since the prenatal death is another significant fact as a non-malleable factor that therapist should consider. Children's early reactions such as crying, sobbing, sorrow, and dysphoria pass over at the time, but psychological well-being and other issues can last over time (Dowdney, 2000). But several studies have mentioned that elapsed time from the parental death has not exceptional impact on outcomes (Haine et al., 2008). Nevertheless, adverse happenings and coping resources that follow the parental death can determine the duration of bereavement.

Several empirical studies have done on cultural differences in bereaving children. But no study has found the impact of culture on children's adaptation to the parental death. Comparison research has done on the understanding of concepts related to death. They have found similarities and differences among different cultures. Schonfeld and Smilansky (1989) have done a study comparing American and Israeli school-age children. They have found results with Significant differences in score. Israeli children score greater than American children with maturity in understanding irreversibility and finality. Therefore, therapists should keep awareness of children's norms of the dominant culture. The therapist should consider children's cultural anticipations and their necessity of coping with the parental death.

Family environment plays a significant part in a bereaved child after parental death. Especially, surviving parent's relationship is a key factor that can impact childhood bereavement. Constructive family relationships and sound parenthood can be a strong protective factor in child bereavement; Poor parenting cause to the psychological difficulties (Ellis, Dowrick, & Lloyd-Williams, 2013).

According to Ellis et al. (2013), parental death in childhood can do long-term damage and suffer in their adult life, if they didn't receive the considerable level of support at the period of bereavement. Lack of self-esteem, social withdrawal, isolation, and lack of ability to express feelings are some reported issues of them. Surviving parent and friends are primary most supportive groups for helping to manage the bereavement

#### IV LONG-TERM EFFECTS OF THE DEATH OF A PARENT IN CHILDHOOD

Children who bereaved after parental death are more likely to have psychopathological problems in future (Dowdney, 2000). Psychopathological issues in parental death consist of depression, anxiety disorder, self-harming behaviors, post-traumatic stress disorder (PTSD), prolong traumatic grief behavior and poor quality of life (Craig, 2010). Anxiety and depression are the most reported psychological issues as long-term effects of the death of a parent in childhood. If the parental death happened in a traumatic way, these children could have higher rates of psychiatric disorders (Berg, Rostila, & Hjern, 2016). The occurrence of low self-esteem is another long-term psychological effect in childhood bereavement (Worden, & Silverman, 1996) Lower self-esteem has been linked with psychological issues in children who bereaved after parental death (Wolchik, Tein, Sandler, & Ayers, 2006). Most of the time, after the parental death, children experience negative happenings that lower their self-esteem. Lack of interaction, lack of communication and strict parenting by the survived parent are few of them.

Incapacity to maintain an intimate relationship and problem-related to relationships are another significant long-term outcome of childhood bereavement (Ellis et al., 2013). According to the Bowlby (1980) parental loss in childhood, make greater exposure to future difficulty. He mentioned that the most primary bond created by the children with their care-taker have a strong impact all over their life. Therefore, break up this bond might affect the emotional world of an individual and this can direct to making difficulties in significant relationships in later life (Bowlby, 1980). A study has found that women who experience parental loss in childhood, less likely to get married and loss tended to marry earlier (Hoeg, Johansen, Christensen, Frederiksen, Dalton, Dyregrov, Boge, Dencker, & Bidstrup, 2018).

Some studies are suggesting that childhood bereavement impacts the physical well-being of an adult. According to them, children who bereaved after parental death are more likely to have symptoms of poor health in adulthood (Coghlan, 2014). The finding of a study by Bendiksen and Fulton (1975), confirmed the Coghlan's findings.

#### V PROLONGED GRIEF DISORDER (PGD)

There is evidence that the parental death can develop the prolonged grief disorder in children. It is precisely known as complicated grief (Shear, Simon, Wall, Zisook, Neimeyer, Duan, & Keshaviah, 2011). Prolonged grief disorder concluded with disrupting yearning, difficulties in accepting the death, loss of attachment, unpleasantness, and sense of loss has devastated view of self, life, and future. It has symptoms in common with anxiety, depression, and PTSD. But it is a different disorder. Prolonged grief is related with other well-being issues such as sleep disturbance, substance abuse, suicidal thoughts and attempts and abnormalities in immune function (Solomon, & Shear, 2015).

## VI APPROACHES AND INTERVENTIONS

As this essay mentioned above, the parental loss can impact a child in a clinical number of ways. Code of bereavement of The Diagnostic and Statistical Manual of Mental Disorders (DSM) V, can be followed when focusing on treatment interventions related to the childhood bereavement. Also, it can identify as traumatic grief symptoms that are very like to seem like symptoms of the major depressive disorder. Therefore, it is necessary to follow basic assessment system and detailed conceptualizations of bereavement diagnosis provided by DSM.

Treatment literature of the child bereavement, significantly emphasizes the Cognitive behavioral therapy (CBT) and the play and expressive therapies (Edgar-Bailey, Meredith, & Kress, Victoria, 2010). CBT and trauma-focused cognitive behavioral therapy (TFCBT) is evidence-based approaches as most effective in working with childhood and adolescent traumatic grief (Edgar-Bailey et al., 2010). Trauma-focused and grief-focused interventions combined help to reduce the PTSD and depressive symptoms in bereaved children (Currier, Holland, & Neimeyer, 2007). Trauma-focused interventions mainly based on expression skills, stress management skills, trauma narratives of children, and cognitive processing (Cohen, & Mannarino, 2004). Grief-focused interventions mainly emphasize the death, dealing with ambivalent feelings, protecting positive memories, entering into other relationships and rationalizing of the loss (Cohen, & Mannarino, 2004).

TFCBT is good for decreasing children's psychological problems (Edgar-Bailey et al., 2010). Majority of malleable factors of bereaved children are associated with cognition. Therefore, by using CBT intervention, they can be increased or decrease appropriately (Haine et al., 2008). So also, CBT can use to increase children's adaptive beliefs as regards control. Sometimes, CBT interventions alone difficult to use for the bereaved children as they haven't an ability to enhance self-regulate emotional reactions. CBT-related creative interventions can be used to overcome such kind of difficulties. There are many creative interventions that therapist can use to decrease traumatic grief and assist for the normal grieving process to bereaved children who have a parental loss. They are poetry therapy, unfinished sentences/writing Prompts life imprints, journaling bibliotherapy, and creative writing, drama, letter writing, commemorating rituals, planting, linking objects, drawing/painting/collage (Edgar-Bailey et al., 2010). These creative interventions can use by combining with CBT. Most grief theories based on the ideas of attachment and loss. These ideas especially focus on individual than the relational aspects of bereavement (Monroe, & Kraus, 2010). Neimeyer (2001) has emphasized the familial and cultural influences that form an individual's efforts regarding bereavement. As he mentioned, families need support in recreating their story.

Wilson (1998) and Freeman introducing playful approaches to work with families. In this approaches children and adults feel comfortable when attempting serious matters with the least sense of being blamed. When working with bereaved children, playful techniques can use as a language to join with children. It is intended to provide a stimulus for creative responses to involve children. Joining survived parent and children in drawing a family tree together make understanding how they tell stories about their family and children's awareness about the happening around the bereavement. A family map or a family tree help therapist to understand more deeply about the child's family. Bereaved children are often trying to manage a secondary losses in their lives. Boys often respond in an aggressive way when they got confused and upset. Externalizing is a technique suggested by White (1990) as a technique for transferring the blame out from the individual. In this externalizing techniques, children are invited to identify their behavioral choices as they feel not blamed. Externalizing technique supports to make the more positive description of a child. Winton's 'Wishes, Muddles, Puddles and Sunshine' activity book' is a good experience for children who have a parental loss. It helps to enrich children's narrative of memories related to dead parent and make sense into different aspects of their grief (Monroe, & Kraus, 2010).

In conclusion, the parental loss is one of the most traumatic events a child can experience. Child bereavement after a parental loss is a prevalent issue in all around the world. As essay mentioned, there are a number of grief reactions, non-malleable and malleable factors that therapist should consider when working with parentally bereaved children. As research suggesting there are

long-term effects in bereaved children that can be identified. CBT with creative interventions is the more effective approach for childhood bereavement following parental death.

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# Fabrication and Spectroscopic Ellipsometry Measurement of SnO<sub>2</sub>:F Thin Film

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DOI: 10.29322/IJSRP.8.8.2018.p8060

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8060>

**Abstract-** Transparent and conducting oxide (TCO) glass electrode is the essential part of solar cell system. Fluorine-doped tin oxide (SnO<sub>2</sub>:F) thin film is one of the TCO layers on glass substrate. Indium-doped tin oxide (SnO<sub>2</sub>:In) (ITO) has high transparency and high electrical conductivity. But the electrical resistance of ITO increases more than three times of former value when the film temperature is 300oC or higher. So, SnO<sub>2</sub>:F (FTO) is more attractive than ITO for dye-sensitized solar cell. In this work, spray pyrolysis deposition technique was used to fabricate SnO<sub>2</sub>:F film on glass substrate. And then film thickness and refractive index of SnO<sub>2</sub>:F thin film were determined by spectroscopic ellipsometer.

**Index Terms-** DSSC, ellipsometer, FTO, ITO, spray pyrolysis, TCO

## I. INTRODUCTION

Large amount of carbon dioxide emission by the combustion of fossil fuel leads to serious environmental problem such as the global warming. In nuclear power stations, no viable method has been found to dispose of the dangerous nuclear fuel wastes yet. So, the searching for clean and sustainable energy resources as substitute for the traditional fossil fuel and nuclear power station, has become an urgent work for human beings. Solar energy is regarded as one of the perfect clean energy resources.

Devices that will permit direct conversion of sunlight to electricity are called photovoltaic solar cells<sup>[1][3][7]</sup>. The first and second generation photovoltaic cells are mainly constructed from semiconductors. Amorphous semiconductor is one of the most promising materials for low cost energy production. But the price of solar energy from silicon technology or thin film solar cells exceeds that from the traditional fossil fuel. So, the searching for affordable solar energy technology is one of the hottest research fields all over the world. Among them, dye-sensitized solar cell (DSSC) gives the high energy conversion efficiency. Therefore, DSSC has been regarded as the most prospective clean energy source.

Dye-sensitized solar cell (DSSC), invented in 1991 by Prof. Michael Graetzel in Switzerland, is a real revolution in solar energy after the invention of silicon solar cell. Anatase TiO<sub>2</sub>, wide band gap metal oxide semiconductor, on transparent conducting oxide (TCO) layer acts as electron acceptor, iodine electrolyte as electron donor or source for electron replacement

and photochemical pumping device is dye sensitizer and carbon layer serves as a catalyst, shown Fig 1.1<sup>[4][5]</sup>.

Film thickness and refractive index of TCO layer are very important factors on solar cell efficiency. Film thickness depends on the deposition time and the distance between spray gun nozzle and the glass substrate. The velocity and the feed-rate of the solution should be carefully controlled by the control button of the spray gun. In this work, spray pyrolysis technique is the simplest method for the deposition of SnO<sub>2</sub>:F thin film. Film thickness and refractive index of the film were analyzed by Ellipsometer and those of TCO layer for TiO<sub>2</sub> based DSSC were studied to improve the performance of dye-sensitized solar cell. DSSC with cost-effective SnO<sub>2</sub>:F layer can yield satisfactory efficiencies.

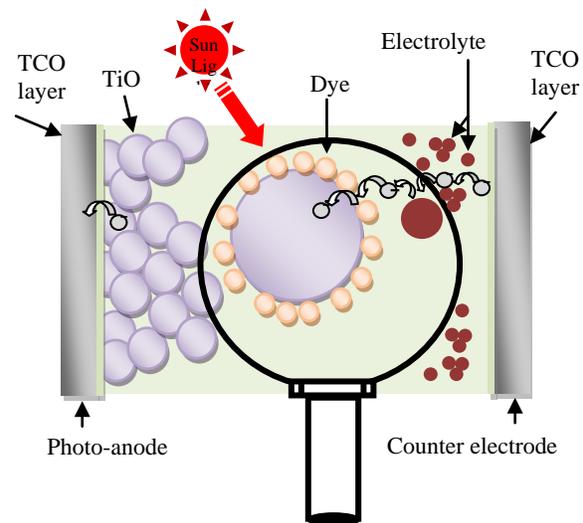


Fig 1.1 Structure of TiO<sub>2</sub> based dye-sensitized solar cell

## II. BACKGROUND THEORY

### 2.1. Spray Pyrolysis Technique

Film coating on a glass substrate by spray pyrolysis technique and photograph of the spray pyrolysis apparatus<sup>[6]</sup> are shown in Fig 2.1 and Fig 2.2 respectively. It contains air compressor, spray gun, heater and digital temperature controller with temperature sensor. Glass cleaning is essential for the nucleation centre of growth, good adhesion and uniform deposition of the film. After that, the glass substrate is put on the

heater at 600°C for FTO. The distance between the spray gun nozzle and the glass substrate can be adjusted.

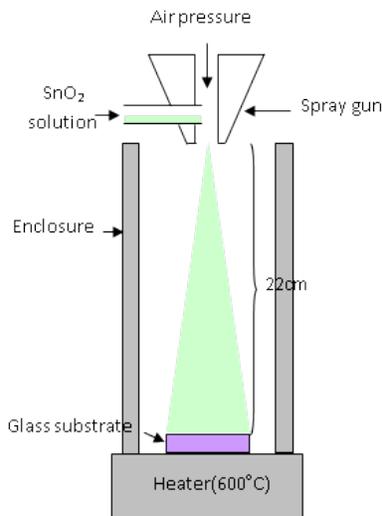


Fig 2.1 Spray pyrolysis technique



Fig 2.2 Photograph of spray pyrolysis apparatus

## 2.2. Spectroscopic Ellipsometry (SE) Measurement

Spectroscopic Ellipsometry (SE) is the sensitive optical technique for measuring the thickness and the optical properties of the films such as the refractive index and the absorption coefficient and so on. The thickness of the film can be determined by measuring the difference between two reflections. The change in polarization of the reflected lights is used to calculate the refractive index and the absorption coefficient.

As shown in Fig 2.3, p-polarized axis is parallel to the plane of incidence and s-polarized axis is perpendicular to it. After the reflection through thin film, the reflected lights, travelling in the same direction, combine into a wave which becomes elliptical polarized  $E$  field vector. The shape of the electric field is the polarization of reflected light and the size of the electric field means the intensity of reflected light. If the refractive index of the film and that of the substrate are known, it is possible to calculate the thickness  $d$  of the film by ellipsometry<sup>[2][18]</sup>.

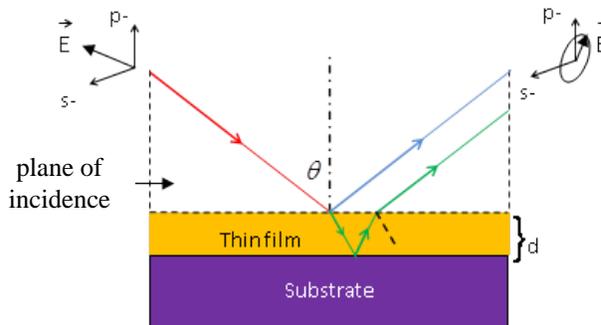


Fig 2.3 Ellipsometry experiment

Fig 2.4 shows photograph of spectroscopic ellipsometer. At first an optical model that describes the sample structure was built and the theoretical data from the optical model that corresponds to the experimental data were generated. And then the generated data were compared with the experimental data. Mean Squared Error (MSE) or Regression Analysis was used to vary unknown parameters and minimized the difference between the generated and experimental data. Ellipsometry is an indirect method for the calculation of the thickness and the refractive index of the film. In this work, the film thickness and refractive index of FTO were analyzed.

Fig 2.4 Photograph of spectroscopic ellipsometer



## III. EXPERIMENTAL DETAILS

### 3.1 Fabrication of Fluorine-doped Tin Oxide (FTO) Glass Substrate

10 g of tin chloride pentahydrate ( $\text{SnCl}_4 \cdot 5\text{H}_2\text{O}$ ) was dissolved in 100 ml of ethanol in a sealed container<sup>[9]</sup>. The solution (A) was stirred continuously with magnetic stirrer for at least 5 h until all  $\text{SnCl}_4 \cdot 5\text{H}_2\text{O}$  completely dissolved as shown in Fig 3.1. In Fig 3.2, the solution (B) was prepared by dissolving 2.0 g of ammonium fluoride ( $\text{NH}_4\text{F}$ ) in 4 ml of deionized water in a sealed container and stirred for 30 min. After that, the solution (A) was placed in a water bath and heated at 40°C and stirred for 1 h as shown in Fig 3.3. And then the solution (B) was added to the solution (A) in water bath, and then stirred the mixed solution at 60°C for 9 h, shown in Fig 3.4. When it

became homogeneous, it was filtered using paper filter and was to be used for SnO<sub>2</sub> film fabrication.

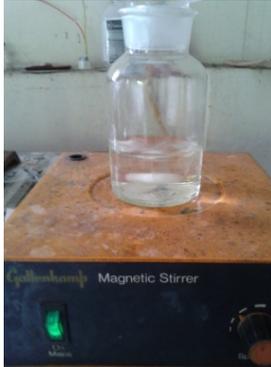


Fig 3.1 SnCl<sub>4</sub>.5H<sub>2</sub>O solution

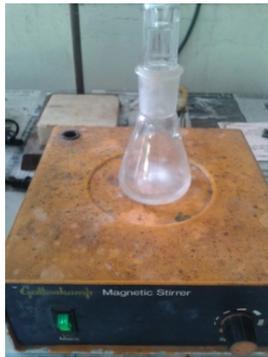


Fig 3.2 NH<sub>4</sub>F solution



Fig 3.3 SnCl<sub>4</sub>.5H<sub>2</sub>O solution in water bath at 40°C



Fig 3.4 Mixed solution SnCl<sub>4</sub>.5H<sub>2</sub>O and NH<sub>4</sub>F in water bath at 60°C

The glass slides have to be cleaned by degreasing them in acetic acid and washed with distilled water, and then cleaned with acetone and dried in air. As shown in Fig 3.5, the glass substrate was put on the heater at 600°C. The distance between the spray gun nozzle and the glass substrate was about 22 cm and the solution feed-rate was 5 ml min<sup>-1</sup>. The deposition time of each substrate took about 10 minutes. The feed-rate of the solution should be carefully controlled by the control button of the spray gun, and the direction of the solution was needed to reach the target glass. After the deposition, the glass with F:SnO<sub>2</sub> thin film should be checked by using the digital multi-meter whether conductive layer or not. The film resistance is 22.9 Ω/cm, shown in Fig 3.6.

NH<sub>4</sub>F solution



Fig 3.5 SnO<sub>2</sub>:F coating by spray pyrolysis



Fig 3.6 Conductive layer of FTO

### 3.2 Spectroscopic Ellipsometry Analysis

Film thickness and refractive index of FTO were analyzed by spectroscopic ellipsometer. At first, the optical model that describes the sample structure was built and the theoretical data from the optical model that corresponds to the experimental data were generated. And then the generated data were compared with the experimental data. Unknown parameters in optical model were varied to try and produce a “best fit” to the experimental data. Mean Squared Error (MSE) or Regression Analysis was used to vary unknown parameters and minimized the difference between the generated and experimental data. Fig 3.7 shows the regression analysis of spectroscopic ellipsometry for FTO. Table (3.1) is the refractive index with various wavelengths. In this work, the film thickness of FTO is 848.11 nm. And the refractive index of FTO is about 1.99 as shown in Fig 3.8.

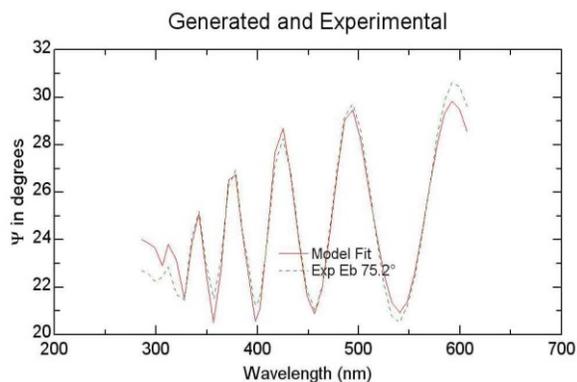


Fig 3.7 Ellipsometry measurement of FTO

Table (3.1) Refractive index of FTO with various wavelengths

$\lambda$ (nm)	n	$\lambda$ (nm)	n
286.0	2.0233	448.8	1.9715
291.5	2.0569	456.1	1.9702
299.0	2.0797	464.2	1.9677
306.0	2.0821	471.5	1.9662
312.0	2.0740	479.2	1.9655
320.8	2.0539	486.4	1.9654
327.8	2.0378	494.4	1.9659
335.1	2.0258	502.4	1.9675
342.4	2.0181	510.0	1.9687
349.5	2.0135	517.6	1.9695
356.8	2.0083	525.0	1.9698
364.0	2.0022	532.5	1.9709
371.3	1.9947	540.4	1.9721
378.4	1.9878	547.9	1.9726
384.5	1.9827	555.5	1.9725
397.5	1.9726	563.2	1.9717
402.1	1.9705	570.7	1.9708
409.7	1.9687	577.9	1.9703
417.2	1.9686	585.0	1.9711
424.9	1.9687	592.3	1.9746
432.8	1.9702	599.7	1.9819
440.7	1.9715	607.0	1.9939

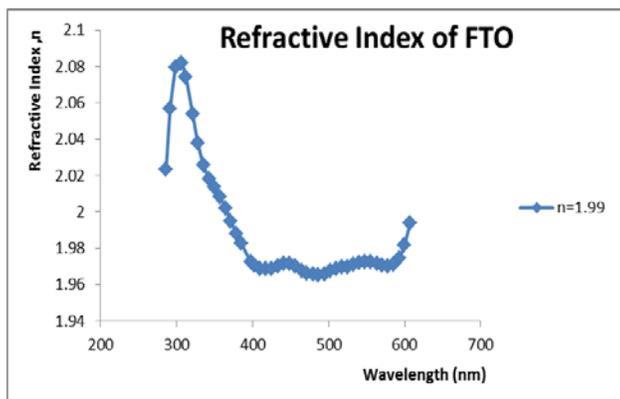


Fig 3.8 Refractive index of FTO

#### IV. RESULTS AND DISCUSSION

##### 4.1 Spectroscopic Ellipsometry Study

Ellipsometry is the indirect method for the calculation of thickness and refractive index of thin film. The parameters  $\Psi(\Psi)$  and  $\Delta(\Delta)$  have to be analyzed and fitted to determine the thickness and the refractive index of the film. In this process, the optical model with generated data has to be built first to compare with the experimental data. And then the difference between generated data and experimental data must be minimized by using regression analysis. FTO thickness 848.11 nm is larger than the optimum value. This is because that the deposition time should be less than 10 minutes and the feed-rate of the solution should be also reduced by using the control button of the spray gun. FTO refractive index, about 1.99 means that the solution needs to be more homogeneous. But the high refractive index is needed for the use of more refraction, but low value for the less refraction. After that the film resistance 23  $\Omega/cm$  can be practically used in DSSC. The film resistance, depends on the materials used in deposition, needs to reduce as much as possible to increase the efficiency of DSSC. In this work, the optimum deposition temperature of FTO is 600°C. For  $TiO_2$  based DSSC,  $TiO_2$  glass electrode will be deposited on FTO glass substrate at 450°C. So, FTO deposition temperature must be greater than  $TiO_2$  layer deposition temperature.

#### V. CONCLUSION

TCO glass electrode is the essential part of DSSC. Low electrical resistivity and high visible transmittance are the key elements for TCO layer. The film thickness and the refractive index of FTO have been studied by SE measurement. The film thickness depends upon the deposition time and the feed-rate of solution. According to SE data, the refractive index is 1.99 and the film thickness is 848.11 nm. To get the optimum film thickness, the solution feed rate and the deposition time should be reduced.

$TiO_2$  coated photo-anode on FTO layer has to be prepared for  $TiO_2$  based DSSC. In this work, FTO deposition temperature is about 600°C. So, FTO deposition should be put emphasis on the film deposition temperature and the film thickness. And then glass cleaning with acetone and methanol, is an essential process to get good adhesion and uniform deposition for FTO film. More homogeneous  $SnO_2:F$  solution should be provided to get uniform thin film. So, the stirring time of the solution and the solution preparation temperature should be adjusted to get homogeneous film<sup>[7]</sup>.

To improve the performance of DSSC, the conductive layer resistance of FTO, about 22.9  $\Omega$  should be reduced to a smaller one.

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# Motivation in Reading Authentic Texts

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DOI: 10.29322/IJSRP.8.8.2018.p8061

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8061>

## Abstract

This research was aimed to examine the effect of authentic materials on the students' motivation to read. At the same time, it was conducted to know their perception after being taught using the authentic materials in reading class in English as a Foreign Language context. The students of English Department at Halu Oleo University Kendari who programmed Reading II course were identified as the participants in this research. It was consisted of 22 students who enrolled in the second semester of the year. To collect the data, two techniques of data collection were used observations, and administering questionnaires

The results of the research indicate that analysis of observation sheet and questionnaire indicates that students' motivation during the six weeks of treatment improved. Another finding reported positive responses are shown by most of the participants toward the use of authentic materials. To conclude, the research proves that authentic materials have an effect to students' motivation to read.

**Keywords:** authentic texts, reading, motivation and EFL

## INTRODUCTION

The increasing numbers of people who want to improve their communication skills in English have increased the demand of learning English in the world. Because of these developments, any educational institutions who serve English as one of their subjects is expected to improve the quality of the language teaching, the teaching materials and the resources/teachers.

In order to become competent users of English, every learner is required to master four language skills, listening, speaking, reading and writing. Reading is dealing with language messages in written or printed form by extracting the required information from it as efficiently as possible (Urquhart and Weir, 1998 in Hedgcock and Ferris, 2009). One becomes language learning problems today is the ability of students who highly lack to understand various reading materials provided to them

Authentic materials expose learners to a wide of natural language, they bring reality into the classroom and make the interaction meaningful. Thus, the students can practice the skills learnt in the classroom in the outside world when they come across similar materials in real life. If we encourage reading it in the classroom, we can expect students to continue doing the same long after they have stopped studying with us. Furthermore, a number of studies has proven that the use of authentic materials results in an overall increase in motivation to learn, a more positive attitude toward learning, as well as increased involvement and interest in the subject matter. Most of them perceive authentic materials as useful, lifelike and interesting. According to Bacon and Finnemann (1990:459), authentic materials can promote both cognitive and affective reasons, in cognitive terms authentic materials make available of context for relating form to meaning in language acquisition process, while affective reason, it acts as motivators and overcomes the cultural barriers to language learning. In short, authentic materials help the students to see the relevance of what they do in the classroom to what they need to do outside it, and real life treated realistically makes the connection obvious.

In the case of EFL situation, mostly English is taught as a subject at school and used only inside, but not outside, the classroom. Students who are from environments where English is not the language of the country have very few opportunities to read the real language; these students therefore are not accustomed to reading the language as it is produced by native speakers for native speakers. As the result, students from the countries have great difficulty understanding English reading when they encounter with the real objects of the language. Students who intended to be a part of English community whether in EFL or ESL context should be provided with opportunities to interact to any objects or things used or created by the native speakers. It is hoped to help them familiar to, so that they will feel that they are treated as if they are the native speaker of the language. To achieve that purposes, teachers who used authentic materials need to explain the reason for the use of authentic materials and activities in the classrooms, as it can bring them to the more meaningful and valuable activities in reading.

## METHODOLOGY

### Research Location

The participants were the second semester students of English Department at Halu Oleo University Kendari who programmed Reading II course. All of them speak Indonesian as the first language and had the same learning experience of English as a foreign language which they had been learning from elementary school. The total numbers of the participants were 22 students. The students attended the class once a week, for two hours.

**Research Design and Variables**

The research was a kind of survey research, it was to see the effect of authentic texts on students’ motivation to read. During the implementation of the experiment, the researcher observed both the students’ individual and overall motivation.

**Data Collection and Analysis**

The instruments used in this research were observation sheets and questionnaire. Class observation was conducted since the beginning of the research, it was recorded in each meeting of the treatment. The observation sheets were used to determine the students’ overall activities during the implementation of the treatments and students’ motivation in the classroom. There were two kinds of observation sheets in the study. Observation sheet 1 adapted from Hopkins (1985) was used to quantify learner on-task behavior. There were 12 columns for 12 scans and 22 lines for 22 subjects, and filled out by non-participant observer (the researcher). The learners were considered on-task if they were engaged in the pedagogic work of the day and they were considered to be off-task if they showed a complete lack of attention to the set task. Observation sheet 2 adapted from Nunan (1989) was used to assess overall class motivation generated by the materials in use, as manifested by level of learner interest, enthusiasm, activity (effort/intensity of application), persistence with the learning task, concentration, and enjoyment during class. There were 8 items in observation sheet 2 and each item was scored on a scale of 1 (low) to 5 (high), 3 is an average mark for any one item. Observations were taken while the period using the target materials is ending.

Then, the questionnaire was administered at the end of the meeting. The questionnaire was a questionnaire adopted from Glikzman, Gardner, & Smythe (1982:646). The questionnaire was a semantic differential scale used to measure levels of motivation generated during class by the materials in use . This questionnaire type consists of a series of contrasting adjective pairs (e.g., good-bad, beneficial-harmful) listed on opposite ends of a bipolar scale. It consisted of seven closed items on semantic differential scale of objectives expressing motivation (e.g. interesting/boring, enjoyable/unenjoyable, etc). Each position on the continuum has an associated score value. Each item scored from 1 to 7, making a total of from 7 to 49 for each complete questionnaire, it was completed by each learner at the end of the daily activity. From this total, a class means score for the day was assessed.

**RESEARCH FINDINGS AND DISCUSSION**

**Findings**

**Data Obtained from Class Observation**

Having calculated the total and percentage of ‘on-task behaviour’ (observation 1) for each students in the 6 meetings of experiment, the following table summarizes general frequency and percentage of students’ ‘on-task behaviour’ in the research.

Table1 :The frequency and percentage of students “on task” behavior on authentic texts

Meeting	Number of students attend	Frequency of ‘on-task’ behaviour	Percentage
1	22	9.09	75.76
2	21	8.33	69.44
3	22	9.36	78.03
4	21	9.86	82.14
5	22	10.09	84.09
6	20	10.40	86.67

Observation of overall class motivation (observation 2) generated by the materials in use, as manifested by level of learner interest, enthusiasm, activity (effort/intensity of application), persistence with the learning task, concentration, and enjoyment during class. There were 8 items in observation sheet 2 and each item was scored on a scale of 1 (low) to 5 (high), 3 is an average mark for any one item. Observations were taken while the period using the target materials is ended.

Table 11: Overall class motivation on authentic materials

Meeting	Number of students attend	Overall class motivation
1	22	29
2	21	27
3	22	35

4	21	37
5	22	36
6	20	37
Mean score		33.5

**Data obtained from questionnaire**

Having calculated the raw score of each meeting in the questionnaire (see appendix 10), the finding of students’ self-reported questionnaire in each meeting are figured below.

Table 12:Results on self-reported questionnaire on authentic materials

Meeting	Number of students attend	Mean score
1	22	37.68
2	21	36.86
3	22	40.14
4	21	39.50
5	22	41.71
6	20	41.90
Mean score		39.63

**Discussion**

The result of the current research indicated that authentic materials influenced positively to enhance students’ motivation in learning. Motivation is said to be a determinant factor that can influence the success of learning, thus looking at strategies to enhance the motivation are necessary to be carried out. Some factors may affect to students’ motivation to learn, among them relates to materials and what tasks they do in classroom (Wachob, 2006 :95). Teaching materials was argued to have a great contribution to the effectiveness of learning process, thus the careful selections constantly affected to motivation. Motivation in this study refers to the positive behavior of students, where they show high interest, persistent, and enthusiasm when authentic materials used. Results indicate a high positive correlation between the three instruments. Observation of “on-task behaviour” has proved to be a good tool for collecting data on class behavior in language teaching (Hopkins (1985), Peacock (1997), and Tra (n.d). Nunan (1992:37) definition of “on-task behaviour” was adopted in this research, “on task behaviour” is defined as “ the time when the student engaged in the pedagogic work of the day ”. It is as engaging in behavior since it is in a straight line related to the activity set by the teacher.

Motivation is one of the crucial variables in language learning and one of the key factors in determining success in second/foreign language learning, thus strategies to enhance motivation is crucial to be carried out. In the context of EFL, Gardner (1985:134) comments, “motivation to learn a foreign language can be defined as a multifaceted of constructs, involving effort and desire, as well as a favourable attitude toward learning the language at hand”. For the fact that authentic materials are feasible to increase the motivation for learning, the present study utilized it to the defined respondent. Mishan (2005:26) postulates that motivation grows to be good reason for applying authentic materials in language learning. According to some proponents of authentic materials, one of the advantages of authentic materials is they have a positive effect on learner motivation since intrinsically they are more interesting and motivating than created one (see Peacock, 1997, Swaffar, 1985, Bacon and Finneman, 1990).

Another maintained that authentic materials bring motivation to learning because a large number of sources for language learning such us on the media and web which likely to attract interest or attention of the learners (Clarke and Silberstein, 1977 and Peacock, 1997). According to Dörnyei (2001:51), learners’ initial motivation can be generated, through teacher efforts to enhance the learners’ language-related values. The values can be classified into three types: intrinsic value, integrative value and instrumental value. Authentic materials are helpful to enhance these three values because they tend to be more numerous in the choices of topics, they are real cultural products from the target community and they could be easily integrated with learners’ daily life.

The positive motivational aspects of authentic materials found in the current research are in line to the findings of previous studies in the same field (Peacock, 2007 and Than Tra (n.d)). Similar to Peacock (1997) and Thanh Tra (n.d) studies on seeing the effectiveness of authentic materials toward motivation, the finding of this research indicated that authentic materials can positively enhance students’ motivation to learning. At the same time, this finding is in agreement to some literatures claimed that motivation is one of the key justification for the use of authentic materials in language learning (see for example Swaffar, 1985, Bacon and Finneman, 1990, Mishan, 2005). Additionally, in the introduction of her journal about motivation, Winke (2005:1) shows that

tapping the students' motivation become the crucial aspects of many language teachers since a long time, and they believed that it is their responsibility to motivate them. Many of these teachers prefer to create interesting and engaging classroom atmosphere by using authentic materials to stimulate further interest in the language and its native speaker.

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# Empirical Analysis of Energy Optimisation of a Supercapacitor using MAX756 DC/DC Boost Converter

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DOI: 10.29322/IJSRP.8.8.2018.p8062  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8062>

**Abstract-** The experiment was required to evaluate the incorporation of a step-up DC/DC converter to boost the energy recovered from a supercapacitor. This involves the use of 8-Pin MAX756 which is manufactured by Panasonic based on CMOS step-up DC/DC switching regulator for small, low input voltage and battery powered system. It accepts low input voltages down to 0.7V and boosts it to a higher selective voltage of 3.3V or 5V with switching frequency up to 0.5MHz and efficiency up to 80% at 200mA. This DC/DC is coupled to capacitor voltage of capacitance of 30F of maximum operating voltage of 2.3VDC with internal resistance of 0.1( $\Omega$ ) at 1kHz, diameter 18mm, length 35mm, pin diameter 0.8mm and spacing between pins of 7.5mm based on manufacture's specification. Charge and discharge characteristics were performed with and without DC/DC converter and compared to theoretical characteristics. It was found that the charge and discharge rate were similar to the theoretical result. Also, when a DC/DC converter was connected, the result showed that the voltage remained more stable as load was increased and the time of discharge was extended.

**Index Terms-** Supercapacitor, DC/DC converter, energy back-up devices.

## I. INTRODUCTION

The challenge facing the designers of electronic system and other interest group in energy field is the storage of energy being generated for future use for an emergency and peak power demand applications. Many applications rely on stored energy for their operations in the absence of the main energy supply. A typical example is the solar powered car that uses light energy but unfortunately if the source of energy goes off vehicle relied on the backup power which may not last a long time. There are many other devices like the energy back-up devices which give temporary energy support to the system like the uninterruptible power supply which sustains power temporarily in the event of power failure from the main [2].

Some other devices use peak power supply for their initialization or start-up which main power will not be able to meet within the short period. Storage power devices are found in most electronic devices such the palm top computers, medical instrumentation, personal data communication, wireless sensor network, and so on. There are different types of energy can be stored in so many forms such as in the vibration, radio frequency, batteries, flywheel and capacitors. The choice of the storage option depends on the application and the capacity of the storage

system. The battery is generally used as an energy storage device in many applications for in which peak power demand is not critical but the battery can supply energy for longer period because its high energy density. However, its chemical properties make it unsuitable in some applications [2]. Supercapacitor is another storage device that has ability to store and quickly release relatively large amount of energy and that make them particularly effective energy harvesting applications where there is need for high burst power [3]. Supercapacitor is formed from two current collector substrates that are coated with porous material which are suspended in electrolyte. If a potential is applied the ions are collected on each collector while the thin barrier prevents the charge from moving between them [5]. It is a reversible reaction without chemical reaction in that it can be charged and discharged several times. Supercapacitor or electrochemical double layer capacitor(EDLC) stores charges as electric field and can be used to power solar car because its high capacitance and high energy density. Another energy harvesting device is the fly wheel in which energy is stored in form of kinetic energy by accelerating a cylindrical assembly called a rotor to a very high speed and making the energy in the system rotational energy. It releases energy very quickly and efficiently well when compared to battery. All these energy harvesting devices have some limitations, for instance the capacitor after discharging still have some stored energy in them that need to be improved by using the dc-dc converter. A dc-dc converter is a step up or down switching regulator for small low input voltage power system. It has high power density, efficient and reliable [4]. It can be regulated or unregulated based on presence of absence of stabilisation function. When the dc output is larger than dc source, the switching dc-dc is called boost converter but when the dc output is smaller than the dc input the converter is referred to as buck converter. In this experiment the MAX756 was used to step up voltage as low as 0.7v and convert it a higher voltage. This is to improve the discharge rate of capacitor using a greater percentage of the stored energy.

## II. IMPLEMENTATION

The experiment was carried out using MAX756 to boost the energy stored in the super capacitor to ascertain the rate of charging/discharging with theoretical results. The characteristics of the super capacitor practical laboratory experiment to compare them with that of the theoretical characteristics.

In the course of the implementation, the supercapacitor was evaluated, and the experimental observations made by

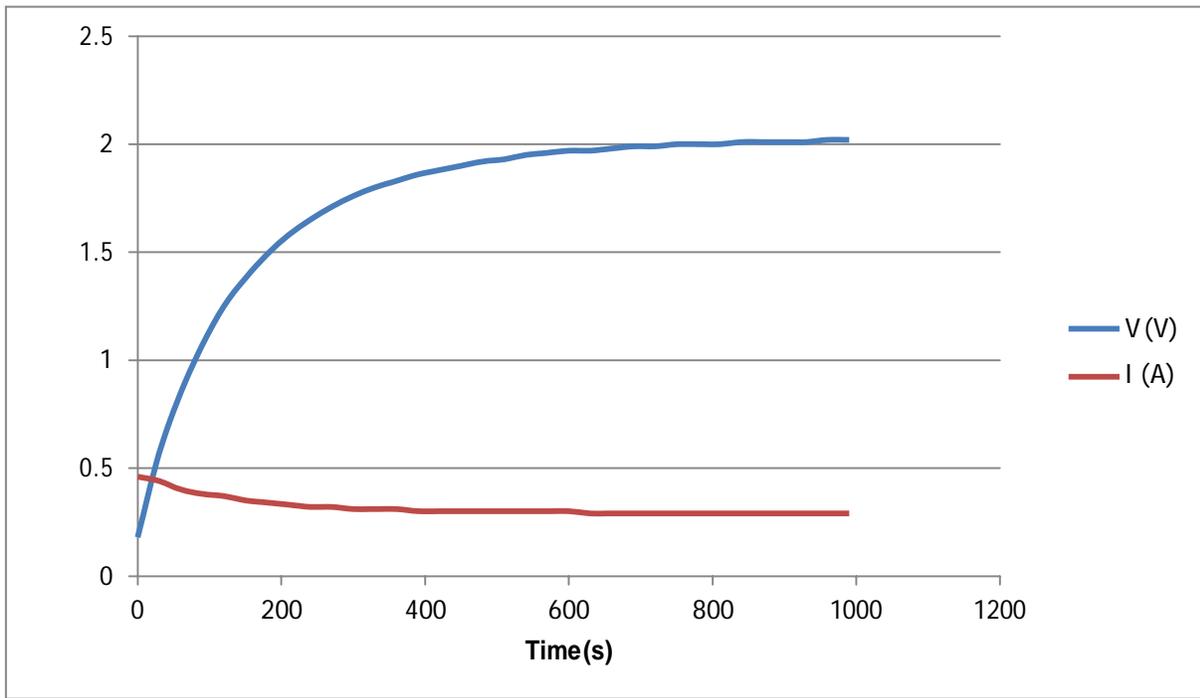
measurements to confirm the manufacturer’s specification of 30F value with internal resistance of 0.1ohms at frequency of 1KHz. Charge and discharge characteristics was carried out and graphs plotted to compare theory and ensured that the components operated over the standard operating voltage range. Load was added to the outputs of the supercapacitor and the effects observed when MAX756 was incorporated.

### III. LABORATORY RESULTS

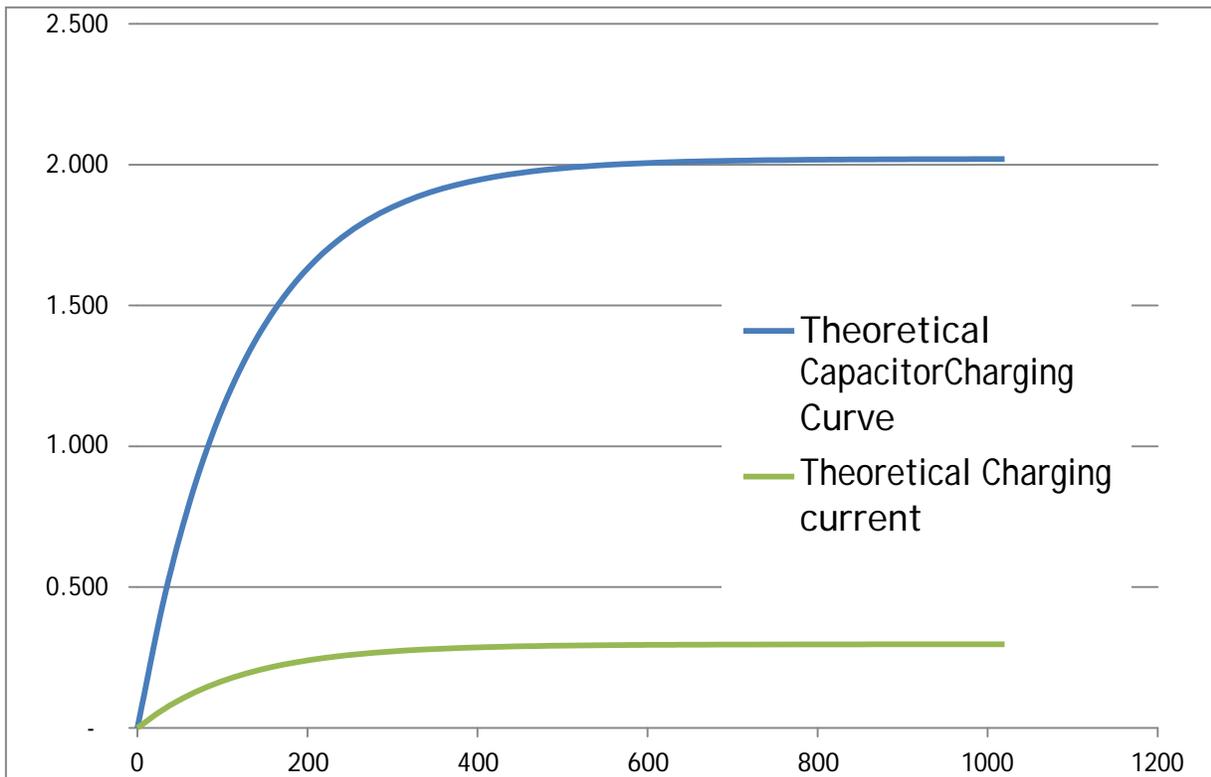
**Table 1.0; Results of Charging Characteristics of a Super Capacitor**

Time (S)	V (V)	I (A)
0.00	0.18	0.46
30.0	0.57	0.44
60.0	0.85	0.4
90.0	1.07	0.38
120	1.25	0.37
150	1.38	0.35
180	1.49	0.34
210	1.58	0.33
240	1.65	0.32
270	1.71	0.32
300	1.76	0.31

330	1.80	0.31
360	1.83	0.31
390	1.86	0.30
420	1.88	0.30
450	1.90	0.30
480	1.92	0.30
510	1.93	0.30
540	1.95	0.30
570	1.96	0.30
600	1.97	0.30
630	1.97	0.29
660	1.98	0.29
690	1.99	0.29
720	1.99	0.29
750	2.00	0.29
780	2.00	0.29
810	2.00	0.29
840	2.01	0.29
870	2.01	0.29
900	2.01	0.29
930	2.01	0.29
960	2.02	0.29
990	2.02	0.29



**Fig 1.0 Charging Characteristics of a practical Super Capacitor**



**Fig 1.1 Showing theoretical charging characteristics of a supercapacitor**

From the characteristics curve of the practical supercapacitor it charges exponentially in with respect to time, initially there was a steady rise in voltage before it finally became stable. It is the other way around in regards to the current, for initially there was a high current increase then over time it beings to reduce then it became constant when it got to the voltage of 2.01v. It can be observed that the practical capacitor had some amount of stored energy in it about 0.18v before charging. The ideal capacitor had zero voltage as compared to the practical supercapacitor. As it can be noticed, even when the capacitor had stored the energy it could store, the current did not go to zero. This is because of the resistors that were connected in across the voltage source.

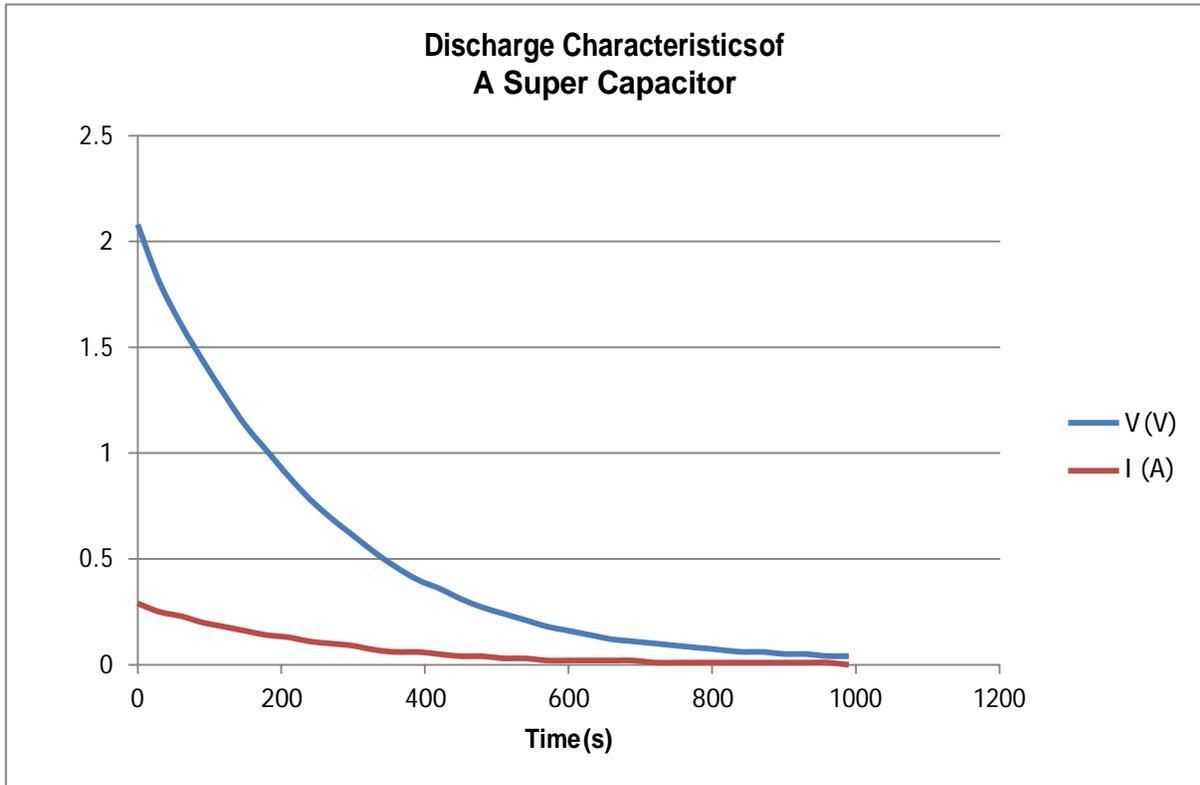
That is why the current did not get to the zero mark. For even if the capacitor is full, current will still flow via the resistors. Outside the influence of the series resistors, this result is the same with available theoretical curves which demonstrates the charging characteristics of a super capacitor.

**Table 1.1; Discharging Characteristics of a Supercapacitor**

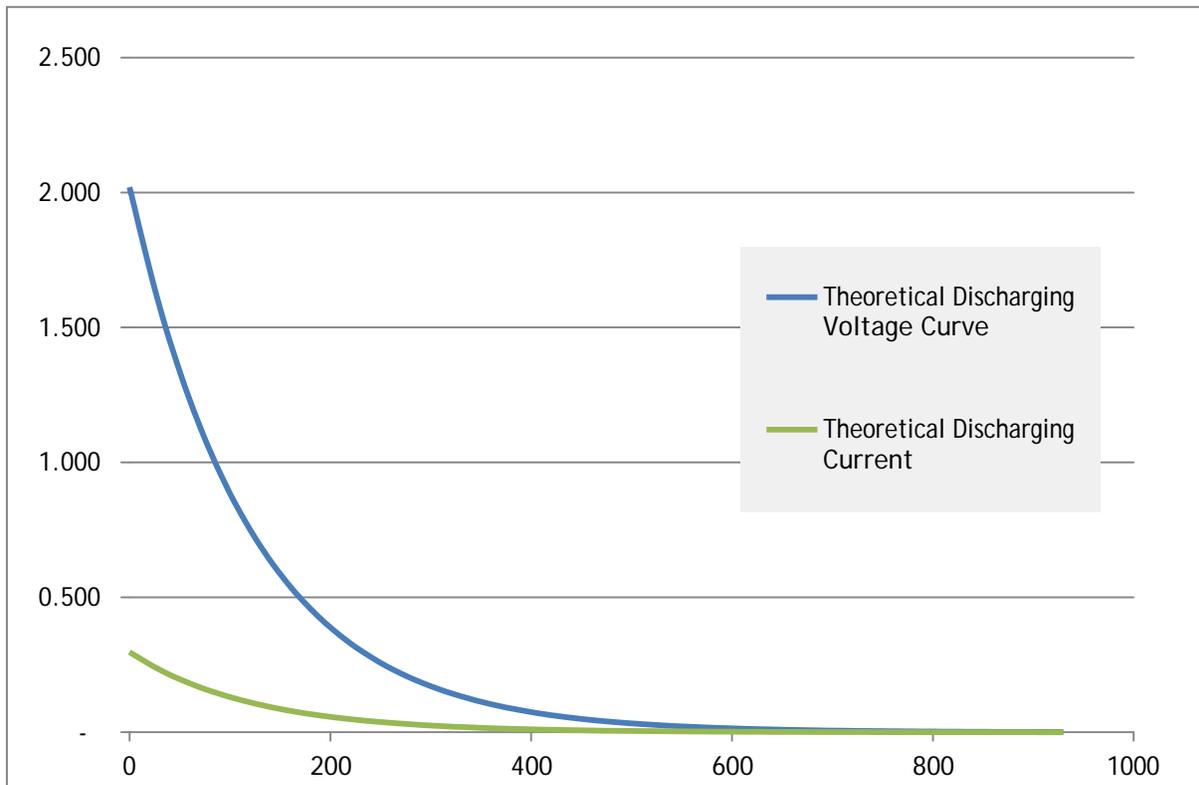
Time (S)	V (V)	I (A)
0.00	2.08	0.29
30.0	1.81	0.25
60.0	1.61	0.23
90.0	1.44	0.20
120	1.28	0.18
150	1.13	0.16
180	1.01	0.14
210	0.89	0.13
240	0.78	0.11
270	0.69	0.10

300	0.61	0.09
330	0.53	0.07
360	0.46	0.06
390	0.40	0.06
420	0.36	0.05
450	0.31	0.04
480	0.27	0.04
510	0.24	0.03
540	0.21	0.03
570	0.18	0.02
600	0.16	0.02
630	0.14	0.02
660	0.12	0.02
690	0.11	0.02
720	0.10	0.01
750	0.09	0.01

780	0.08	0.01
810	0.07	0.01
840	0.06	0.01
870	0.06	0.01
900	0.05	0.01
930	0.05	0.01
960	0.04	0.01
990	0.04	0.00



**Fig 1.2 Discharging Characteristics of a practical Super Capacitor**



**Fig 1.3 Discharging characteristics of a theoretical capacitor.**

The only difference spotted from the theoretical graph is the rate at which the voltage was dropping was similar to the practical capacitor but the difference is that it took longer time from the practical capacitor to drop to zero due to internal resistance. It could hardly be spotted here because in this application it is very small. Outside that, it is perfectly the same with theoretical curves.

The total amount of energy in the capacitor before discharge (initially);

Using the formula =  $\frac{1}{2}CV^2$

$$= \frac{1}{2} \times 30 \times 2.08^2 = 64.9J$$

Energy supplied to the load; Energy =  $PT = IVT = I^2RT$   
But  $I = \frac{1}{2}C \frac{dv}{dt}$

Therefore, using the formula; Energy =  $(\frac{1}{2}C \frac{dv}{dt})^2 \times R \times T$

The graph below shows energy supplied over time;

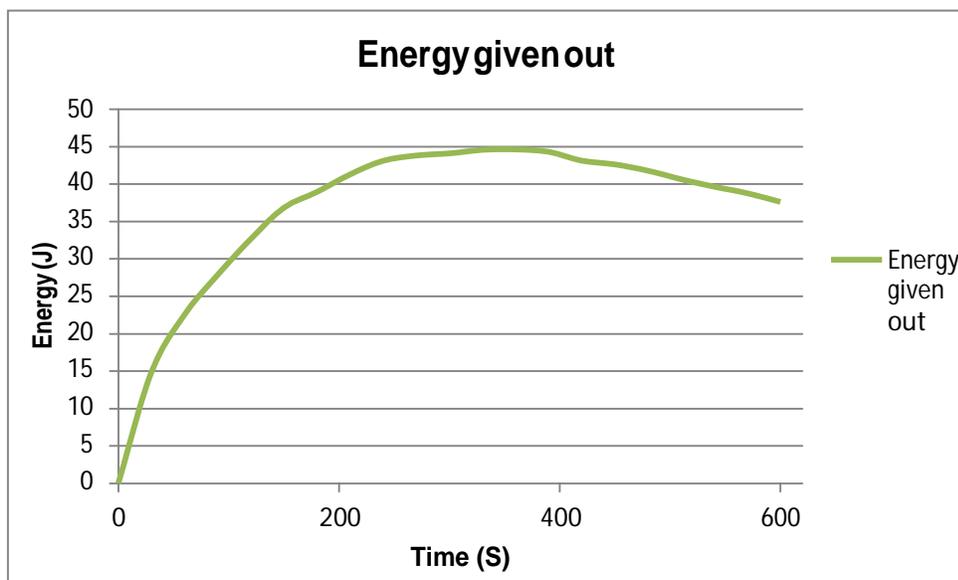


Fig 1.4 Energy output to a 6.8Ω Load against Time

As noticed from the graph, the maximum energy output was at time 330s which was 44.6J. As time increased, the energy calculated began to reduce below its previous value.

This insinuates that 44.6J was the maximum the capacitor could give out at a resistive load of 6.8Ω. Beyond the 330s point, the other values read (voltage, current) will not be able to do any meaningful work or could be seen as noise in the system; since it is not possible that the total energy supplied, will over time begin to reduce.

44.6J is below its calculated initial potential energy which is 64.9J which is about 68.7%. Therefore it could only supply about 68% of its stored energy.

Calculating its capacitance;

Using the value within the first 1 minute

$$I = C \frac{dv}{dt}$$

Where;  
 $I = 0.29 + 0.023 = 0.26 \text{amps}$

$$dv = 2.08 - 1.61 = 0.47V$$

$$I = C \frac{dv}{dt} = 0.26 \times 60 = 33.19F$$

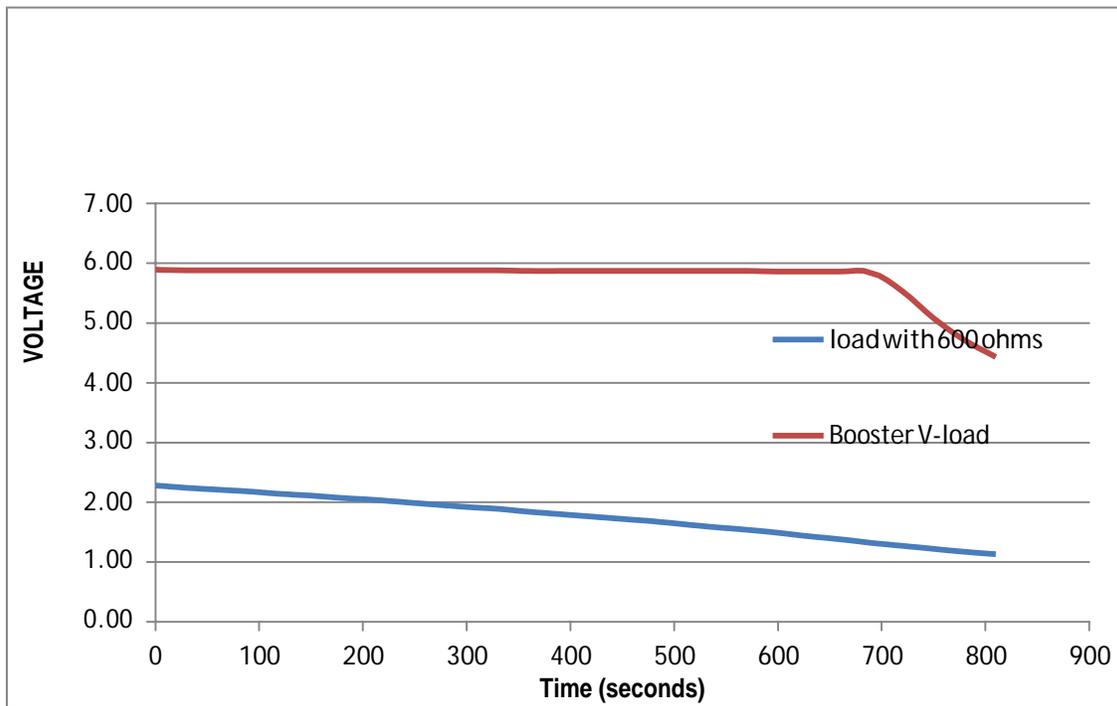
Since the capacitor has a -20% - +40% tolerances, therefore the value above is within limit and in line with the manufacturers' datasheet.

Calculating its internal resistance;

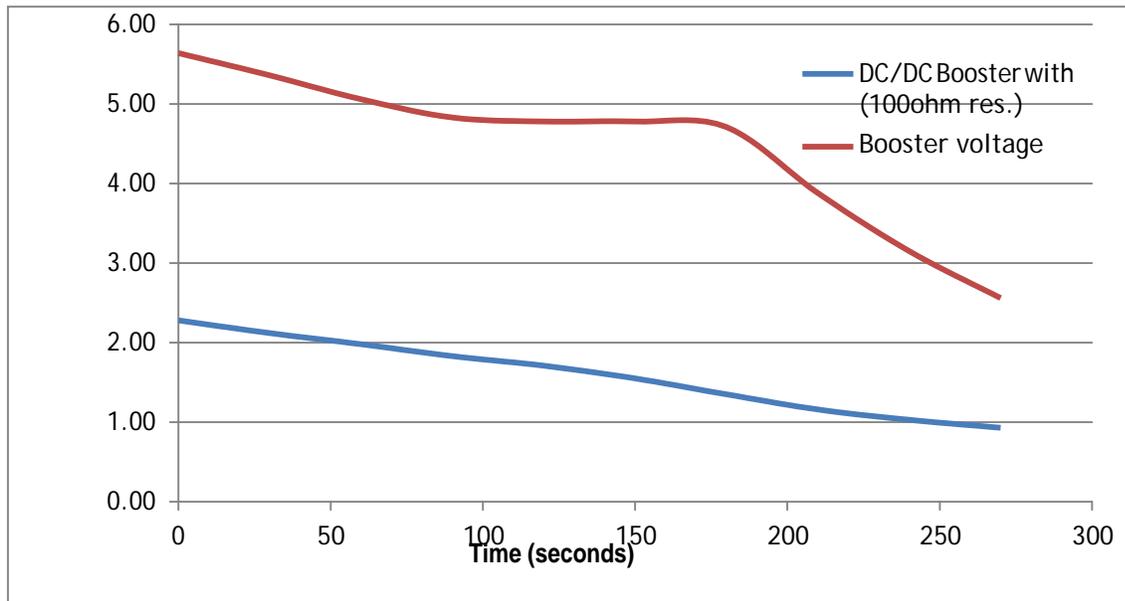
$$= \frac{\text{Voltage before loading} - \text{Voltage after loading}}{\text{Current}}$$

$$= \frac{2.10 - 2.08}{0.29} = 0.07\Omega$$

As illustrated on the graph, as current is drawn from the capacitor the voltage also reduces. This is one of the major problems of a super capacitor which do make it a very strong contender with the battery. To overcome this short fall, a DC-to-DC converter will need to be used which adds up to the overall complexity and cost of the system.



**Fig 1.5 Discharge of capacitor with DC-DC**



**Fig1.6 Discharge characteristics of supercapacitor when a load of 100ohms was connected with dc-d**

#### IV. CONCLUSION

The experiment was performed taking care of some errors that might occur from equipment limitation which might affect the expected result. From the result of the experiment with the super capacitor without the DC/DC converter from the fig1.0, it was observed that the super capacitor curve followed the same curve with that of the theoretical result. As can be seen the practical capacitor charges at the same rate with the reference theoretical capacitor until at a voltage of 2.08 before it continued

at that constant rate which is the maximum and the current has little deviation from the theory because the capacitor which was used for this experiment contained some charges in it because practically the capacitor supposed to have started from zero. In fig1.1 of the discharge curve, it would be observed that the capacitor discharges correspondingly with the theoretical characteristics. Both these results confirmed that the theory is the same as the practical computation from the laboratory. From fig 1.6, when the load of 100ohms was connected with capacitor and with the dc-dc converter it was observed that the dc-dc converter

continued to boost the voltage level and the time of discharge was found to have extended more than the actual rate without dc-dc. And when a load of 600ohms was connected across the output terminal it was found that the voltage was more constant and the discharge rate was increased this showed that as the load was increased the discharge the more stable the voltage. It can be concluded that power retaining capacity of a supercapacitor can be increased using a DC/DC converter.

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# Appraisal of the Role of Co-operative Societies on Well-Being of Members in Adamawa State, Nigeria

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DOI: 10.29322/IJSRP.8.8.2018.p8063

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8063>

## ABSTRACT

This study appraised the role of cooperative societies on well-being of members in Adamawa State. The study used subjective measures, such as income & expenditure, educational & training status, housing & shelter status, nutrition & feeding status, health status, materials & household needs as well as household utilities to determine the respective status of members before and after joined cooperative societies. The structured questionnaire was used to collect data from randomly selected 397 members from four agricultural zones of the state. This study recorded 95% returning rate and data collected were analysed with simple percentage, frequency table and pairwise t-test analysis. The results from analyses show that there are significant improvement in the well-being of member after joined cooperative in all measures: income & expenditure, educational & training status, housing & shelter status, nutrition & feeding status, health status and materials & household, exception of household utilities. The study concluded that cooperative influence good well-being among members and recommends that government should include cooperative in its poverty alleviation programme to reach most people in the rural communities

**Keywords:** cooperative, well-being, income & expenditure, housing & shelter status, household utilities.

## INTRODUCTION

The declining trend in the global economic situation has created an era where many feel weak to change their livelihoods. Recently, many governments and people in different parts of the world have been showing great interest in the activities of cooperative societies. The globally acceptance of cooperative could be as a result of the significant roles that cooperative organisation is playing in all fields of human endeavors, especially, as vital alternatives to strengthening the weak economy and social status of the rural poor (Tanko, 2002). Nigeria is richly endowed with both human and natural resources. Despite the vast resources, the country's economy has not experienced the required institutional and structural changes that guarantee rapid and sustainable growth relative to an acceptable standard of living (UNDP, 2014). In spite of the huge man capacity in Nigeria economy, it could be argued that Nigeria has just presently begun to build a strong and highly competitive market oriented and technology-driven national economy (Onyeze et al., 2014). However, to create such an open and caring economy, popular participation in economic activities is necessary. Thus, because of the low capital base of majority of people, especially the 60–75% population residents in the rural areas, government recognizes the importance of cooperative societies as one of the catalysts of economic empowerment and popular participation of the relatively poor people (NBS, 2014). It was concluded that no meaningful development can be achieved without embracing the poor majority as part of the overall nation building. Cooperatives offer opportunity for local people to take development into their own hands and make it a meaningful concept at the local level. They have arisen where the cost of adjustment to economic change has threatened to destroy communities, where local people needed power to control the pace and direction of change in order to preserve what they value.

Bebeji (2001) asserted that most cooperative societies in Nigeria have failed for a number of reasons which have acted simultaneously. First, there has been an almost universal inadequacy of resources channeled for the promotion of cooperatives. Secondly, there are short-comings in the state of non-governmental administration of cooperatives. Thirdly, government has abused cooperatives by using them for achieving political goals and empowerment their allied. A review of the activities of cooperatives in Adamawa State indicated that there are over 12,000 registered cooperative societies of various categories both at the rural and urban levels, out of which 9,000 are operational (MCI, 2012).

In spite of all odds, cooperative remains one of the measures to atone the negative effects of economy downturn among less privilege, mostly people from rural areas. However, due to lack of interest among elite and Nigerian politicians, cooperatives have not been making any significant strides. Meanwhile, each Government in Nigeria is making efforts to alleviate poverty among people without looking into direction of cooperative society, this shows further how little government of Nigeria appreciate the important of cooperative societies on wellbeing of members. This study therefore, is an attempt to investigate the effective cooperative on wellbeing of members, in Adamawa State.

Evidences from various studies have shown that Nigeria economy is not transmits richly endowment of both human and natural resources. Babajide (2013) mentioned that the development trend in Nigeria's economic sector did not reflect its great wealth in terms of human and natural resources. This was further reaffirmed by United Nation's Report in 2007 that despite the abundant agricultural resources and oil wealth, poverty is wide spread in the country and has increased since the late 1990. Recently, the International Fund for Agricultural Development, IFAD (2014) reported that the well-being of majority of Nigerians is poor. Specifically, people in the rural areas live below the poverty line and social services/infrastructure are limited, leading to decline in productivity of the majority agricultural oriented activities.

Tanko (2015), reported that the Adamawa State Government has actively encouraged co-operatives in order to promote social and economic changes desirable for attainments of its rural development. The extent at which this effort yielded desire results is still unclear. The well-being of most members of cooperatives has not being in review over the years in Adamawa State. Though, view studies have been conducted but none has considered the well-being of members of Cooperative in Adamawa state as a study focus.

This study will be an insight for the governments, federal and state that is making efforts of improving living standard of populace. Identifying the roles of cooperative as well-being booster will make government to mull the use of cooperative as poverty alleviation strategy. The findings from this paper will give a clear picture about cooperative societies to various individual that may like to join cooperative societies. The likes of institutions of learning, researchers and others that wish to take further studies on the development of cooperatives will finding this paper handy.

Generally, there four principles underlies the formation of cooperative society which are; formation by group of individual that common in needs and aspirations; the formation must be voluntary; the decision for forming society has to democratic, while its control and ownership still belong to the people to meet their needs (Champo et al., 2012). Likewise, Baarda (2006) express cooperative societies as voluntary organizations that open to all persons to use their services and ready to accept the responsibilities of membership, without gender, social, racial, political or religious discrimination. In primary cooperative organisations members have equal voting rights and cooperatives at other levels are as well organized in a democratic manner.

The World Health Organization, in 2009, advocates that a state of well-being is a multifaceted. According to Bourne et al. (2010), to be well-being goes beyond complete physical, mental and social well, or absence of disease or infirmity to a life satisfaction, through self-rated status which can serve as a proxies for actual well-being. Thus, it is difficult to adjudge well-being from distance observation, the self-rating remain idea. Lora et al. (2009) argued that life satisfaction is broader in scope and include aspects such as jobsatisfaction and social relations. This causes Bourne et al.(2010) to recommend life satisfaction as better measure of overall well-being. Champo, Mwangi and Oloo (2012) expressed that over the years the actual measurement of well-being is changing and keep changing, and recently the future measurement of well-being will be complicated than ever thought, as people yearning for materials and more economic power increasing. well-being determination can be categories into quality of life which include health status, work-life balance, education and skills, social connections, civic engagement and governance, environmental quality, personal security and subjective well-being, while material well-being include income and wealth, jobs and earnings and housing standard, but the sustaining well-being over time thorough preserving will be considered as future well-

being include natural capital, human capital, economic capital and social capital. Of all categories, only quality of life gives hope for other well-being measures.

In order to include all aspects of well-being, subjective measures are more preferred. Onyeze et al. (2014) expressed that though most economists preferred using objective measures for the purpose of investigating over all well-being. However, objective measures are inadequate because they leave out social and mental aspects of well-being (Brenes–Camacho, 2011). To appropriately measure over-all well-being should include all aspects of life, such as life satisfaction and happiness, frequency of laughter, sociability, optimism and those reporting themselves to be happy are also considered to be happy by others (Lora et al., 2009). Both SRH and life satisfaction are affected by cognitions and subjective perceptions. Because of this the concepts are interrelated, and together they form a good base for understanding over-all well-being.

Opong-Manu (2014) carried out survey study on the impact of participating in cooperative societies on members' economic actualization. The study indicated significant impact of cooperative participation on 145 members in their post-harvesting marketing than 150 non-member marketers. This showed an improvement in members' economic status as a result of benefited from credit facilities from their respective cooperative. Omoregbee and Okoedo (2012) found significant influences of the assistances benefited from NGO and other international donors on members' economic activities. Good supervision of the activities of members by teams from cooperatives significantly assisted the members to become more successful within the liberalized economy. Opong-Manu (2014) recommended that government should encourage other marketers to participate in cooperative activities in order to stabilize their economic activities in such chaotic economic situation like Nigeria. It was suggested from study by Tanko (2015) that more cooperative societies should be introduced to increase the catchment areas and wooing more members of communities into cooperative societies and in turn developed the economic standard of the entire communities. In another study conducted by Najamuddeen et al. (2012) on the role of cooperative societies in community development in Sokoto metropolis, Sokoto state, Nigeria. It was established from the study that the contribution of cooperative societies in community development through self-help efforts are ranged from schools rehabilitation, road construction and other community projects, and offer of financial and material assistance to disabled people. This pinpointed how cooperative can be used to positively touch life of needy within society to uplift their well-being. Generally, the members are economically fair among others in the communities in spite of the fact that majority have not been effectively utilized the loan and invest other financial benefit derivable from cooperative. Adurayemi (2014), examined the roles played by cooperative societies in the economic development of Nigeria and the problems faced by cooperatives and their prospects in Igbesa, Ogun State, Nigeria. The study found that members of cooperatives perceived cooperative to be a unique form of business that can be used by people and business for their mutual benefit and well-being. Also, it was established that irrespective of types of purpose or membership, starting a cooperative requires considerable time, energy, commitment and technical resources. The members of cooperatives were found to be unanimously agreed that recognition of a common need is fundamental to the formation and successful operation of a cooperative. Muhammad (2014) reviewed the role played by cooperative organizations in rural community development in Nigeria. The study established that cooperative organizations serves as an effective rural community development vehicle, where most members were able to build economic self-reliance and civil society. It was concluded that being a member of cooperative empower people in rural community.

## **Materials and Methods**

Adamawa state is one of six states in the north eastern Nigeria, made-up of twenty-one Local Government Areas shared international border with Cameroon. Currently, all twenty-one local government areas within the state are zoned under four (4) Agricultural zones based on the climatic and types of crop grown (Kadams and Sajo, 1999). In all, there are 1140 cooperative societies with total of 54,280 members (Tanko, 2015). This study used Taro Yamane sample size formula to randomly select total of 397 members of cooperatives societies from population, comprises total 126 members from Zone A, 87 from Zone B, 75 from

Zone C and 109 from Zone D respectively. The structured questionnaire was used to collect data from sampled respondents and data were analyzed using simple percentage, frequency count and chi-square.

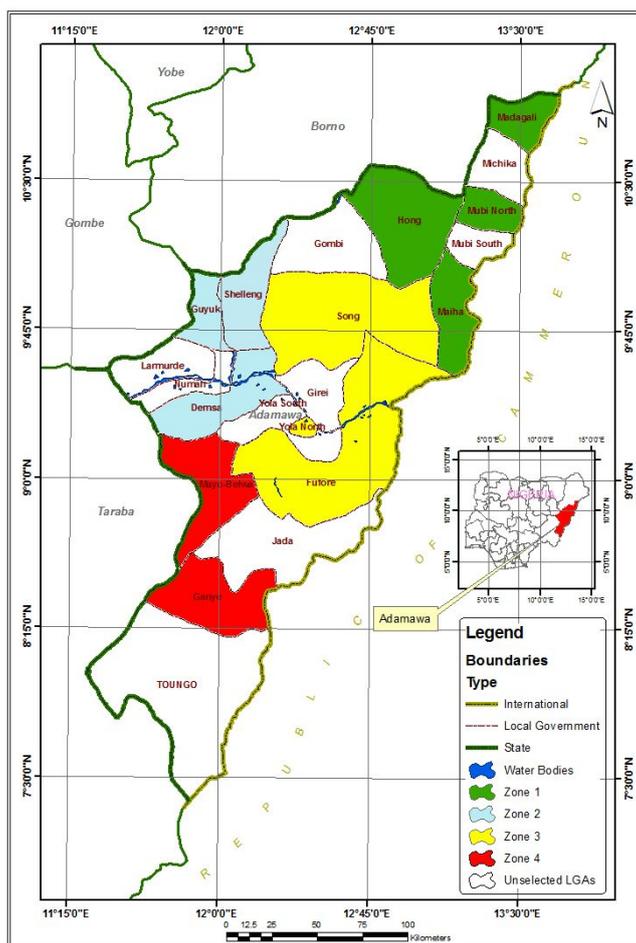


Figure 1: The Study Area

RESULTS

Table 1: Respondents’ Opinion on Wellbeing Status Before And After Joining Cooperative

Well-being indicators	Percentage Change				
	Zone 1	Zone 2	Zone 3	Zone 3	Overall
<b>Income &amp; Expenditure</b>					
High	37	31	40	18	32
Moderate	-33	-24	-34	-8	-26
Low	-4	-7	-6	-10	-6
<b>Education status</b>					
High	39	30	33	30	34
Moderate	-31	-17	-26	-18	-24
Low	-8	-13	-7	-12	-9
<b>Housing and Shelter status</b>					
High	33	45	41	34	38
Moderate	-26	-35	-28	-23	-28
Low	-7	-9	-13	-11	-10

**Household Nutrition status**

High	29	45	32	35	35
Moderate	-20	-38	-21	-23	-25
Low	-9	-8	-11	-13	-10

**Access to Health Care Status**

High	34	30	43	35	36
Moderate	-24	-24	-29	-20	-25
Low	-10	-6	-14	-15	-11

**Household Materials status**

High	36	36	30	29	33
Moderate	-26	-25	-12	-13	-20
Low	-10	-11	-18	-16	-13

**Household Utilities Status**

High	1	1	1	1	1
Moderate	-12	-9	-11	-2	-9
Low	11	8	10	1	8

%Δ (percentage change in status rating) = % status after being members – % status before being members,  
Source: Field Survey, 2013.

Table 2: Pairwise T-test on Wellbeing Status Before and After Joining Cooperative

	Zone 1	Zone 2	Zone 3	Zone 4	Overall
<b>Income &amp; Expenditure</b>					
t-calculated	11.11	8.38	9.83	6.16	7.48
t-critical	1.968	1.98	1.976	1.98	1.962
Degree of freedom	193	127	154	126	603
Sig. (2-tailed)	0.000**	0.000**	0.000**	0.000**	0.001**
<b>Educational Status</b>					
t-calculated	9.83	9.74	10.59	8.08	9.57
t-critical	1.968	1.98	1.976	1.98	1.962
Degree of freedom	193	127	154	126	603
Sig. (2-tailed)	0.000**	0.000**	0.000**	0.000**	0.001**
<b>House/shelter status</b>					
t-calculated	5.007	5.667	3.935	4.703	4.859
t-critical	1.968	1.98	1.976	1.98	1.962
Degree of freedom	193	127	154	126	603
Sig. (2-tailed)	0.01**	0.001**	0.02**	0.003**	0.001**
<b>Household Nutrition</b>					
t-calculated	11.17	7.79	9.83	10.6	10.16
t-critical	1.968	1.98	1.976	1.98	1.962
Degree of freedom	193	127	154	126	603
Sig. (2-tailed)	0.000**	0.000**	0.000**	0.000**	0.026*
<b>Household Health Care</b>					
t-calculated	11.33	7.25	11.18	7.88	8.16
t-critical	1.968	1.98	1.976	1.98	1.962
Degree of freedom	193	127	154	126	603

Sig. (2-tailed)	0.001**	0.01**	0.001**	0.002**	0.021*
<b>Household Assets</b>					
t-calculated	11.444	9.253	8.619	7.579	5.813
t-critical	1.968	1.98	1.976	1.98	1.962
Degree of freedom	193	127	154	126	603
Sig. (2-tailed)	0.000**	0.000**	0.000**	0.000**	0.013**
<b>Household utility</b>					
t-calculated	1.355	0.529	0.377	0.717	1.147
t-critical	1.968	1.98	1.976	1.98	1.962
Degree of freedom	193	127	154	126	603
Sig. (2-tailed)	0.177 <sup>NS</sup>	0.598 <sup>NS</sup>	0.707 <sup>NS</sup>	0.475 <sup>NS</sup>	0.252 <sup>NS</sup>

t-cal: calculated t-test, t-crit: critical t-test value, df; degree of freedom, sig: significant (p-value)

\*\* Significant at 0.05 level (2 tailed), NS: Not Significant

Source: Field Survey, 2013.

## Discussion

The respondents were requested to rate their status with respect to some wellbeing indicators, which includes income and expenditure, education, healthcare, nutrition/feeding, shelter/housing household assets and utilities, before and after joining cooperative society. Thus, their self-determined opinions (subjective) on what their status was, served as data for this section, with the aimed to determine if their being members of cooperatives noticeable impacted on their wellbeing. Table 1 revealed changes in the respondents' income and expenditures status. In overall, the results indicated 32% increments in the category of respondents across the four zones that earn high income status, while those in the categories of moderate income and low income status reduced by 26% and 6% respectively. Likewise, pairwise t-test (Table 2) established significant differences between respondents' income and expenditure level before and after being a member of cooperative society. The overall t-test value of 7.48 which is greater than t-critical value of 1.962 at degree of freedom of 603, suggested that participating in cooperative societies had positively impacted on the level of income of members of cooperatives across the four zones. This finding agreed with the finding of Oladejo (2013) that the main reasons behind cooperative societies was to creating vibrant mobilization and financial support for the members. Marilyn (2008) maintained that among the benefits for the members of cooperatives is the loan facility with which the members of cooperatives invested and boost their respective income.

Likewise, it is notable on Table 1 the educational status of members across the four zones. In overall, there was relative improvement in the status of the respondents' household education from low to high by 34%, an improvement that might not be unconnected with their participation in cooperative activities. The results on Table 2, established further that being a member of cooperatives played significant role on educational improvement of members. The overall calculated t-value (4.859), greater than t-critical (1.962) at degree of freedoms of 603. More so, the impact of cooperative on members' household education status was found positive and this may not be unconnected with the fact that the income generated through cooperative enables the members to pay their children school fees and other educational requirement of the households. this agrees with findings made from different earlier studies that cooperative is one of the avenues to achieve household educational development through availability of loan, dividends and rooms for special saving for household training and development (Oluwatayo, 2009 and Babajide, 2013).

There was also a noticeable improvement in the respondents' housing shelter status, the overall result indicated 38% increment in the category of respondents across the four zones that had improvement in their housing status, while those in the categories of moderate and low housing status reduced by 20% and 18% respectively. The pair t-test as shown in Table 2 also reaffirmed that the difference between respondents' housing status before and after joining a cooperative society is significant with overall t-test

value of 9.57 which is greater than t-critical value 1.962 at degree of freedom of 603. The impacts of cooperative on household assets may not be unconnected with the accessibility to loan from which individual members of a cooperative can make use as a capital for their various trades. This finding corroborate the findings of Babajide (2013) that cooperative benefits individual by making easier for the members the accessibility to loans either in cash or in the form of goods. The report by World Bank (2014) revealed that it is very difficult for the average individual to get loan from the banks and other financial institutions in Nigeria. For low income earners, it is even worse and somewhat complicated, because they do not normally meet up with collateral.

More so, the results from Table 1 revealed an improvement in the respondents' nutrition status across the zones by 35% increment in the category of members that had high household status, while those in the categories of moderate and low housing status reduced by 20% and 15% respectively. The pairwise t-test (Table 2) also revealed a significant difference between respondents' household status before and after being a member of cooperative society (t-test calc. value; 10.16 > t-critical value of 1.962, df 603). Thus, the 35% improvement in the household status of respondents across the zones recorded was as a result of joining the cooperative society. Also, Table 1 shows that respondents with high healthcare status increased by 36% as a result of vertical movement from low and moderate status respectively. The pairwise t-test analysis in Table 2 revealed t-test value of 8.16 was depicted, which shows significant difference compared to t-critical value of 1.962 at degree of freedom of 603. Thus, the effect of being a member of cooperatives is felt on the household healthcare access of the respondents, a fact that may not be unconnected with the accessibility to loan for the members of a cooperative. Furthermore, results on Table 1 shows that across the four zones, there was 33% increment in the number of respondents with high household assets status as a result of vertical movement from low and moderate status respectively. In the overall, the pairwise t-test analysis (Table 2) revealed t-test value of 5.813 which shows significant difference compared to t-critical value of 1.962 at degree of freedom of 603. Thus, the effect of being a member of cooperatives is felt on the household assets of the respondents, a fact that may not be unconnected with the accessibility to loan for the member of a cooperative. Based on the findings from this study the health, shelters, nutrition and household education status could not have accidentally improved without the easy access to loan from the respective cooperative societies. In all, accessibility to loan may in-turn boost members business and eases their accessibility to other well-being indicators such as health care, work life, educational status, personal security and housing.

However, the results on Table 1 revealed poor access of respondents to household utilities across the four zones. The overall result revealed that there is 8% declined in the growth of those that had moderate access to households utilities before and after being members of cooperatives while those having high households' utilities before and after joining the cooperative indicated insignificant improvement. The t-test analysis in Table 2 revealed that in the overall the calculate t-test value of 1.147 is less than t-critical value of 1.965, an indication that of no significant difference in the respondents' household utilities despite been members' of cooperative societies. This result may not be unconnected with the fact that household utilities, such as Pipe borne water, Telephone, and Electricity, are provided at government subsidies and may not necessarily have effects on the affordability of respondents before and after joining cooperatives. Provision of household utilities is function of government as a contribution towards provision of social amenities in the communities. this concurred with the conclusion drawn by Oladejo (2013) that over the years, the government commitments in Nigeria, towards the provision of electricity, telephone services and pipe borne water were noticeable declined. Above all, the findings from this study showed the well-being status of members' recorded significant improvement after in their respective zones. This conformed to the conclusion drawn at the end of the study conducted by Tanko (2015) that cooperative societies improve the overall living standard of the members irrespective of type and location.

## Conclusion

The application of the basic principles of cooperative societies is simple and adaptable. People of different gender and occupations, farmers, crafts men, traders, public and private workers were able to organize themselves to pool their resources for

the benefits of their livelihoods through the cooperatives. It is evident from the findings of this study that cooperative societies played significant role in the well-beings status of members of cooperatives, the likes of; household income, health, education, shelter and feeding recorded improve. In a nutshell, cooperative societies if well managed and supported with necessary incentive from both governmental and Non-governmental agencies, the societies stand the chances to turn things around to better for the members of cooperatives.

## Recommendations

Based on the findings and the conclusions of this research, the following recommendations are put forward:

- i. The well-being of members of cooperatives improved significantly. The government should therefore make cooperative movements an integral package of Rural Development Programmes, to ensure that the rural poor truly benefit in the poverty reduction.
- ii. The coordinating ministries should ensure that cooperatives at all levels are active and operate within the established laws. This will checkmate cases of misappropriated practices and ensure even assess to the resources among members
- iii. Rather than serving as political tools, cooperatives should be focused more on business activities in order to generate more funds to enhance benefits to members. Focusing more on business may give more credibility to cooperatives and enhanced their accessibility to external assistances.

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# Roles of Islamic Banking System In Indonesian Economics

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DOI: 10.29322/IJSRP.8.8.2018.p8064  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8064>

**Abstract-** Bank as financial institutions have an important role in society. They are closely related to the circulation of money in order to smooth all public financial activities. Almost all economic activities of the community require bank services, so it can be said that banking institutions are very important and vital in economic structure of a country. Financing in an Islamic banking, essentially the financing contract is the same as the credit agreement of interest system, but the difference lies in the purpose of the financing as well as the specific clauses contained in the financing contract, such as those concerning the format of the loan interest substitute. In its development, although its age is relatively younger than conventional banking, their performance of Islamic bank in Indonesia has well shown. This can be seen from the increasing number of Islamic banks, as well as the performance of Islamic banks in channeling financing to the community. Islamic bank as a bank that is not based on the interest system, running business activities based on the principle of profit sharing, buying and selling. Therefore, in general, one of the principles in financing the operational of Islamic bank is *mudharabah*. Financing in Islamic bank is something that cannot be avoided, because the *mudharabah* financing has a high risk. Therefore, in order to protect the funds of depositors who are then distributed to the customers (*mudharib*), the law provides for sufficient collateral to guarantee the refunds that have been distributed. In banking practice the requirement of such guarantee is a practical requirement of banking business actors.

**Index Terms-** Islamic banking, *mudharabah*, sharia, *mudharib*

## I. INTRODUCTION AND REVIEWS

In a very straightforward society, whereas number of economic actors, number of goods and service, and type of goods and service were quite low, transaction of goods and service was done by exchanging them during a direct meeting between one and another party in mutual needs. This transaction was known as barter economy. Along with time, marked by more developed economic actors and more complex transaction activities, transaction activities using barter economy was no longer suitable. Therefore, economy-related activities started to aim at the importance of payment tools that can be used to conduct the exchange. This payment tools in its development was known as money.

In economic system, money has one main function which is to facilitate goods and service exchange. Using money, all

economic actors can conduct commercial transaction in a cost-effective and efficient way. The benefit of money in the economic system was to enable trade exchange in the most cost-effective way to obtain optimum productivity. Therefore it can be said that money has the effect toward economy activity, because money is the main instrument of commerce.

In the early time when money was introduced as the tools to conduct economic activities, exchange between parties who have money surplus (surplus unit) with the parties who need money (deficit unit) can be conducted by direct meeting. In its development, whereas number of economic actors and money user were increasing, distance between those who have money surplus and those who need money can be done not only through direct meeting but also through mediator or known as financial institution, [1]. In modern economy, financial institution is part of financial system that serves monetary service users.

This financial institute in its subsequent development has the very crucial role in modern economy activities. Such institution would arrange the meeting between the surplus units with deficit unit. In modern economy, financial institution is part of financial system that serves monetary service users.

According to [2], financial system is one of the most important elements related to economic situation of a country. Financial system provides the highly necessary services within modern economic system. This modern economic system would not work without the role of financial system. Economic condition of a country did not always work as expected by the government and the society. Certain conditions such as high inflation, the increasing unemployment, deficit overseas payment balance were macro-economy symptoms undesirable for any country in the world. To omit or to prevent those symptoms would only possible by controlling the economy through macro-economy policies. What was meant with macro-economy policies was government act to affect the economy aimed so that the economy was not deviating from the expected conditions, such as through fiscal policies and monetary policies, [3].

The position of financial institution was highly important to the economic system of a country. Financial institution as part of the monetary system, along with other monetary authorities could conduct control function over the amount of circulated money. Monetary policies are monetary authority act conducted to affect the amount of circulated money and the credit with the objective to affect the flow of economy. This monetary policy was aimed for economic stabilization which can be measured by job opportunities, price stability and proportionate international payment balance, [4]. With the function to control the amount of

circulated money, a good climate for price stability and economic growth can be raised and it will be able to control toward credit actions. Thus, it could suppress inflation level and unemployment level.

Financial institution can be grouped into two types, bank financial institution and non-bank financial institution. In financial system, bank financial institution has the privilege over the non-bank financial institution. Bank can create some sort of saving that can be withdrawn any time without having to inform the related bank using instrument called check or bilyet giro (BG). This instrument was known as *gral* money which can be used as payment tool in a transaction. Also, bank has the ability to increase or decrease the buying power in the economy. With this ability, bank could affect the amount of money circulated in the society by providing credits for business units that needs the fund.

Generally speaking, main function of a bank is to collect fund from the people and re-distribute it in the form of credits for the people for various objectives or act as financial intermediary. In its development, bank could function as the agent of trust, agent of development and agent of services. As agent of trust, banks carry the function as financial intermediary which being trusted to serve any financial needs from and to the people. As agent of development, banks carry the function as financial intermediary to encourage development progress through credit facility and facilitation in payment and withdrawal within transaction process conducted by economy actors, [5]. And as agent of services, other than to collect and redistribute people's fund, bank would

#### A. Definition of Islamic banking

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.

Prior to the spread of Islam by Prophet Muhammad SAW, trading in Arab peninsular was bustling lively and rapidly developed because it lies in the crossing region between Europe, Africa and Asia continents. Along with this, trading facilities such as financial institutions have developed, including procedure of loaning money with usury system. With the arrival of Islam as the reformer and modernization of life order, loaning money using usury system was forbidden because it was unsuitable with the reforming enthusiasm which emphasizes unity and justice, ([7]; [8]). Before arrival of Islam, business partnerships under the concept of *mudharabah* has existed and worked along with money loan with interest system as a way to finance various economic activities. Once Islam arrived, interest-based financial transaction was forbidden and all fund should be distributed under *profit sharing* concept. Business partnership technique, by using *mudharabah* principle, has been practiced by Prophet Muhammad SAW himself, [8].

Term 'bank' in Islam literature would tend to identify *baitut tamwil* or *baitul mal*, an institution which collect fund from the people and redistribute it to the people. The basis of provision for the operation of *baitut tamwil* was Al Qur'an and Hadith that forbid usury practice as suggested in surah Al Baqarah verse 275 to 281 and surah Ali Imran verse 130 to 131 also Hadiths concerning usury. By not contravene the prohibition about usury

also offer other banking services such as money delivery service, valuable deposit box, warranty bank, credit card and others.

Meanwhile, Islamic bank as a financial institution operates based on Islamic sharia law. It basically has the function as mentioned above, such as intermediary function, trust function, agent of development function and services function. From the bank point of view, as the agent of development, it is clear that Islamic banking has a very important role. This can be seen in Indonesian Article 3 Statute No. 21 of 2008 concerning Islamic Banking, which stated: "Islamic banking is aimed to support the implementation of national development in order to improve justice, unity and fair distribution of people's welfare. Seeing the backgrounds of Islamic bank in Indonesia, one of them would be to facilitate moslems who do not want to relate to conventional banks which use interest system, and they would like to trust their fund to Islamic bank. Islamic banking has an advantage compare to the conventional banking, which is superior from its orientation side. Islamic banking does not only focus on how to be profit oriented, but more than that. It is focused on common good, kindness or helping each other (*falah* oriented).

## II. METHODOLOGY

This study adopted the comparative research reviews between Islamic Banking and Conventional Banking. [6] stated that comparative research may examine differences and similarities between the variables of the study.

## III. ISLAMIC BANK AND ITS SYSTEMS

practice, *baitut tamwil* would operate according to business venture and agreement as ordered in Al Qur'an, Hadith and also by business venture and agreement that has existed before Islam but not forbidden in Al Qur'an and Hadith.

The prohibition to take interest over money was not only existed in Islam. Other religions such as Jews and Christian would also forbid it. Taurat forbid usury, thus Jewish also forbid usury among themselves, but they did not forbid it for people other than Jewish. Christians also forbid usury, not only for themselves but also for those with other beliefs. But some people from businessman and economist under Jews would try to convince the Church to support some part of usury system. Such as, low interest rate for *service fee*. However, the Church was unaffected. Aristotles said that interest or usury was forbidden (haram), no matter how small it is.

In order to provide description about Islamic banking, below was opinion cited from [8], which explains about what is called as Islamic banking; Islamic banking provides services to its customers free from interest, and the giving and taking interest is prohibited in all transactions. Islam bans Moslem from taking or giving interest, and this prohibitions makes an Islamic banking system differ fundamentally from a conventional banking. From the definition, it is known that Islamic banking and conventional banking carry a fundamental difference in which conventional banking implement interest system, while Islamic banking does not, instead using profit and loss sharing principle. Islamic banking implement *profit and loss sharing* principle because it has different philosophical basis than of conventional banking. Islamic banking philosophical basis is the Islamic economy principles.

Islamic banking does not implement interest system, instead, profit and loss sharing. It does not use interest system because interest system was categorized as usury and highly forbidden (haram) in Islam. In interest rate system, money has the characteristic of goods or commodity, and therefore interest rate was assumed as the rental fee because money was used/loaned for certain duration. Islam saw money not as goods or commodity to be rented; therefore asking for rental fee over loaned money was not permitted, [9]. According common views, interest rate is necessary for development. Interest means to increase savings and spend capital for productive investments. But, this view has been criticized and deemed to be a mistake. Usury, in terms of *riba*, according to Al Quran is forbidden (*haram*) even small amount. But, many people try to find the reason to justify bank interest. After all efforts from Indonesian moslem scholars and intellectuals, July 5, 1990 witnessed the positive response from the government toward establishing banks under Islamic law.

#### B. Philosophical principles of Islamic bank

The philosophical principle of the Islamic bank is Islamic economy order as arranged in Al Qur'an and Hadith. The principles are as follows, [10]:

- a. *Non usurious*, usury (*riba*) which means, in this verse, *riba nasiah*. It doubles in amount and commonly occurs among past Arabians (*jahiliyyah* era), which means more payment required by lender. Usury (*riba*) in *jahiliyyah* era has cause a lot of damage and crime. Usury system is a disaster for humanity because it doesn't only affect faith, moral and people's view toward life but also economic and works aspects. Usury system is the worst system which deplete one's happiness and obstruct one's growth to become a balance person. Thus usury was forbidden (*haram*) in any forms.
- b. True and honest. Any transaction should be done with morality that highly appreciates honesty. With this value, each transaction should be done by proposing the rightful way (*halal*) and avoiding the questionable way (*syubhat*) and also avoiding the forbidden way (*haram*).
- c. Justice. Justice in this concept is not being unjust, which means that both parties are not mutually loss and both parties would gain the agreed benefit. Justice contains broad definition and covers all good behavior norms.
- d. *Legitimated profit*. Islam allows limited profit because unlimited profit gained by a capitalist would be as exploitation to the people. Such profit would generally result from monopoly and combination of firms which monopolize price and production, which is the main characteristic of capitalist economy. Its definition from accounting point of view and compiled from Al Qur'an and As Sunnah as well as from several opinions of *fuqaha* suggest that profit is the addition toward trading's main capital or additional value not due to trade expedition barter. Meanwhile, asset appreciation was not considered as profit.

#### C. Difference between Islamic bank and Interest-based bank

Interest-based bank and Islamic bank have several similarities in several aspects, such as both are intermediary institution which

relate those who need the fund and those with excess fund by collecting fund from the people and redistribute it to the people. However, there were some fundamental differences between both institutions. There are differences between interest-based bank and Islamic bank, namely:

- 1) Islamic banks only work with *halal* investment, while conventional work with all types investment,
- 2) Islamic banks use profit sharing besides sales and rental principles, while conventional banks use interest rate system,
- 3) Based on contract/agreement and legality aspects, Islamic banks should obey Islamic law (*sharia*) and the positive law, while conventional banks would only obey the positive law. In contract/agreement, it is believed that it would contain worldly and afterlife consequences, therefore contracts made based on Islamic bank should not deviate from the principles based on Islamic (*sharia*) law,
- 4) According to their objectives, conventional banks are *profit oriented* while Islamic banks are not only *profit oriented* but also *falah oriented*, which means other than pursuing profit, they also try to help people in good/kindness,
- 5) Based on their customer relationship, conventional banks create creditor and debtor relationship, while Islamic banks use partnership relationship,
- 6) Based on their organizational structure, Islamic banks establish *Dewan Pengawas Syariah* or (DPS) or *Sharia Monitoring Council* which has the authority to monitor the Islamic law so that Islamic banks do not deviate and loyal to Islamic principles, while conventional banks do not have the DPS, and
- 7) When there is dispute between bank and customer, dispute settlement in Islamic bank is done through BASYARNAS or Religious Court, while dispute settlement in conventional bank is done through *Badan Arbitrase Nasional Indonesia* (BANI) or National Arbitrage Agency or in State Court.

#### D. Development of Islamic banking system

Initial idea of financial institution which operates under Islamic law was originated from moslem scholars and economist of Islamic Conference Organization. In their second conference, foreign affair ministers from moslem countries in December 1970 at Karachi, Pakistan has officially discussed the idea to establish *Islamic Development Bank* (IDB). Near the beginning of 1980s, Islamic banks start sprouting in Egypt, Sudan, Pakistan, Iran, Malaysia, Bangladesh and Turkey. In general, those Islamic banking institution can be divided into two types, as commercial Islamic bank, such as *Faysal Islamic Bank* in Egypt and Sudan, Kuwait Finance House, Dubai Islamic Bank, Jordan Islamic Bank for Finance and Investment, Bahrain Islamic Bank, or in form of investment institution or international holding companies such as Daar Al Maal Al Islami in Jenewa, Islamic Investment Company in Sudan, Islamic Investment House in Amman, [11].

After seeing the advantage of Islamic banking system, they start to provide Islamic (*sharia*) financial services. In 2005, Deutsche Bank, HSBC, Citigroup, and BNP Paribas establish their Islamic

(sharia) service unit, [11]. Talking about Islamic banking development in various countries, Sudan was one of the country that experience rapid Islamic banking development due to its government commitment. This commitment is materialized in one government policy by conducting Islamization to its economic system in 1983 when Islamic law was implemented for the first time in Sudan.

#### E. Islamic banking in Indonesia bankingsSystem

Informally, Islamic financial industry development has been initiated before there was formal legal framework as the operational basis for Islamic banking in Indonesia. To fulfill people's need for Islamic-based banking system, the Indonesian government has proposed this possibility into the new banking statute. Indonesian Statute No 7 of 1992 about banking has implicitly opened the business opportunity for banking with profit sharing operational basis and explicitly explained in Indonesian Government Regulation No. 72 of 1992 about bank which is based on profit sharing principle. The development of Islamic-based (*sharia*) economy activities has increase because there were financial institution and banking that provide products and services in accordance with Islamic (*sharia*) principle.

#### IV. TYPES AND ACTIVITIES OF ISLAMIC BANK

Referring to categorization above, Islamic bank in Indonesia is divided into two types, Islamic Commercial Bank and Community Financing Islamic Bank. The differences lie on the scale or business scope for each bank. While for its operational principle, both types of Islamic banks have no differences as they all use Islamic banking principle (*sharia*).

What was meant on Islamic banking principle is the Islamic law (*sharia*) principle for banking activities which is based on the decisions issued by institution authorized to make Islamic-based provisions. Business activities based on Islamic principle are the one which does not contain *usury*, *maisir*, *gharar*, *haram* and *zalim*. To achieve objectives in supporting national development, Islamic banking would still use Islamic principles in comprehensive (*kaffah*) and consistent (*istiqamah*) manner. Islamic bank as well as other banks has intermediary function. Islamic bank would also run social function in form of *baitul mal* institution, such as receiving fund from *zakat*, *infaq*, *shodaqoh*, grant or other social fund and redistribute it to zakat management organization.

#### A. Carefulness in its financing provision

It is known that the development of a bank depends on bank's ability in managing utilizing people's fund. This ability would affect people's trust toward bank. Higher trust from the people means more growth and development for the bank itself. Carelessness or lack of carefulness in managing customer's fund would carry severe consequence and it will be lowering bank's health. Once bank's health decreases, it would disturb the liquidity of the related bank, and thus, the bank would no longer solvent or liquid. This would also reduce people's trust toward the related bank. Lower trust from the people would also create other banking problems; in first stage, the bank would face difficulties which endangered its business venture. If there is no effort to repair bank's health, second stage would endanger the banking system. And without any amelioration effort, third stage

would means that bank's existence would endanger national economy.

#### B. Partnership in Islamic banking finance

As described above, relationship between Islamic banking and its customer is a partnership in form of relationship, which is different from the relationship between customer in conventional bank which called creditor and debtor. This might occur because conventional bank implement interest rate system, thus its products would always related to interest.

Islamic bank base its activities in profit sharing, transaction exchange and rental principles. Thus, Islamic bank do not apply creditor and debtor relationship. In profit sharing, transaction exchange, and rental principles, there are no money loan relationship. Instead, it tends to be sharing in nature or helping one another for the goodness for both parties. Also, agreement between Islamic bank and their customer should be made based on agreement's principles as described above so that there is no coercion in the agreement and thus it is voluntarily in nature. There is also nothing to be despotic for, because the object of the agreement is *halal* and no parties are at loss because each party has its own rights and duty as written in agreement.

In *mudharabah* financing between bank and customer, it is built as partnership based on trust and not money loan which raise creditor and debtor relationship. Other financing principles are also corresponding with partnership relationship because all agreement should be based on agreement's principles as regulated under Islamic law.

#### C. Risk and responsibility of all parties in Islamic bank finance

Operationally, Islamic bank would base its activities to the philosophical foundation of Islamic bank as described previously. Therefore, Islamic bank conduct investment in order to finance productive business activities or business activities that face uncertainty and thus its income is uncertain and fluctuate. Their productive business activities and investment will improve welfare and life quality of the people. Business activities by holding interest over money is less risky due to certain and fixes interest rate, [7].

Compared to the existed principles within conventional bank that only familiar with safe calculation and profit in releasing its money, Islamic banking law, always stronger, and lies on top. On the contrary, the same principle would put customer in weaker position and lies on the bottom for conventional bank. As the consequence of this principle, whenever there is legal case between bank and its customer, conventional bank would never been involved in the *profit and loss of the customer*, while this profit and loss is always held toward the customer. This very controversy position would always occur in contracts between conventional bank and its customer.

By not using equal rights in its activities, new agreement or contract between conventional bank and its customer would always reflect unfairness or injustice in all its articles. According to [12], imbalance position of related parties could create unfairness, because the agreement is unfair and contain articles which highly exploit one of the parties involved.

In Islamic banking, with profit sharing between the bank and its customer, both parties hold the same risk and accountability according to the agreements during contract. In a contract based

on profit sharing, whenever there is loss, the bank (*shohibul mal*) would carry the capital loss, while customer (*mudharib*) would carry non-capital loss such as time, energy and mind to the business venture. If it is succeed, the capital would be returned to the bank and profit would be shared between bank and customer based on the agreed percentage during the agreement.

As described in explanation of Indonesian Statute No. 21 of 2008 concerning Islamic Banking, Islamic financing carry failure or default risk in its payment. Thus it would affect the health of Islamic bank. This reminds us that distribution for financing was coming from people's fund entrusted to Islamic bank, and thus the risk faced by the bank would affect the security of people's fund.

In order to maintain the health and to improve Islamic bank's endurance, they oblige to spread the risk by regulating the finance so that it is not concentrated to certain debtor or group of debtors. Also, Islamic bank is obliged to implement risk management, customer relation principle as well as customer protection. Islamic bank is obliged to explain about the possibility of loss risk related with customer's transaction through Islamic bank.

#### D. Islamic banking business activities

Main activities of Islamic Commercial Bank (BUS) would covers: 1) collecting fund in savings such as giro, deposit or other similar forms based on *Wadi'ah* contract or other contracts in line with Islamic law; 2) collecting fund in investment such as deposit, savings or other forms similar to it based on *mudharabah* contract or other contracts in line with Islamic law; 3) distributing profit sharing in financing based on *mudharabah* contract, *musyarakah* contract, or other contracts in line with Islamic law; 4) distributing the financing based on *murabahah* contract, *salam* contract, *istishna'* contract or other contracts in line with Islamic law; 5) distributing financing based on *qardh* contract or other contracts in line with Islamic law; 6) distributing the moving or non-moving goods rental financing for customers based on *ijarah* contract and/or transaction exchange in the form of *ijarah muntahiya bittamlik* or other contracts in line with Islamic law; 7) conducting debt acquisition based on *hawalah* contract or other contract in line with Islamic law; 8) providing debit and/or financing card products based on Islamic principles; 9) buying, selling or warranting securities over self-risk from third party issued based on real transaction based on Islamic law, such as *ijarah*, *musyarakah*, *mudharabah*, *murabahah*, *kafalah* or *hawalah* contracts; 10) buying securities based on Islamic principles issued by government and/or Central Bank; 11) receiving payment on bills over securities and conducting calculation with third party or between third party based on Islamic principles; 12) providing deposits for other parties based on contract under Islamic principles; 13) providing place to keep valuable goods and securities based on Islamic principles; 14) transferring money, either for self-interest or for customer's interest based on Islamic principles; 15) conducting function as Mandated Guardian (*Wali Amanat*) based on *wakalah* contract; 16) providing letter of credit (loc) facility or bank warranty based on Islamic principles; and 17) conducting other normal activities completed in banking and social field as long as they do not against Islamic principles and in line with statute regulations.

While business activities for BUS include: 1) collecting fund in savings such as giro, deposit or other similar form based on *Wadi'ah* contract or other contract in line with Islamic law; 2) collecting fund in investment such as deposit, savings or other form similar to it based on *mudharabah* contract or other contracts in line with Islamic law; 3) distributing profit sharing of financing based on *mudharabah* contract, *musyarakah* contract, or other contract in line with Islamic law; 4) distributing the financing based on *murabahah* contract, *salam* contract, *istishna'* contract or other contracts in line with Islamic law; 5) distributing the financing based on *qardh* contract or other contracts in line with Islamic law; 6) distributing the moving or non-moving goods rental financing for customer based on *ijarah* contract and/or transaction exchange in the form of *ijarah muntahiya bittamlik* or other contracts in line with Islamic law; 7) conducting debt acquisition based on *hawalah* contract or other contracts in line with Islamic law; 8) providing debit and/or financing card products based on Islamic principles; 9) buying, selling or warranting securities over self-risk from third party issued based on real transaction based on Islamic law, such as *ijarah*, *musyarakah*, *mudharabah*, *murabahah*, *kafalah* or *hawalah* contracts; 10) buying securities based on Islamic principles issued by government and/or Central Bank; 11) receiving payment on bills over securities and conduct calculation with third party or between third party based on Islamic principle; 12) providing place to keep valuable goods and securities based on Islamic principle; 13) transferring money, either for self interest or for customer's interest based on Islamic principle; 14) providing *letter of credit* (loc) facility or bank warranty based on Islamic principles; and 15) conducting other normal activities completed in banking and social field as long as it did not against Islamic principle and in line with statute regulations.

Other than conduct business activities as meant in Article 19 subsection (1), Islamic Commercial Bank could also: 1) conduct foreign exchange activities based on Islamic principle; 2) conduct capital participation to Islamic Commercial Bank or financial institution which conduct business activities based on Islamic principle; 3) conduct temporary capital participation to address financing failure based on Islamic principle, under the requirement to pull back its participation; 4) act as founder and manager of pension fund based on Islamic principle; 5) conduct activity in capital market as long as not against Islamic principle and statute provisions of capital market; 6) conduct activities or provide electronic-based products under Islamic principle; 7) issue, offer and trade short-term securities based on Islamic principle, either directly or indirectly through money market; 8) issue, offer and trade long-term securities based on Islamic principle, either directly or indirectly through capital market; and 9) provide product or conduct other activities based on Islamic principle.

Other than to conduct business activities as mentioned in Indonesian Article No 19 subsection (2), UUS could also: 1) conduct foreign exchange activities based on Islamic principles; 2) conduct activities in capital market as long as not against Islamic principle and statute provisions of capital market; 3) conduct temporary capital participation to address financing failure based on Islamic principles, under the requirement to pull back its participation; 4) conduct activities or provide electronic-

based products under Islamic principle; 5) issue, offer and trade short-term securities based on Islamic principles, either directly or indirectly through money market; 6) provide product or conduct other activities based on Islamic principles. Activities as mentioned in subsection (1) and (2) would compulsory to meet the provisions determined by Central Bank and statute provisions.

Meanwhile, Business activities for Community Financing Islamic Bank would include: 1) collecting fund from the people in form of: a) deposits such as savings or other similar form based on *wadi'ah* contract or other contracts in line with Islamic principles; and b) investment such as deposit or savings and other similar form based on *mudharabah* contract or other contracts in line with Islamic principles; 2) redistributing fund to the people in the form of: a) profit sharing of financing based on *mudharabah* or *musyarakah* contract; b) financing based on *murabahah*, *salam* or *istishna'* contract; c) financing based on *qardh* contract; d) financing for moving or non-moving goods toward customers based on *ijarah* contract or rental exchange in the form of *ijarah muntahiya bittamlik*; and e) debt acquisition based on *hawalah* contract; 3) depositing fund to other Islamic bank in the form of deposits based on *wadi'ah* or investment based on *mudharabah* and/or other contract in line with Islamic principles; 4) transferring money, either for self interest or customer's interest through Community Financing Islamic Bank within Islamic Commercial Bank, Conventional Commercial Bank and UUS; and 5) providing products or conduct other business activities for Islamic bank in line with Islamic principle based on the approval of Central Bank.

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# Generator Control System Used in Aircraft Power Supply

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DOI: 10.29322/IJSRP.8.7.2018.p8065  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8065>

**Abstract-** Aircraft have two primary sources of electrical energy. The first is the generator, which converts mechanical energy to electrical energy. The second is the battery, which converts chemical energy to electrical energy. The generator is the main source and the battery is the auxiliary source. In aircraft, the electrical system is primarily an AC system. Aircraft electrical components operate on many different voltages both AC and DC. However, most of the systems are 115 VAC with 400 Hz, 28 VDC and 26 VAC is also used in aircraft for lighting. DC is also supplied from a battery installation. The battery provides 28 VDC. The function of the electrical system is to generate, regulate and distribute electrical power throughout the aircraft. New generation aircraft rely heavily on electrical power because of the wide use of electronic flight instrument systems. For aircraft constant frequency systems 400 Hz has been adopted as the standard. The application of 400 Hz frequency, which is higher than usual frequencies, offer several advantages over 60 Hz - notably in allowing smaller, lighter power supplies to be used for aircraft operations and computer applications.

**Index Terms-** Power Generation System, Power Generation Control, Integrated Drive Generator, Constant Speed Drive, Generator Control Unit

## I. INTRODUCTION

AS the aircraft fly higher, faster and grow larger the service that the aircraft electrical power system has to satisfy also grow more and more complex. There are several different power sources on aircraft to power the aircraft electrical systems. These power sources include: engine driven AC generators, auxiliary power units (APU), external power and ram air turbine (RAT). The primary function of an aircraft electrical system is to generate, regulate and distribute electrical power throughout the aircraft.

The electrical power generation system supplies all the electrical consumers with enough electrical power on the aircraft. There are two main types of power in power generation, the first one is Direct Current (DC) power and the other one is Alternating Current (AC). The main advantage of AC power is that it operates at a higher voltage; 115 VAC rather than 28 VDC for the DC system. The use of the higher voltage is not an advantage in itself; in fact higher voltage is most apparent. For a given amount of power transmission, a higher voltage relates to an equivalent lower current. The lower the current, the lower the losses such as voltage drops (proportional to current) and power

losses (proportional to current squared). Also as current conductors are generally heavy it can be seen that the reduction in current also saves weight; a very important consideration for aircraft systems.

## II. COMPONENTS OF GENERATOR CONTROL SYSTEM USED IN AIRCRAFT

The A320 family includes Airbus A318, A319, A320 and A321. The family has integrated state-of-the-art technology in its overall operation, including: fly-by-wire flight control, side-stick controller, and digital avionics to support these functions.

### A. Integrated Drive Generator (IDG)

The integrated drive generator (IDG) consists of a Constant Speed Drive (CSD) and AC generator mounted side by side in a single housing. The CSD performs the operation by controlled differential action to maintain the constant output speed required to drive the generator.

The input constant speed of the generator provides the constant voltage and constant frequency generator output. The output of the generator used in A320 is 115VAC, three-phase, 400 Hz. The Flight Authority Digital Engine Control (FADEC) provides the GCU with the corresponding engine speed information, which is also used for the under speed protections. The drive speed varies according to the engine rating. The IDG internal gearing, converts the variable gearbox frequency to a stable 400Hz. The IDG supplies a 115 VAC, three-phase, and 400 Hz AC.

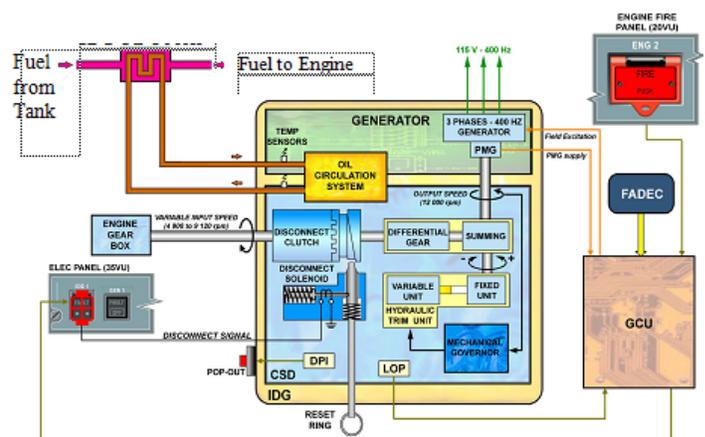


Fig.1 Internal Connection IDG

- 1) Constant speed drive: The CSD converts the variable input speed (4900 to 9120) provided by the engine gearbox to the constant speed (12000 rpm) through the CSD hydro mechanical components. A mechanical governor, acting on a hydraulic trim unit, controls the differential-gear in order to maintain the constant output speed. A mechanical epicyclic differential-gear transmits power to the generator of the IDG.
- 2) AC main generator: The main AC generator consists of a 2 pole rotor and a three-phase winding stator. As the rotor rotates, the DC field induces an AC voltage in the stator windings. The AC generator portion of the Integrated Drive Generator (IDG) is a three-phase, brushless, spray oil-cooled unit. The output constant speed is regulated at 12000 rpm. The generator rotor consists of an exciter rotor, and a 4 pole main field rotor. The exciter rotor and main field rotor are mounted on a common shaft supported by a roller bearing set at the drive end and a ball bearing set at the opposite end. The generator is a three-stage assembly which has three machines connected in cascade. The first machine (Pilot Exciter (PE)) is a 12 pole Permanent Magnet Generator (PMG). The Permanent Magnet Generator (PMG) rotor is mounted on the output ring gear of the differential assembly. The main generator stator, exciter stator, PMG stator and generator Current Transformer (CT) are mounted in the housing. Rotating diodes rectify the three-phase output of the main exciter rotor. The resulting DC current feeds the third machine (main alternator) rotor winding. Thus, the main alternator receives excitation for the rotating salient 4 pole field from the rectified output of the main exciter. The main alternator has a three-phase star-connected stator winding. The three phases star point neutral are taken to the generator output terminal block.

**B. Generator Control Unit (GCU)**

The GCU is supplied by the Permanent Magnet Generator (PMG). The GCU is also supplied by the AC network. The GCU has four different functions. They are;

- 1) Voltage regulation
- 2) Control , protection of the network and the generator
- 3) Control of the various indications
- 4) System test and self-monitoring

The main functions of the GCU are:

- 1) Regulation of the generator voltage
- 2) Regulation of the generator frequency
- 3) Regulation of the generator speed (Servo Valve (SV) control)
- 4) Control and protection of the network and the generator
- 5) Interface with System Data Acquisition Concentrator (SDACs) for the ECAM
- 6) Interface with Full Authority Digital Engine Control (FADEC) for engine speed
- 7) Interface with Centralized Fault Display System (CFDS) via the Ground and Auxiliary Power Control Unit (GAPCU)

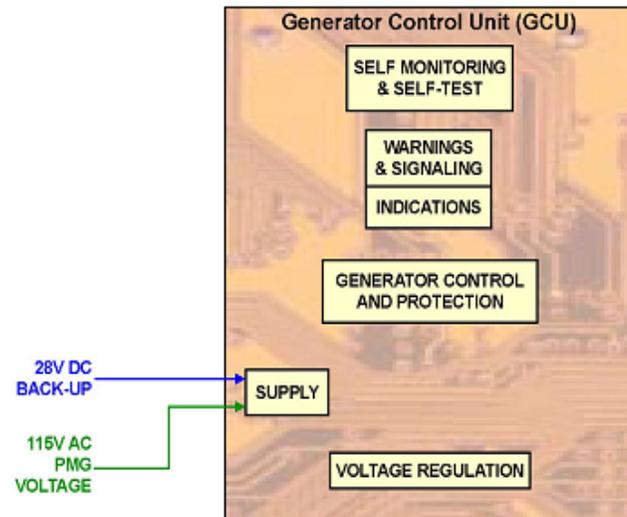


Fig. 2 Generator control unit (GCU)

**C. APU Generator**

The AC auxiliary generation comes from the APU generator. This generator can:

- 1) In flight, replace either or both engine generator(s) in case of failure.
- 2) On the ground, supply the aircraft electrical network when the electrical ground power unit is not available.

The APU generator is not interchangeable with the Integrated Drive Generators (IDGs). It is driven at a constant speed by the APU and can be connected to the electrical network in flight in case of any generator failure. It can supply the entire electrical network if no other power sources are available.

The APU directly drives the APU generator at a nominal 24000 rpm constant speed. The APU gearbox supplies the oil for cooling and lubrication of the generator. The cooling circuit is common to the APU and the generator. The APU supplies, scavenges, drains the oil. The generator is a brushless oil-cooled generator with a nominal 115/200 V, 90 kVA, three-phase, 400 Hz output. The generator includes three stages which are:

- 1) Pilot exciter
- 2) Main exciter
- 3) Main alternator

The operation principle is the same as that of the IDG generator. The operation of the APU generator is through the APU generator pushbutton switch, which has two stable positions:(1) when in OFF position, the pushbutton switch is released, and the white OFF legend is on. The generator is shut down (de-energized) and the line contactor is opened and (2) when the pushbutton switch is pushed, the generator is energized, because its rotational speed is high enough. If the electrical parameters are correct, the GCU controls the line contactor closing: this causes the supply of the transfer circuit. The APU GLC supplies the aircraft electrical network if the other power sources are not available.

### D. AC Emergency Generator

The AC emergency generation comes from the AC emergency generator. This generator is used when;

- 1) Loss of the two main generation sources and
- 2) unavailability of the auxiliary generation.

The emergency generation system is mainly composed of a Constant Speed Motor/Generator (CSM/G) including a hydraulic motor and drives a generator, and a Generator Control Unit (GCU). The hydraulic motor speed is regulated by a servo valve. The generator operation principle is identical to that of the main or auxiliary generation. During transient configuration, battery 2 and then the Permanent Magnet Generator (PMG) supplies the CSM/G control unit and the exciter field through a voltage regulation module.

The voltage regulation module maintains the Point Of Regulation (POR) at a nominal voltage value (115 VAC). The generator output characteristics are: three-phase 115/200 VAC, 400 Hz (12000rpm), output power: 5 kVA continuously. As the emergency AC generator parameters are correct, the emergency Generator Line Contactor (GLC) is supplied by the CSM/G control unit. The emergency AC generator has priority to supply the AC and DC essential buses.

### III. GENERATOR CONTROL SYSTEM USED IN AIRBUS A320 FAMILY

The A320 family includes Airbus A318, A319, A320, A321. The family has integrated state-of-the-art technology in its overall operation, including: fly-by-wire flight control, side-stick controller, and digital avionics to support these functions

#### A. Normal Operation Condition of A320 Family

In normal configuration, both BTCs are de-energized. IDG 1 generator supplies AC BUS 1 and IDG 2 generator supplies AC BUS 2. In normal flight configuration, each generator supplies its own distribution network via its Generator Line Contactor (GLC). The two generators are never electrically coupled.

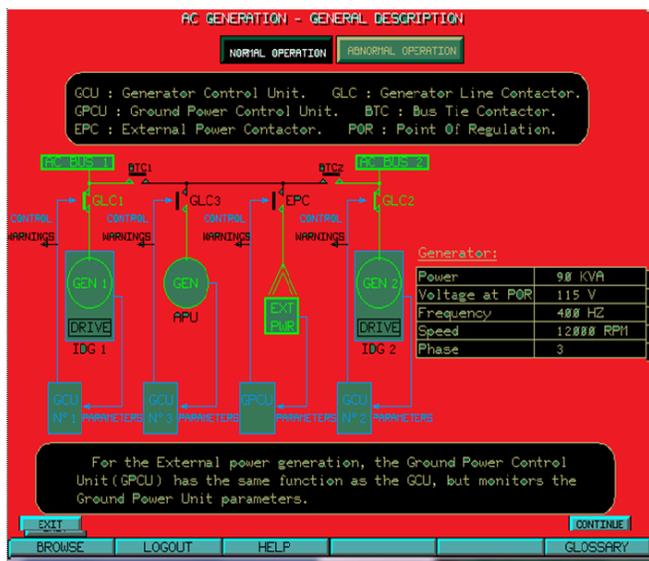


Fig.3. Normal operation of AC generation

The Constant Speed Drive (CSD), in the IDG, drives the AC generator at constant speed. Each generator is controlled, via a GCU, by a GEN pushbutton switch located on the electrical (ELEC) panel on the overhead panel. The order of distribution priorities are:

- 1) On side IDG to own bus, the IDG 1 to AC BUS 1 and the IDG 2 to AC BUS 2
- 2) External power
- 3) APU generator
- 4) Opposite IDG: IDG 1 to AC BUS 2 or IDG 2 to AC BUS 1

#### B. Abnormal Operation Condition of A320 Family

The generator 1 (IDG 1) failure, generator 2 (IDG 2) can supply the AC BUS 1 and 2. The following control or fault signals cause generator shutdown or de-energization;

- 1) IDG disconnection
- 2) GLC failure (BTC is only locked out)
- 3) Engine shutdown with the ENG 1(2) FIRE pushbutton switch
- 4) PMG short circuit
- 5) Over/under voltage
- 6) Over/under frequency
- 7) Open cable (IDG position)

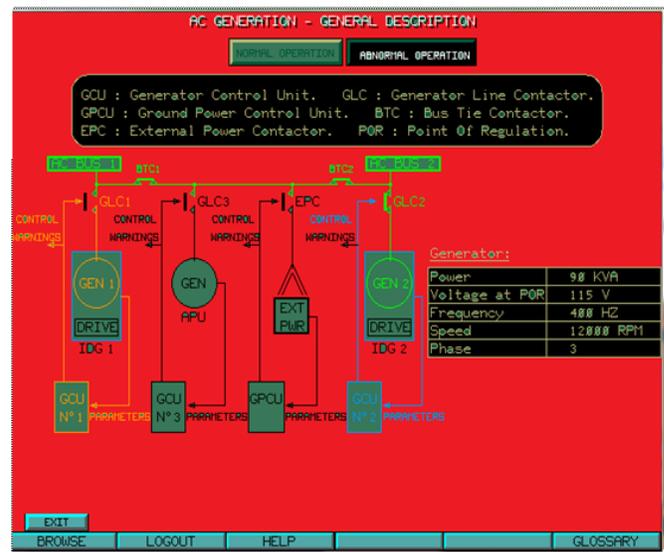


Fig. 4 Abnormal operation of AC generation

The following conditions are also turned off the generator. They are:

- 1) If over-voltage of IDG and APU generator is about of highest of Point Of Regulation (POR) 130 VAC (+ or -) 1.5 V, the generator logic contactor (GLC) and generator control relay (GCR) turn off the voltage regulator (during 4 to 5 sec),
- 2) If under-voltage of IDG and APU generator is about of lowest phase of Point Of Regulation (POR) 100 VAC (+ or -) 4 V, the generator logic contactor (GLC) turn off the

- voltage regulator (during 4 to 5 sec),
- 3) If over-frequency of IDG and APU generator, sensing from PMG frequency, is about of 433 Hz (+ or -) 3 Hz, trip from the generator logic contactor (GLC) and generator control relay (GCR), turn off the voltage regulator (during 3 to 5 sec),
- 4) If under-frequency of IDG and APU generator, sensing from PMG frequency, is about of 363 Hz (+ or -) 3 Hz, trip the generator logic contactor (GLC) and generator control relay (GCR), turn off the voltage regulator (during 3 to 5 sec).

**C. AC Main Generation Operation Control**

When the input speed is about 12,000 rpm, the PMG mounted on the same shaft of the aircraft engine is energized. Then PMG supplied the excitation field through the Generator Control Relay (GCR). If the electrical parameters are correct, the operation of GCR is controlled by the control and regulation of Generator Control Unit (GCU). The excitation current depends on the comparison between the voltage sensed at the Point Of Regulation (POR) and a reference voltage. If the electrical parameters are correct, the Generator Line Contactor (GLC) closes.

The GCUs use the CT outputs for protection functions (differential current, over current, overload). One CT is located inside the IDG and the other is just before the GLC.

The excitation control and regulation module keeps the voltage at the nominal value (115 VAC) at the Point Of Regulation (POR). Then the voltage at the POR is compared to 115 VAC (reference) and used as an operational error to regulate the field current. The GCU supply from the aircraft network is duplicated (back up supply). The supply is taken from the DC essential system. The excitation control and regulation module keeps the voltage at the nominal value at the Point Of Regulation (POR).

is high enough, the generator is energized. If the delivered parameters are correct, thus the Power Ready Relay (PRR) closed; the Generator Line Contactor (GLC) closes to supply its network. When the GEN P/B is released out after fault detection, the GCU is reset. The GCR and the PRR are reset.

**D. Voltage Regulation**

The voltage regulation is achieved by regulating the generator excitation current. It also supplies the exciter field through the Generator Control Relay (GCR), which is normally closed, and through a rectifier. When the generator starts running, the PMG supplies the GCU. The exciter field current is reduced inside the GCU until 335 Hz is obtained. As the PMG frequency is below the threshold, the generator excitation is reduced through the excitation control module. The voltage regulation shutdown signal, generated by the protection module, triggers the voltage regulation shutdown control module which simulates a high generator load signal via the current limit module. As soon as the PMG frequency is over the threshold, the generator excitation is regulated normally. The excitation current depends on the comparison between the voltage sensed at the Point Of Regulation (POR) and a reference voltage. As the parameters are correct, the Generator Line Contactor (GLC) closes. The generator excitation also depends on the load. If a fault is detected by the GCU protection module, the voltage regulation shutdown control module simulates a high generator load signal. The exciter field coils are no longer supplied. The GCR and GLC are tripped.

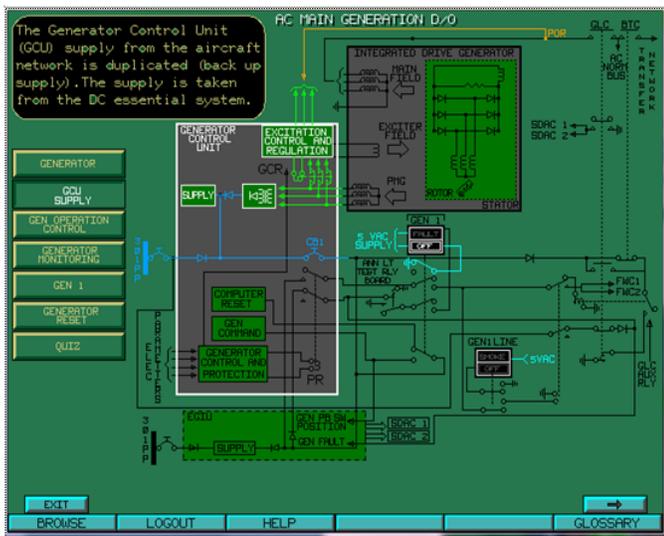


Fig.5. AC Main Generation Operation Control

The generator is controlled by the corresponding generator pushbutton (P/B) switch. When pressed in, if the generator speed

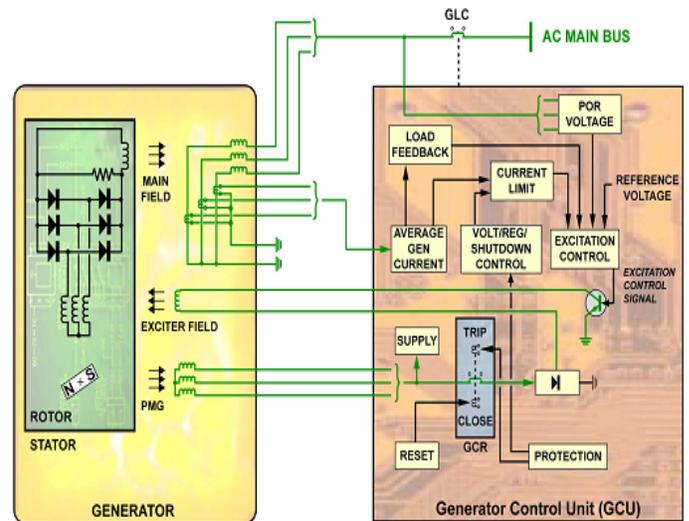


Fig.6. Voltage regulation

**E. AC Auxiliary Generation Operation Control**

When two main generators are out of operation, the APU generator comes in operation. Speed regulation function of IDG and APU generator are different. Allows the APU to run 15 minutes.

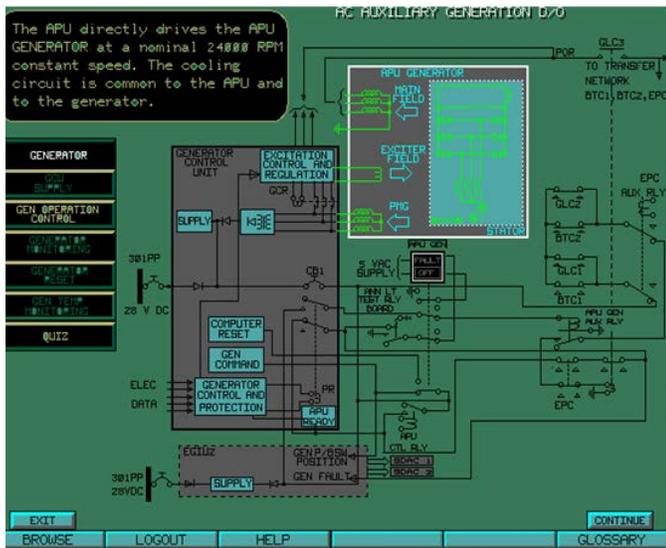


Fig.7. AC Auxiliary generation operation control

Its operation in the same way of IDG, but it is not interchangeable with the two IDGs. If the APU generator parameters are correct, the APU generator is controlled by a P/B located on the electrical panel and has two lights: white OFF and amber FAULT. The APU generator is connected to the network via the APU Generator Line Contactor (GLC) and the Bus Tie Contactors (BTCs).

When the APU is available the APU ready signal allows the power relay to be energized via the protection module (delivered parameters correct). The APU Generator Line Contactor (GLC) 3) is energized through a priority logic Generator Line Contactor (GLC), Bus Tie Contactor (BTC) and External Power Contactor (EPC). The Generator Control Relay (GCR) and the Power Ready (PR) are reset.

#### IV. CONCLUSION

The aircraft uses both 115 VAC and 28 VDC power. AC power systems result in better design and use equipment than older electronic equipment powered by direct current (DC), which have inverters for AC power and dynamo motors for supplying higher voltage DC power. Therefore, modern aircraft electrical systems use 115 VAC, 400 Hz, and three-phase AC power system. The 115 VAC, 400 Hz, and three-phase AC power system has many advantages over 28 VDC system. It

requires less current than the 28 VDC system because of higher voltage and a ground neutral system. This permits the use of smaller aircraft wiring, saving weight. For the reliable and efficient electrical power supply system, electronic devices are used in aircraft. In this paper, Airbus A320 family uses 115/200 V, 400 Hz, three-phase constant frequency AC system. Integrated Drive Generator (IDG) and Generator Control Unit (GCU) are used in the generator control system of A320 family as the main parts. The IDG includes a Constant Speed Drive (CSD) and AC generator. The CSD converts the variable input speed of engine gearbox to the constant output speed. This paper described the components of aircraft and then the generator operation and its control systems are also described.

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# Magnetic Resonance Imaging in a case of myxopapillary ependymoma in a young female.

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DOI: 10.29322/IJSRP.8.8.2018.p8066  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8066>

**Abstract-** In children, tumours of the spine are much rarer than intracranial tumours. They are classified into intramedullary, intradural and extradural tumours. Magnetic resonance imaging provides crucial information regarding the extent, location and internal structure of the mass thus critically narrowing the differential diagnosis. Our department reports a case of a 16 year old female who presented with history of proximal muscle weakness and MR features of the above disease. We discuss the typical MR features of myxopapillary ependymoma and determine the role of MR imaging in identifying the tumour, establishing its extent and defining its relationship with adjacent intraspinal structures.

**Index Terms-** Myxopapillary ependymoma,,MRI ,Intramedullary,Syringomyelia.

## I. INTRODUCTION

Myxopapillary ependymomas are highly vascular tumours arising almost exclusively in the dorso lumbar region and produce symptoms that can mimic discogenic pathology. Ependymomas constitute approximately 8% of all intracranial gliomas in children and 63% of primary intraspinal gliomas.<sup>3</sup>Myxopapillary ependymoma is a distinct pathological sub type that occurs almost exclusively in the conus medullaris

and filum terminale; it accounts for a majority of ependymomas in this region.<sup>2</sup>

Patients clinically present with back pain, radiculopathy, paraparesis, bowel and bladder disturbances with a peak age incidence of 30-40 years however has been reported at all ages with a predilection in males.

## Case history:

A 16 year old female presented to the department of paediatrics with history of dysphagia ,pneumonia and proximal muscle weakness.

## MRI:

MRI brain with gadolinium was performed in a Siemens Magnetom Avanto 1.5 Tesla scanner.

The study reveals a well defined intra medullary altered signal intensity lesion in the region of the conus measuring around 6.9cmx1.3cm with widening of the spinal canal. The lesion shows intermediate signal intensity on T1 and T2 and appears hyperintense on STIR sequences with a hypointense rim noted on T2 weighted sequences in the lower margin of the lesion. Post contrast study shows intense enhancement. An extensive intra medullary CSF signal intensity cavity with septations noted proximal to the lesion extending upto C2 level. These features are consistent with myxopapillary ependymoma with syringomyelia.



Figure 1: Shows an intensely enhancing intra medullary lesion on post contrast.

Figure 2 shows an intra medullary signal intensity cavity extending proximal to the lesion upto the level of C2.

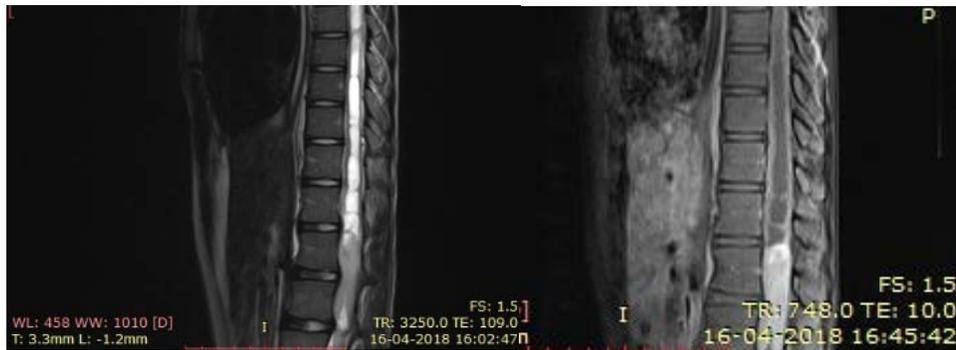


Figure 3 shows the lesion with altered signal on T2 sequences with a hypointense rim.

Figure 4 shows a hyperintense signal intensity lesion on STIR sequence.

### Histopathological findings:

The patient underwent a partial excision biopsy of the lesion and the histopathological evaluation revealed tissue composed of tumor cells arranged in papillary pattern. The cells were cuboidal to elongated radially arranged around vascularised

and myxomatous stroma cores. The cells are also seen in clusters in a loose myxoid matrix. The nucleus is mildly enlarged, with fine chromatin. Areas of hemorrhage seen. Features suggestive of myxopapillary ependymoma –conus medullaris WHO Grade I.

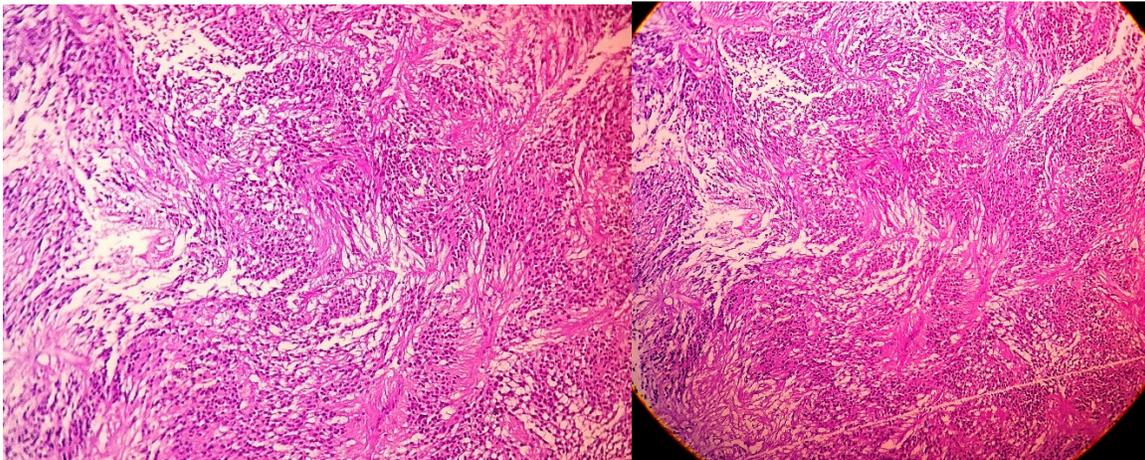


Figure 5 and 6: Slides were air dried and fixed in alcohol and stained by Giemsa and Papinicolaou stain respectively. Smears were highly cellular showing cuboidal and columnar cells with surrounding myxoid material.

## II. DISCUSSION

Ependymomas are the most common intra medullary spinal cord tumours in adults. Even so, they are quite rare with only about 227 cases in the United States each year. The two most common ependymoma subtypes are cellular and myxopapillary ependymomas. Cellular ependymomas can arise anywhere however they usually occur in the cervical cord whereas myxopapillary ependymoma occurs almost exclusively in the conus medullaris and filum terminale<sup>5</sup>

Patients with these tumours typically present with low back pain which may or may not be associated with sciatica. Other symptoms, such as sensorimotor disturbances and bowel and bladder dysfunction are much less common<sup>5</sup>

At gross examination, myxopapillary ependymomas are soft, vascular, lobular or sausage-shaped masses which are often encapsulated and may show haemorrhagic or mucinous degeneration. The site of these tumours are usually within the

filum terminale but may also extend and incorporate the conus medullaris. Myxopapillary ependymomas may grow to a quite large size, filling and expanding the spinal canal. Tumours located around the sacrum can cause bone destruction, although such cases are rare<sup>5</sup>

Radiographs of myxopapillary ependymomas are usually normal but may show a widened spinal canal or bone destruction. Myelograms may demonstrate a well defined intradural mass at the conus medullaris<sup>5</sup>

On unenhanced CT scans, myxopapillary ependymomas are typically isoattenuating to the spinal cord. Small tumors produce nothing more than non-specific canal widening whereas larger tumors may produce scalloped vertebral bodies, neural foraminal enlargement. On contrast-enhanced CT scans, myxopapillary ependymomas typically demonstrate intense homogeneous enhancement.<sup>5</sup>

The MRI features of myxopapillary ependymoma are non-specific. Tumors are usually isointense relative to the spinal cord on T1-weighted images and hyperintense on T2-weighted

images. At times they can be hyperintense relative to the spinal cord on un-enhanced T1-weighted images due to proteinaceous mucoid matrix. This is a feature which may be useful in distinguishing myxopapillary ependymoma from other ependymoma subtypes which are virtually always hypo- or isointense on T1-weighted images<sup>6</sup>. Myxopapillary ependymomas enhance intensely after administration of contrast material. Enhancement is homogenous but may be heterogeneous when haemorrhage or necrosis is present. MRI may also show expansion of the spinal canal and neural foramina, bone destruction and surrounding soft tissue invasion.

The differential diagnosis for small myxopapillary ependymomas in the conus medullaris and filum terminale includes schwannoma and subependymoma, both of which can mimic features almost similar to myxopapillary ependymoma. The differential diagnosis also includes astrocytoma, hemangioblastoma, ganglioma, paraganglioma and other ependymoma subtypes.<sup>5</sup> For large ependymomas that cause sacral destruction the differential diagnosis should include sacral tumours such as aneurysmal bone cyst, chordoma, plasmacytoma, metastasis and giant cell tumour.<sup>5</sup>

### Conclusion

Ependymoma is the most common intra medullary spinal tumour, however they are quite rare with only 227 intra dural spinal ependymomas diagnosed in the United states each year. MR imaging is valuable in identifying the extent of thoracolumbar myxopapillary ependymomas and in defining the relationship to intraspinal structures. The MR findings in myxopapillary ependymoma are nonspecific, however the diagnosis can be suggested by a large, intensely enhancing, intradural extramedullary thoracolumbar mass that extends for several vertebral levels. Myxopapillary ependymoma should also be included in a differential diagnosis of a post sacral mass.

Imaging protocols should examine the entire dorsolumbar region and include IV contrast material administration.<sup>2</sup>

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# Influence of Health Financing and Impact on Quality of Hospital Services - Case of Kosovo

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DOI: 10.29322/IJSRP.8.8.2018.p8067  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8067>

**Abstract-** The situation in the social and health sector in Kosovo despite efforts and engagements remains severe. According to World Bank reports, around 45% of the population are unemployed and about 15% of the population have difficulties in securing their elementary needs or living in extreme poverty. Health indicators remain among the lowest in the region.

**Key words:** health, health financing, health insurance, quality of services

## I. INTRODUCTION

The ability to build, develop and maintain a strong healthcare system is essential for the overall wellbeing of the people. In this regard, ongoing reforms of the health system infrastructure, particularly those of funding, and the provision of health services are at the forefront of the global reform agenda. European countries that have a historic development with the foundation of an early legislation, today enjoy stable health systems and can continue their further development through the most well-known structures. Particularly, the issue of health care is among the most sensitive issues faced by Kosovar society, which passed a decade-long apartheid phase that ended with a war in which the lives of tens of thousands of people were lost. During the war, the health care system and the health insurance system were completely destroyed.

Kosovo has so far had another scheme of health financing, not health insurance. This current health system is financed with that the state collects from general taxes, where it creates the budget and allocates funds for the health activities from the budget. Therefore, the analysis of the way of health financing in post-war Kosovo is an actual and very important topic to be addressed at professional scientific levels and will, in part, serve science and improve health services in our country.

## II. BUDGET FOR HEALTH SECTOR FOR THE PERIOD 2008 – 2015

The allocation of the Kosovo budget for the category of expenditures in health within a fiscal year is based on the Law on "Budget of the Republic of Kosovo" for that fiscal year in our case for the years 2008-2015 where Article 3 of this law determines the budget appropriations from the Kosovo fund for the fiscal year, which is presented in the table attached to the law[1].

As shown in the table below (table no.1), the government budget is the main budgetary source of funding for the public healthcare system. From 85.84 million Euros in public sector spending in 2010, exactly 93 percent come from the government budget. Government budget support for hospitals takes the form of direct transfers from Treasury. Funds for HCGs are provided on the basis of transfers according to the formula to the respective owners of the municipalities.

In addition, patients should pay contributions for health services and medicines in hospitals and primary care centers, based on the price list issued by the MH, and where low-income groups are excluded. These comprise the remaining seven percent of budget funding and are considered as own source revenues[2], **table no.2**

**Table no. 1.** Budget expenditures in health in Kosovo for the period 2008 - 2015 mil €

Year	2008	2009	2010	2011	2012	2013	2014	2015
Kosovo Budget Expenditures	1,090,3	1,094,4	1,376,0	1,414,93	1,508.9	1,586,1	1,589,32	1,682,49
Public expenditures on health	70.7	68.6	70.3	79,08	88,17	96,16	114,71	116.99
In % of GDP	3.2	3.0	3.1	2.53	2.4	2.3	2.7	2.8
In % of Total Government budget	9.6	9.8	9.8	7.7	6.37	6.1	7.2	6.95

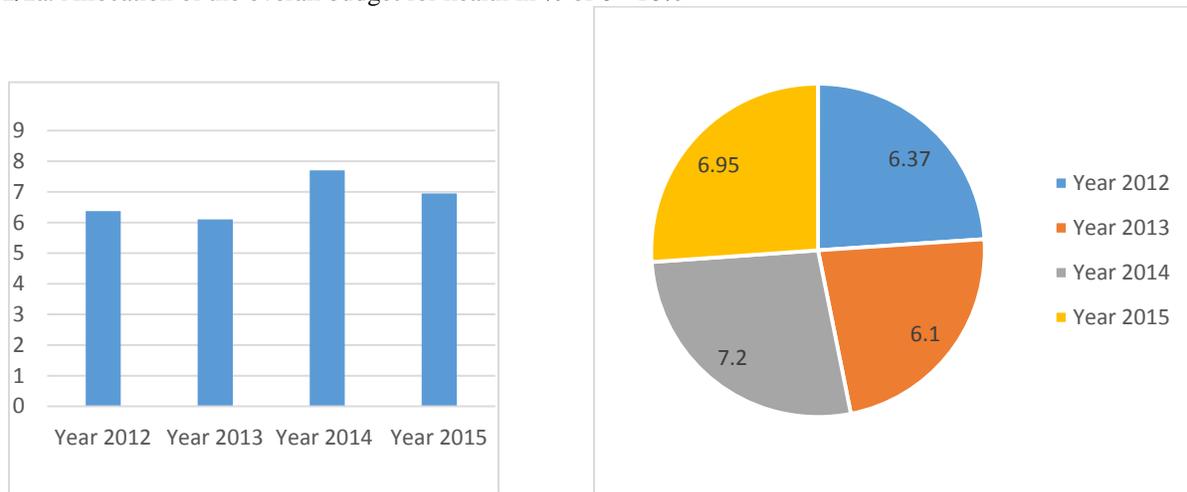
**Source:**MF, Expenditure Framework 2013-2015 estimation by authors

While health spending as a percentage of GDP has remained stable over time, it has been reduced as a percentage of government spending over the past five years. By 2008-2010, Kosovo has spent about ten percent of the total government spending on health, corresponding to the amount of about 33 Euros per capita per year[3]. Since then, the proportion has dropped steadily up to 6.37 percent in 2012 [4] and 6.1 percent in 2013 to mark a slight increase in 2014 to 7.2 percent[5] and in 2015 it was 6.95 percent or

expressed in funding for per capita healthcare costs about 51 Euros per capita per year[6]. Unlike the states of the region, the government does not seem to be using increasing revenues to increase spending in this sector.

During 2014, 81 436 patients were hospitalized at the University Clinical Center with 479,998 days of healing[7]. Also, 20,496 operations were performed. For one year, 377 829 ambulatory visits were performed and 583 280 were special diagnostic services, and 747 141 laboratory services, total of services in UCCK were performed 2 683 235 services[8], see chart no.1.

**Chart no. 1/1a.** Allocation of the overall budget for health in % of 0 - 10%

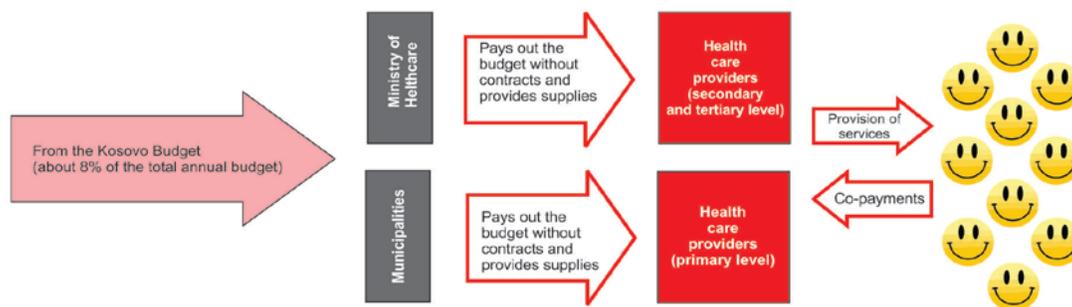


**Source:** Ministry of Finance of RKS, chart no.1 / 1a calculation by authors

### III. FINANCING OF KOSOVO HEALTH SYSTEM

Public health expenditures aim at covering all the needs of the population for the preventive / vaccinative system, outpatient care and the hospital system. A complete, organized and efficient healthcare system is an important prerequisite for increasing the quality of life in general, increasing job skills and longevity.

Health financing is mainly managed at the central level by the MoF with a very limited involvement of the MoH and very small autonomy of health institutions.



**Figure no. 1.** The current system of funding and organization of health care in Kosovo

The income of health institutions is not kept in the health sector but derives from the treasury of the state in accordance with the Law on Public Financial Management and Accountability. There is no mandatory public health insurance[9]. Ministry of Health receives 22 percent of total health funds, secondary and tertiary hospitals receive 51 percent, while municipalities receive the remaining 26 percent of the budget allocation for health care[10].

The budget is designed based on past spending, without any correlation with the needs of the population and without a strategy of priorities. Budget execution monitoring is mainly done by the MoF and the health institutions are not responsible for the use of drugs, employment and exclusion of personnel and capital investments. Therefore, institutional accountability is small and incentives are not intended to improve productivity, efficiency, and quality[11].

The Kosovo Government has been looking for alternative ways to organize a health financing system. There have been many public discussions but even behind closed doors as well as the tendency to learn from health insurance experiences from other countries[12].

In previous years, health insurance has become an important topic in health sector discussions. This topic has included representatives from the Government, civil society and the media.

However, so far, there have been no concrete results at the policy level. Perhaps the exception is the approval by the Government and Parliament of the Law on Health which sets out the step for the health insurance system and the approval of the law on health insurance[13]. The delay in health system financing reform is keeping an unfavorable status quo of the health care system, with unsatisfactory performance for Kosovo citizens. This situation is getting worse every day, more and more.

One of the chain effects from this situation is the increase in the number of patients seeking help abroad. Among other things, this means a continuous flow of funds abroad and the use of services at a higher price.

#### IV. MODEL AND METHODOLOGY

In order to measure the impacts of health financing in Kosovo, this research is based on econometric findings. Specifically, healing days, number of beds, number of operations, outpatient visits, laboratory services, and other hospital services will be treated as endogenous variables or variables dependent on the hospital budget. Otherwise, the hospital budget will be treated as a non-dependent variable that presumes to have positive impact and correlation in the above-mentioned endogenous variables.

$$Y_i = a + b_1X_{1i} + b_2X_{2i} + b_3X_{3i} + b_4X_{4i} + b_5X_{5i} + \epsilon$$

Econometric tests initially measure coefficients, continuing with F-test tests to identify the model best described by the population. Another test is the t-test through which the population averaged as well as autocorrelation testing through the Durbin Watson test. Finally, the correlation testing between the variables is done through the Pearson Product Moment test to identify the fact that the hospital budget has a positive correlation with the hospital services provided.

#### V. RESULTS

The table below summarizes the results of the tests based on the above-mentioned model which treats the non-budget variable and recovery days, number of beds, number of operations, outpatient visits and laboratory services as well as other hospital services as variables. From the coefficient testing it is evident that the data is very close to the regression line, which means that the variability of the nonvariant variables causes variability in the variable. More precisely, budget changes cause changes in most hospital services (See table below).

Table 1. The results of Simple Linear Regression

	Healing days	No. of hospitalized	No. Of operations	Visits in ambulants	Laboratory services	Other hospital services
R	.093	.992	.993	.936	.829	.986
R square	.009	.985	.987	.876	.688	.972
R adjusted	-.157	.982	.985	.856	.636	.967
f-test significance	.827	.000	.000	.001	.011	.000
t-test significance	.229	.000	.000	.001	.031	.000
Durbin Watson	1.386	1.763	1.074	1.5360	1.403	2.391

values of coefficient testing results to be high for all variables except for recovery days resulting to be low in value of .093. More than 90% of variability, number of beds, number of operations, outpatient visits, laboratory services and other hospital services is directly related to variability at the budget level for health in Kosovo.

Table 2. Correlatin Test "Pearson"

**Correlations**

		Budget	Healing days	No. of hospitalised	No. of operations	Ambulative visits	Laboratory	
Budget	Pearson Correlation	1	.093	.992	.993	.936	.829	.986
	Sig. (1-tailed)		.413	.000	.000	.000	.005	.000
	N	8	8	8	8	8	8	8
Healing days	Pearson Correlation	.093	1	.199	.155	.303	.564	.147
	Sig. (1-tailed)	.413		.318	.357	.233	.073	.364
	N	8	8	8	8	8	8	8
No. of hospitalised	Pearson Correlation	.992	.199	1	.993	.963	.880	.983
	Sig. (1-tailed)	.000	.318		.000	.000	.002	.000
	N	8	8	8	8	8	8	8
No. of operations	Pearson Correlation	.993	.155	.993	1	.951	.844	.985
	Sig. (1-tailed)	.000	.357	.000		.000	.004	.000
	N	8	8	8	8	8	8	8
Ambulative visits	Pearson Correlation	.936	.303	.963	.951	1	.917	.927
	Sig. (1-tailed)	.000	.233	.000	.000		.001	.000
	N	8	8	8	8	8	8	8
Laboratory	Pearson Correlation	.829	.564	.880	.844	.917	1	.863
	Sig. (1-tailed)	.005	.073	.002	.004	.001		.003
	N	8	8	8	8	8	8	8
Other	Pearson Correlation	.986	.147	.983	.985	.927	.863	1
	Sig. (1-tailed)	.000	.364	.000	.000	.000	.003	
	N	8	8	8	8	8	8	8

Based on the Durbin Watson tests, tests for independent variables giving an indication of less than 2 in all cases with the exception of the endogenous variable to other services. This means that in all cases we have positive evidence of positive correlation.

A positive correlation can be seen in the table below, from the "Pearson product Moment" tests. With the exception of the endogenous "day of recovery" variable, for the confidence interval of 95%, the values "p" are smaller than .05, which means that the zero hypotheses are rejected and alternative hypotheses are accepted. The alternative hypothesis states that we have a positive correlation between the exogenous and the endogenous variables with the exception of the variable "days of healing" when this hypothesis can not be excluded.

## VI. CONCLUSIONS

Based on the results of this study it can be concluded that the University Clinical Center of Kosovo despite many services and hard work that still has deficiencies in its functioning, which were also expressed by the participants in the research.

From the research we can conclude that special attention should be paid to the budget allocated to UCCK and in general for the health of Kosovo which does not meet the needs and demands of citizens for the provision of health services to the desired level so that these services matched to EU standards.

Also, based on this study, we conclude that the Government of Kosovo respectively Ministry of Health draft new policies that respond to the needs of the population by raising financial funds and establish mechanisms for supervision and evaluation of work in health institutions.

Improving the management of healthcare institutions is one of the key factors to be taken into account by the bodies dealing with the selection of managers in order for health institutions to function at EU level by recruiting adequate and professional human resources that are prepared for health management of these institutions.

Lack of supply of medicines, medical supplies, lack of medical equipment, failure to function properly, poor maintenance and service life have shown an inadequate functioning of health services.

Based on the research we have noticed that with the increase of the budget the quality of the health services is increased.

This research confirms that the improvement of the health sector is not on the government agenda and the share of spending on health in the budget of only 2 to 3% of GDP does not reflect even close to meeting the health needs of the population, which confirms us fully **"The level of funding of the health system in Kosovo is not in line with the health needs of the population"**.

This research shows that the more the budget will be and the services will be more qualitative.

## VII. RECOMANDATIONS

- Give priority to the health sector respectively UCCK.
- UCCK budget increase based on the needs of the population.
- Supplying with medical materials and medications
- Equipment with contemporary work equipment.
- Decentralization of clinics and services at UCCK.
- Planning the development of constituent units of UCCK
- Develop health plans and programs for work
- Strict monitoring of the realization of these programs
- Assessment of achievements

- Professional oversight of the work of UCCK's constituent units in fulfilling their duties.
- Proper systematization of human resources according to EU needs and standards
- The Government of Kosovo should have a clear vision about the fact that without finance there are no health services.
- Based on the special circumstances of Kosovo, the application of the combined health financing system would be more sustainable.

**APPENDIX**  
**Variables Entered/Removed<sup>a</sup>**

Mode	Variables Entered	Variables Removed	Method
1	Budget <sup>b</sup>	.	Enter

a. Dependent Variable: Days of healing

b. All requested variables entered.

**Model Summary<sup>b</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.093 <sup>a</sup>	.009	-.157	39217.255	.009	.052	1	6	.827	1.386

a. Predictors: (Constant), Budget

b. Dependent Variable: Days of healing

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	80603007.108	1	80603007.108	.052	.827 <sup>b</sup>
	Residual	9227958716.767	6	1537993119.461		
	Total	9308561723.875	7			

a. Dependent Variable: Days of healing

b. Predictors: (Constant), Budget

**Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations		
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part
1 (Constant)	51293.453	17630.418		2.909	.027	8153.374	94433.532			
Budget	.000	.001	.093	.229	.827	-.002	.003	.093	.093	.093

a. Dependent Variable: Days of healing

**Residuals Statistics<sup>a</sup>**

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	51708.15	62070.36	53786.38	3393.334	8
Residual	-40094.957	60013.398	.000	36308.123	8
Std. Predicted Value	-.612	2.441	.000	1.000	8

Std. Residual	-1.022	1.530	.000	.926	8
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a. Dependent Variable: Days of healing

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4314318469.064	1	4314318469.064	384.971	.000 <sup>b</sup>
	Residual	67241134.811	6	11206855.802		
	Total	4381559603.875	7			

a. Dependent Variable: No of hospitalized

b. Predictors: (Constant), Budgete

**Model Summary<sup>b</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.992 <sup>a</sup>	.985	.982	3347.664	.985	384.971	1	6	.000	1.763

a. Predictors: (Constant), Budget

b. Dependent Variable: No of hospitalized

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4314318469.064	1	4314318469.064	384.971	.000 <sup>b</sup>
	Residual	67241134.811	6	11206855.802		
	Total	4381559603.875	7			

a. Dependent Variable: No of hospitalized

b. Predictors: (Constant), Budget

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Correlations		
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part
		1	(Constant)	3640.871							
	Buxheti	.002	.000	.992	19.621	.000	.002	.002			

a. Dependent Variable: No of hospitalized

**Residuals Statistics<sup>a</sup>**

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	6674.87	82485.98	21879.37	24826.019	8
Residual	-5619.082	5222.653	.000	3099.335	8
Std. Predicted Value	-.612	2.441	.000	1.000	8
Std. Residual	-1.679	1.560	.000	.926	8

a. Dependent Variable: No of hospitalized

**Variables Entered/Removed<sup>a</sup>**

Model	Variables Entered	Variables Removed	Method
1	Buxheti <sup>b</sup>		Enter

a. Dependent Variable: No. of operations

b. All requested variables entered.

**Model Summary<sup>b</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.993 <sup>a</sup>	.987	.985	787.330	.987	454.473	1	6	.000	1.074

a. Predictors: (Constant), Budget  
b. Dependent Variable: No. of operations

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	281722405.410	1	281722405.410	454.473	.000 <sup>b</sup>
	Residual	3719331.465	6	619888.577		
	Total	285441736.875	7			

a. Dependent Variable: No. of operations  
b. Predictors: (Constant), Budget

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	281722405.410	1	281722405.410	454.473	.000 <sup>b</sup>
	Residual	3719331.465	6	619888.577		
	Total	285441736.875	7			

a. Dependent Variable: No. of operations  
b. Predictors: (Constant), Budget

**Residuals Statistics<sup>a</sup>**

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1241.80	20614.38	5127.13	6343.978	8
Residual	-1099.792	1068.141	.000	728.926	8
Std. Predicted Value	-.612	2.441	.000	1.000	8
Std. Residual	-1.397	1.357	.000	.926	8

a. Dependent Variable: No. of operations

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# Present Day Internet Design, Architecture, Performance and an Improved Design

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DOI: 10.29322/IJSRP.8.8.2018.p8068

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8068>

**Abstract-** Internet design has to do with its architecture. Internet architecture is a meta-network that constantly changes collection of thousands of individual network that intercommunicate with common protocol. The success of the present day internet has been hindered by many sophisticated network attacks because of its security challenges embedded in the original architecture. The original architecture is hard to modify and new functions have to be implemented via myopic and clumsy adhoc patches on top of the existing architecture. This work aimed at analyzing the present day internet design, emphasizing on its architecture, performance and then proposing an improved design with clear reasons for the improvement.

**Index Terms-** Internet Design, Internet Architecture, MobilityFirst, NEBULA, FIRE.

## I. INTRODUCTION

Internet design has to do with internet architecture. Internet architecture is a Meta - network that constantly changes collection of thousands of individual network that intercommunicate with common protocol [1]. It can also be defined as internetworking and it is based in TCP/IP specification protocol that is designed to connect any two networks that could be really different in internal hardware, technical design and software. When there is interconnection between two networks, communication with the TCP/IP is enabled end-to-end to permit nodes on the internet that possesses the capacity to communicate any other irrespective of their location. Internet architecture has grown to global standard because of the nature of the design [1].

Practically, the technical aspect of the internet architecture looks like multi-dimensional river system, with minute tributaries that feeds medium-sized streams, feeding large rivers. For instance when an individual access a network it is most times from home through a modem to connect with a local internet service provider that mostly connects to a regional network that is connected to a national network [1], while in an establishment an individual can connect their desktop computers to a Local Area Network (LAN) via company connection to a corporate intranet, to many national network service providers.

In a nutshell, local internet service providers connects to medium-sized regional networks in order to connect to large

national networks, which connects to very large bandwidth networks on the internet backbone. Many internet providers have many network cross-connections that are redundant to other providers to make sure that there is continuous availability. Companies who runs internet backbone administers higher rate of bandwidth networks relied on by large establishments, government, internet service provider and corporations. The companies' technical infrastructure mostly are global connections via underwater cables and satellite links to enable communication between countries and continents. Larger scale which introduces new phenomena; the amounts of packets that flows via the switches on the backbone is very large and it shows the kind of complex non-linear patterns that is mainly found in natural, analog systems which is like water flow or development of the rings of Saturn [2]. Each communication, in order to get its destination network where local network routing takes over to deliver it to the addressee, packets, goes up the hierarchy of internet networks irrespective of the distance. Relatively each level in the hierarchy pays the next level for the bandwidth they have used. Moreover, large backbone companies settle up with one another.

This paper aimed at analyzing the present day internet design, emphasizing on its architecture, performance and then proposing an improved design with clear reasons for the improvement. In order to achieve this aim we will be looking at the present day internet architecture and its performance, Innovations in various aspects of the internet, Collaborative projects putting multiple innovations into an overall networking architecture, and Testbeds for real-scale experimentation; after which we will be designing an improved internet architecture with better performance.

## II. PRESENT DAY INTERNET DESIGN

The present day internet was designed over 40years ago, it is facing different challenges especially commercial challenges. The demands for mobility, security [3] and content distribution, need to be met. Incremental changes through ad-hoc patches cannot handle this challenges. In order to handle this challenges, there's need for an improved design based on new design principles [3].The internet has evolved from an academic network to a large commercial plat-form. It has aid our day to day transaction, it is indispensable.

Technically, the present day internet, its continuing success has been hindered by many sophisticated network attacks because of

its security challenges embedded in the original architecture. The original architecture is hard to modify, and new functions have to be implemented via myopic and clumsy ad hoc patches on top of the existing architecture.

However, it has really become difficult to support the increasing demands for security, performance reliability, social content distribution and mobility via such incremental changes [3]. Due to the challenges of this present day internet architecture, there's need for an improved design of the internet. From a non-technical aspect, commercial usage requires fine-grained security enforcement as opposed to the current "perimeter-based" enforcement. There is need for security to be an inherent feature and integral part of the architecture. "There's a demand to transform the internet from simple "host-to-host" packet delivery paradigm into a more diverse paradigm built around the data, content, and users instead of the machines", [3]. The above challenges have led to the research for an improved internet architecture.

The present day internet in terms of its performance contains; web, email, VoIP, eBusiness, HTTP, RTP, SMTP, TCP, UDP, SCTP, IP, Ethernet, WiFi, CSMA, ADSL, Sonet, Optical fiber, copper, and radio.

### III. IMPROVED INTERNET ARCHITECTURE

In order to propose an improved internet design we will be looking at research topics handled by different research projects on internet architecture.

Efforts in obtaining an improved internet architecture (design) can be based on their technical and geographical diversity or targets at individual topics, some researchers aimed at holistic architecture by creating collaboration and synergy among individual projects.

The research topics handled by different research projects on internet design are: Experimental testbeds, mobility and ubiquitous access to networks, cloud – computing-centric architectures, security and content-or-data-oriented paradigms.

Experimental Testbeds: Testbeds research are; multiple testbeds with different virtualization technologies, and coordination among these testbeds [3].

Mobility and Ubiquitous Access to Networks: Mobility is a key driver for the future internet in as much as the internet is improving from PC-based computing to mobile computing. Demands for heterogeneous networks such as cellular, IP, and wireless ad-hoc or sensor networks that have different technical standards and business models are increasing rapidly. "Putting mobility as the norm instead of an exception of the architecture potentially nurtures future internet architecture with innovative scenarios applications", [3].

Cloud-Computing-Centric Architectures: A trend that demands new internet services and applications migrates storage and computation into the cloud and creates a computing utility [3]. It

creates new ways to provide global-scale resource provisioning in a "utility like" manner. Data centers are the key components of such new architectures [3]. It is important to create secure, trustworthy, extensible, and robust architecture to interconnect data, control, and management planes of data centers [3]. Perspective of cloud computing has attracted considerable research effort and industry projects toward these goals. How to guarantee trustworthiness of users while maintaining persistent service availability is a major technical challenge [3].

Security: In the original internet security was added as an additional overlay instead of an inherent part of the Internet architecture [3]. Now security has become an important design goal for the future Internet architecture. The research is related to both the technical context and the economic and public policy context. From the technical aspect, it has to provide multiple granularities like; encryption, authentication, authorization, for any potential use case. It needs to be open and extensible to future new security related solutions [3]. From the non-technical aspect, it should ensure a trustworthy interface among the participants like users, infrastructure providers, and content providers. There are many research projects and working groups related to security [3]. The challenges on this topic are very diverse, and multiple participants make the issue complicated [3].

Content-or-Data-Oriented Paradigms: Present day internet builds around the "narrow waist" of IP, which brings the elegance of diverse design above and below IP, but also makes it hard to change the IP layer to adapt for future requirements [3]. Since the primary usage of present day Internet has changed from host-to-host communication to content distribution, it is desirable to change the architecture's narrow waist from IP to the data or content distribution [3]. Efficiency of new paradigm, scalability of naming and aggregation, data and content security and privacy, compatibility and co-working with IP are challenges introduced by the new category of paradigm [3].

#### A. Research Projects Handled on Future Internet Architecture

The projects handled on Future Internet Architecture are; MobilityFirst, Named Data Networking (NDN), FIA AND FIND, Nebula and eXpressive Internet Architecture (XIA). These projects were done by researchers from U.S. In order to propose an improved internet design we will be looking at the MobilityFirst future internet architecture and the NABULA future Internet architecture.

MobilityFirst: The MobilityFirst project is led by Rutgers University with seven other universities. Its motivation is that the present day Internet is designed for interconnecting fixed endpoints and fails to address trend of increasing demands of mobile devices and services. The demand change and usage of the internet is a key driver for providing mobility from the architectural level for the future internet. MobilityFirst is a future internet architecture with mobility and trust worthiness as central design goals. Mobility means that all endpoints-devices, services, contentment, and networks-should be able to frequently change network attachment points in a seamless manner [5].

Design Principle Adopted by MobilityFirst: The MobilityFirst project is led by Rutgers University with seven other universities. Its motivation is that the present day Internet is designed for interconnecting fixed endpoints and fails to address trend of increasing demands of mobile devices and services. The demand change and usage of the internet is a key driver for providing mobility from the architectural level for the future internet. MobilityFirst is a future internet architecture with mobility and trust worthiness as central design goals. Mobility means that all endpoints-devices, services, contentment, and networks-should be able to frequently change network attachment points in a seamless manner [5].

Key Protocol Features of MobilityFirst: Key protocol features of mobility first are; separation of naming and addressing, fast global naming service, storage –aware (GDTN) routing, self-certifying public key names, support for content/context/location, programmable computing layer, separate network mgmt plane and Hop-by-hop (segmented) transport [4].

The aim of MobilityFirst is to address the cellular convergence trend motivated by the huge mobile population of 4 to 5 billion cellular devices, for the near time. It provides mobile peer-to-peer (P2P) and infestation (delay-tolerant network [DTN]) application services which offer robustness in case of link/network disconnection. In terms of long term, in the future, MobilityFirst has the ambition of connecting millions of cars via vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) modes, which involve capabilities such as location services, georouting, and reliable multicast [3].

Challenges of MobilityFirst: The challenges of mobilityFirst are; Trade-off between mobility and scalability, content caching and opportunistic data delivery, higher security and privacy requirements, robustness and fault tolerance. The Figure below is the diagram of MobilityFirst.

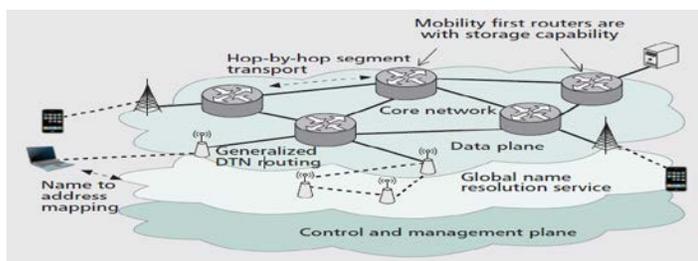


Figure 1 Architecture of MobilityFirst  
Source: [3].

NEBULA Internet Architecture: NEBULA is a future Internet architecture focuses on building a cloud –computing-centric network architecture. NEBULA is led by the University of Pennsylvania with 11 other universities. It seeks for a future internet with high available and extensible core network interconnecting data centers to provide services like utility. In NEBULA multiple cloud providers can make use of replication by themselves and cloud comply with the agreement for mobile

“roaming” users to connect to the nearest data center links with variety of access mechanisms such as wired and wireless links.

Design Principle Adopted by NEBULA: NEBULA design principles are; ultra-reliable, high-speed core interconnecting data centers, secure access and transit, authentication during connection establishment, parallel paths between data center and core router, and policy-based path selection.

Design Goals of NEBULA (What it seeks to achieve): NEBULA design principles are; ultra-reliable, high-speed core interconnecting data centers, secure access and transit, authentication during connection establishment, parallel paths between data center and core router, and policy-based path selection.

How NEBULA is designed to work: NEBULA uses multiple dynamically allocated paths and reliable transport. Its NVENT/NDP is designed to be easy to automate and used as DHCP/IP [4]. NEBULA policies is implemented with NDP and NVENT; its NDP sends packets by encapsulation and its NVENT networks by virtualization. Its NCore places resources where it is needed architecturally, regulatory and also where its policy can be analyzed [4].

NEBULA Internet Architectural Paths: NABULA Architectural path includes, NDP, NVENT, and Ncore. The NABULA data plane (NDP) establishes policy-compliant paths with flexible access control and defense mechanisms. NABULA Virtual and Extensible Networking Techniques (NVENT) is a control plane providing access to application selectable service and network abstractions like redundancy, consistency, and policy routing. The NABULA Core (NCore), redundantly interconnects data centers with ultrahigh-availability routers. NVENT also offers control plane security with policy-selectable network abstraction including multipath routing and use of new networks. NDP has to do with a novel approach for network path establishment and policy-controlled trustworthy paths establishment among NEBULA router. Below is the architecture of NABULA and how the NDP, NVENT, and NCore interacts with each other.

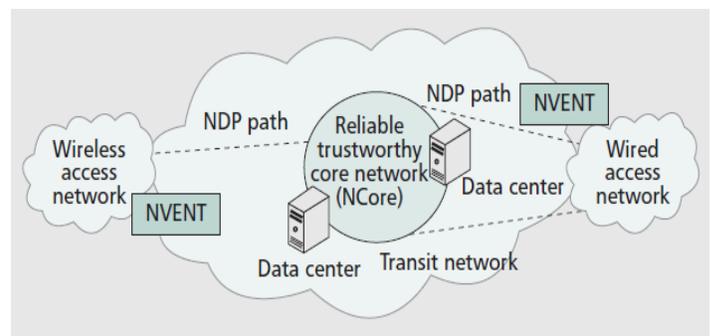


Figure 2: Architectural Components of NEBULA and their Interactions  
Source: [3].

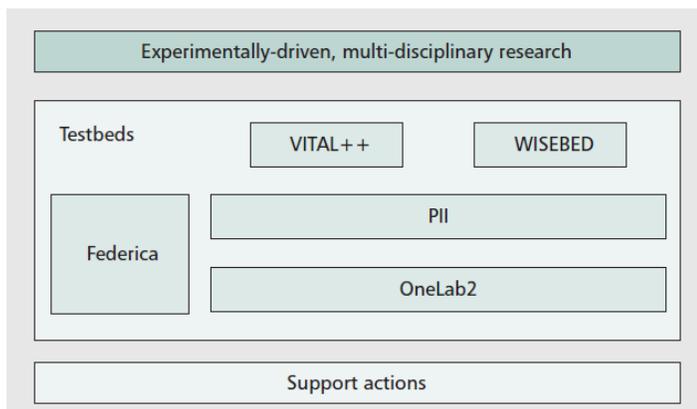
B. Future Internet Research Experiment

NEBULA is a future Internet architecture focuses on building a cloud –computing- centric network architecture. NEBULA is led by the University of Pennsylvania with 11 other universities. It seeks for a future internet with high available and extensible core network interconnecting data centers to provide services like utility. In NEBULA multiple cloud providers can make use of replication by themselves and cloud comply with the agreement for mobile “roaming” users to connect to the nearest data center with variety of access mechanisms such as wired and wireless links.

**FIRE:** FIRE is one of the European Union’s research projects on testbeds. FIRE started in 2006 in FP6 and has continued via several consecutive cycles of funding. It involves efforts from both industries and academia. Currently it is in third wave focusing on providing federation and sustainability.

Two interrelated dimensions of FIRE are; to support long-term experimentally driven research on new paradigms and concepts of architectures for the future internet and to build a large scale experimentation facility by gradually federating existing and future emerging testbeds. It changes internet in both technical and socio-economic terms by treating socio-economic requirements in parallel with technical requirements [3].

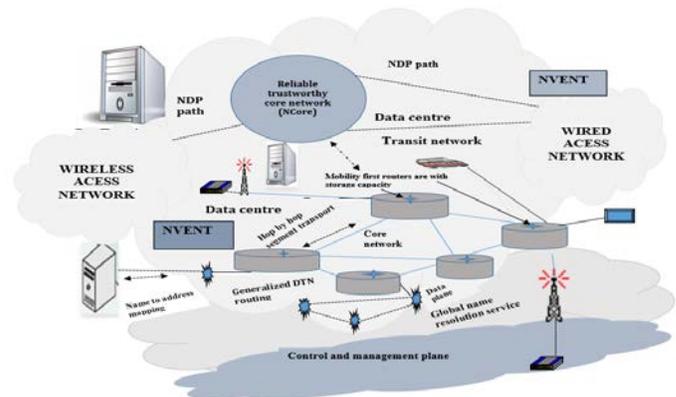
“A major goal of FIRE is federation, which by definition is to unify different self-governing testbeds by a central control entity under a common set of objectives”, [3]. FIRE project can be cluttered in a layered way as shown in the figure below. It consist of three basic clusters which includes; the Top-Level cluster, the bottom cluster and the middle cluster [3]. The top-level cluster consists of a bundle of novel individual architectures for routing and transferring data. The bottom cluster consists of projects providing support for federation. The middle contains federation cluster that consists of existing testbeds to be federated [3]. The small and medium sized testbeds can be federated gradually to meet the requirements for emerging future internet technologies. The figure below is the diagram of Fire clustering Projects.



**Figure 3: Fire clustering of projects**  
Source: [3].

#### IV. THE INTERNET ARCHITECTURE IMPROVED DESIGN

Due to the short comings of the present day internet architecture discussed earlier, there is need for an improved internet architecture. This improved architecture is a hybrid architecture. It is the combination of the NEBULA and MobilityFirst Internet Architecture. Its design principles adopted are; visibility and choice, usability, manageability, simplicity, reliability, technology-awareness, high-speed core interconnecting data centers, secure access and transit, authentication during connection establishment, parallel paths between data center and core router, and policy-based path selection. This improved internet architecture is an internet architecture with mobility and trustworthiness, its end points; devices, content, services and networks has the capability of changing network attachment points in a better way. This improved internet architecture also has the capability of securing and addressing threats to the emerging computer utility capacities which is known as cloud computing. The figure below is the diagram of the proposed internet architecture.



**Figure 4: The Proposed Internet Architecture (Improved Design)**

#### V. CONCLUSION

In conclusion, internet has brought massive change in our world today, it has invaded most aspect of life and society; communications, work, social interaction and changing life. The internet brings increasing benefits but also threats. Government is on the watch about the defects of internet. This is why there is need for an improved internet architecture. Our present day internet fails to cob the issue of cybercrime because of its shortcomings in its architectural design. The Improved internet architecture has the capability of handling the shortcomings of the present day internet design.

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# Comparative Analysis of Drop Tail, Red and NLRED Congestion Control Algorithms Using NS2 Simulator

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DOI: 10.29322/IJSRP.8.8.2018.p8069

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8069>

**Abstract-** Congestion in a network may occur when the load on the network is greater than the capacity of the network and consequently, performance degrades. Congestion control is a technique and mechanisms that can either prevent congestion before it happens, or remove congestion after it has happened. This work presents a comparative analysis of Drop Tail, RED and NLRED congestion control algorithm and performed a simulation experiment to show their relative effectiveness. The experiment was done using NS2 simulator on the basis of End-to-End Delay, Throughput, Packet Drop, and Packet Delivery Ratio in a wired network. The simulation result showed that NLRED performs best in high congestion network, while in low cohesive network, Drop Tail gives a good result. Drop Tail, RED and NLRED was also analysed in real audio traffic and the entire results showed that in congested network, NLRED and RED are better while in low congested network Drop Tail is better. This is because in heavy congested network, congestion avoidance mechanism aids the network to gain better performance while in low congested network unnecessary computation avoidance mechanisms degrades the performance of the network. If parameters are set effectively in RED, it will be the best queuing mechanism for that particular network. However, it is of great importance to know which congestion control mechanism is suitable for each network and traffic.

**Index Terms-** Congestion, Congestion Control Algorithm, Drop Tail, RED, NLRED, Networks.

## I. INTRODUCTION

Congestion is an important issue that can arise in packet switched network. Congestion is a situation in communication networks in which too many packets are present in a part of the subnet performance degrades. Congestion in network may occur when the load on the network is greater than the capacity of the network performance degrades sharply when too many traffic is offered. Techniques and mechanisms that can either prevent congestion before it happens, or remove congestion, after it has happened is known as congestion control [14]. Mechanisms that controls congestion are divided into two categories. Category one prevents congestion from happening and category two removes congestion after it has taken place. The different types of congestion control mechanisms are (Random Early Detection (RED), Drop Tail, Nonlinear Random Early Detection (NLRED), Weighted Random Early Detection (WRED), Class Based Weighted Random Early Detection

(CBWRED), Random Exponential Marking (REM), Stochastic Fair Queue (SFQ), Flow Random Early Drop (FRED), and Stabilized Random Early Detection (SRED). Though there are other variations of congestion control mechanisms, so it is important to choose a suitable active queue management technique in every network.

[7] submitted his dissertation in which the three mechanisms Drop Tail (DT), Early Random Drop (ERD) and Multithreshold Adaptive Early Random Drop (MTAERD) are compared using a Java framework and outcomes are showing the total improvement in the quality of service that can be obtained by the mechanisms over their non-adaptive supplements. One approach in this area was given by [4], in which they replaced RED based on linear packet dropping function by NLRED which is based on nonlinear quadratic function. NLRED is gentler than RED which improves the performance. [5] compare the performance of RED and adaptive RED from the viewpoint of nonlinear dynamics. Their simulation results confirm that adaptive RED performs better than RED. [1] proposed a new improved algorithm ARED to stabilize the queue length and avoid oscillation. [6] presented a survey of RED, GRED, ARED and DRED for congestion avoidance mechanism and measured their performances on the basis of different metrics such as delay, throughput, packet loss and average queue length.

Here we will be discussing only Drop Tail, RED and NLRED. Drop Tail is a simple active queuing management (AQM) algorithm used in many routers [10]. It doesn't differentiate traffic from different sources [10]. When its queue is filled up, it drops subsequent arrived packets. Drop Tail is simple and easy to implement, though it suffers from a couple of drawbacks like; it fails to distribute buffer space fairly because it doesn't differentiate traffic from different sources, sources with higher traffic volume takes more buffer space. If multiple TCP connections exist in the system, a buffer overflow will cause TCP global synchronization, which reduce the network throughput and utility significantly [10]. RED is a congestion avoidance mechanism that takes advantage of TCP'S congestion control mechanism and it takes proactive approach to congestion. It doesn't wait for the queue to be completely filled up, it drops packets with non-zero drop probability after the average queue size exceeds a certain minimum threshold. RED detects incipient congestion in advance and communicate end-hosts, allowing them to trim down their transmission rates before queues begin to overflow and packets start dropping. RED maintains an

exponentially weighted moving average of the queue length which it used as a congestion detection mechanism [2]. NLRED is a queue management algorithm that encourages the router to operate in a range of average queue sizes rather than a fixed one. When its load is heavy and the average queue size approaches the predetermined maximum threshold, which means the queue size may soon get out of control. NLRED allows more aggressive packet dropping to back off from it. [8] proposed a nonlinear RED active queue management scheme, with the proposed nonlinear packet dropping function, packet dropping changes according to the type of the load. By simulation, it can be concluded that NLRED achieves a more reliable throughput than any other queuing mechanism.

This work aimed at doing a comparative analysis of Drop Tail, RED and NLRED congestion control algorithm/mechanisms and performing their simulation experiment to show their relative effectiveness using NS2 simulator. The comparative analysis will be done on the basis of different performance metrics such as end-to-end delay, throughput, packet drop and packet delivery ration using N2.

NS2 is a discrete event simulator targeted at networking research. Ns provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks [13]. Ns began as a variant of the REAL network simulator in 1989 and has evolved substantially over the past few years. In 1995 ns development was supported by DARPA via the VINT project at LBL, Xerox PARC, UCB, and USC/ISI. Currently ns development is support via DARPA with SAMAN and via NSF with CONSER, both in collaboration with other researchers, including ACIRI. Ns has always included substantial contributions from other researchers, including wireless code from the UCB Daedalus and CMU Monarch projects and Sun Microsystems.

## II. CONGESTION CONTROL ALGORITHM/ MECHANISM

Congestion control is a technique and mechanisms that can either prevent congestion before it happens, or remove congestion, after it has happened. Here we will be discussing three types of congestion control algorithm/mechanisms which are; Drop Tail, RED and NLRED.

### A. Drop Tail

Drop Tail is a simple queue management algorithm used by network schedulers in network equipment to decide when to drop packets [12]. With drop Tail, when the queue is filled to its maximum capacity, the newly arriving packets are dropped until the queue has enough room to accept incoming traffic. Its name arises from the effect of the policy on incoming packets. Once a queue has been filled, the router begins discarding all additional datagrams, thus dropping the tail of the sequence of packets. The loss of packets causes the TCP sender to enter a slow-start, which reduces throughput in that TCP session until the sender begins to receive acknowledgements again and increases its congestion window.

### B. Random Early Detection (RED)

RED is a type of congestion control algorithm/mechanism that takes advantage of TCP's congestion control mechanisms and takes proactive approach to congestion [11]. RED drops packets with non-zero drop probability after the average queue size exceeds a certain minimum threshold, it doesn't wait for the queue to be completely filled up. Its objectives are to provide high link utilization, remove biases against busty sources, attenuate packet loss and queuing delay, and reduce the need of global synchronization of sources [9]. RED was proposed to reduce limitations in Drop Tail, it is an active queue technique.

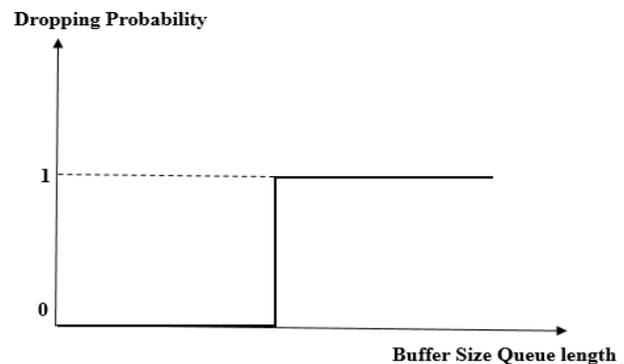


Figure 1: Dropping probability of Drop Tail

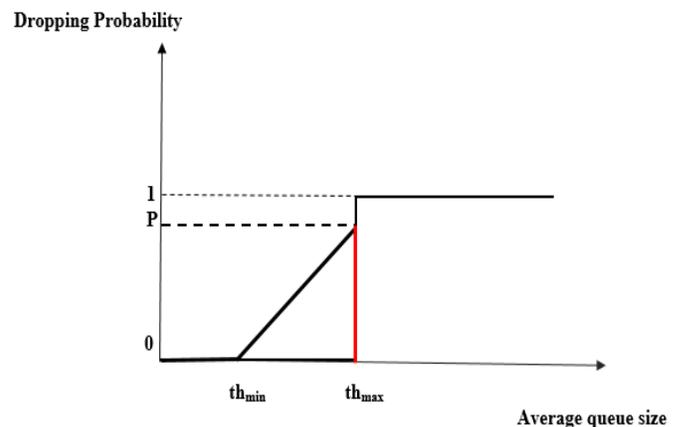


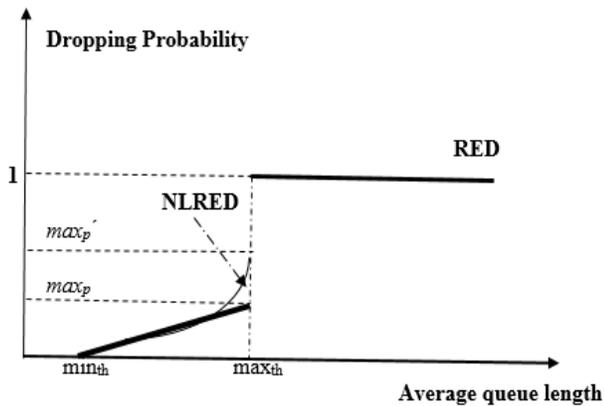
Figure 2: Dropping probability of RED

Linearly with average queue size, the dropping probability varies and the average queue length lies between minimum threshold  $T_{min}$  and maximum threshold  $T_{max}$ , then dropping probability lies from 0 to p within the range. Packets starts dropping as the average queue size increases and the dropping probability is 0 from the beginning. When the dropping probability becomes 1 and the average queue size crosses the maximum threshold, all packets are dropped.

### C. Non Linear Random Early Detection (NLRED)

RED does not maintain the state of each flow, which means data is placed from all the flows into one queue and concentrates on their performance. It originates the problems caused by non-responsive flows. In NLRED, there is nonlinear quadratic function where in RED the dropping function is linear. With the proposed nonlinear packet dropping function, at light traffic load packet drops in gentler fashion and once average queue size

approaches the maximum threshold  $T_{max}$ , this is used as an indicator that the queue size could soon be full, so NLRED will first drop more aggressive packets, which means more heavy packets. Also, it is less parameter sensitive. NLRED obtains much stable throughput as compared to RED. Also, the packet dropping probability of RED will be always greater than that of NLRED due to which at same  $P_{max}$  value NLRED is gentler than RED for all traffic load.



**Figure 3: Dropping probability of NLRED and RED**

### III. PERFORMANCE METRICS

The primary metrics in our simulations that can work as basic building blocks for calculating other metrics are; Throughput, End-to-End delay, Packets Drop and Packet Delivery Ratio.

#### A. Throughput

The main features of performance measure and commonly used is throughput. It measures how fast the beneficiary can get a particular measure of information sent by the sender. Also, throughput is simply the proportion of the aggregate information got to the end-to-end delay. Total throughput is dependent on bottleneck bandwidth and the fairness among different flows is illustrated with the aid of throughput.

#### B. End-to-End Delay

The time slipped when a packet moves from sender to receiver is called delay. The characteristics of delay can be indicated in various ways, which are; average delay, variance delay (jitter) and delay bound. When the value for delay is large, the bandwidth will be high and it will be more difficult for transport layer to maintain.

#### C. Packet Drop

When size queue increases with the maximum capacity and packets starts dropping, it is called packet drop. Packets loses in network when queue in the network node increases. The quantity of packet drop during steady state is a major attribute of congestion control. Sustaining high bandwidth is more difficult and sensitivity to loss of packets for higher rate of packet drop.

#### D. Packet Delivery

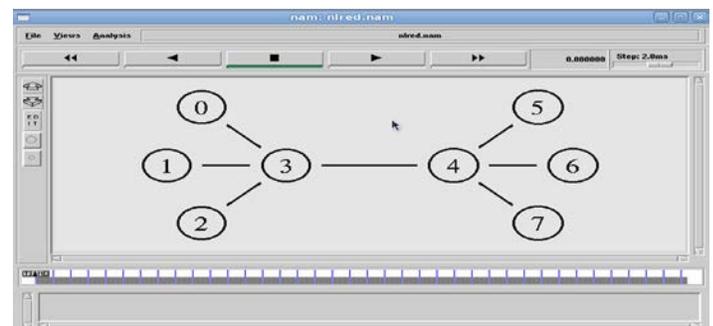
The proportion of the total packets sent to the total packet received is called packet delivery and its mathematical

expression is;  $PDR = T1 \div T2$  where  $T1$  is the Total number of data packets received from each destination and  $T2$  is the Total data packets formed by each source.

### IV. SIMULATION

The network topology used here is the classic dum-bell, which is illustrated in figure 4. The classic dum-bell is a known example where different types of traffic share a bottleneck link. TCP (FTP application in particular), UDP flows (CBR application in particular) and real audio traffic are chosen as typical traffic patterns. Here we will be using three different mechanisms which have different behavior for different network configuration and traffic pattern. Most importantly, the task in designing the simulation is to select parameters (bandwidth, queue limit, packet size, etc.) and a typical set of network topology. A simple topology is used in our simulation where different flows share a bottleneck between the two routers (3,4). The packets sent from sources queue to the queue of router 3 and wait for transmitting. If the sender keeps sending and the queue overloaded, then congestion occurs.

This work focuses on congestion and by this simple topology we can easily create congestion by setting different parameters accordingly and analyze the behavior of the three congestion control mechanisms. If we increase the network size or change its topology, then results may change depending on the amount of congestion and bandwidth at any bottleneck link of the network. If bandwidth is large enough to allow the transmission of all the flows, then no need of applying any active complex mechanism. Simple drop-tail would give the best result. Else if bandwidth is low compared to the amount of congestion, then RED or NLRED would give good performance. In this research work, there are total four experiments that have been performed, and then, the simulation results have been analyzed through a thorough study.



**Figure 4. Classic Dum-bell Network Topology**

#### A. Experiment 1.

In this experiment, there are three nodes at each side of bottleneck link 3-4 where node 0 is acting as a UDP source to send CBR traffic and node 6 as null, while node 2 is acting as TCP source to send FTP traffic and node 6 as sink. Bandwidth at bottleneck link 3-4 is 1.7 MB. Here, in this experiment we take CBR flow rate as 1Mbps and size of packet as 1000 bytes. Queue limit is 15 packets. We mimic this network on ns2 for diverse queuing instruments Drop-Tail, RED and NLRED. Parameter

setting in Drop Tail is easy. For RED, we have to select values for minth and maxth. Also, some other remaining parameters such as maximum probability of drop are taken as 0.5 bytes; exponential weighted moving normal consistent is 0.001. Calculations of average queue size are in bytes. Setting queue in bytes to false demonstrate average queue size is in packets (not in bytes). Gentle RED mode is set to be false indicates gentle mode is OFF. Average size of a packet touching the router is likewise made equivalents to 1000. We have chosen such values of parameters just to create a congested network as 1.7 MB is very low bandwidth in comparison with packet size and queue size (Figures 5, 6, 7, 8; Tables 1, 2, 3, 4).

In this experiment, the same simple dumb-bell topology in wired network is being used. But, bandwidth at bottleneck link 3-4 is being increased from 1.7 to 10 MB. It means congestion in the network is decreased. Remaining parameters such as CBR flow rate, packet size and queue limit are kept same. Also, parameters of RED and NLRED (such as minimum threshold, maximum threshold, weight, etc.) remain unchanged. Here, all other parameter values are same except the bandwidth just to check the performance of all the three mechanisms in non-congested network (Figures 9, 10, 11, 12; Tables 5, 6, 7, 8).



Figure 5: Comparing the variation of throughput for Drop Tail, RED, and NLRED



Figure 8: Comparing Variation of Packet Delivery Ratio (PDR) for Drop Tail, RED and NLRED

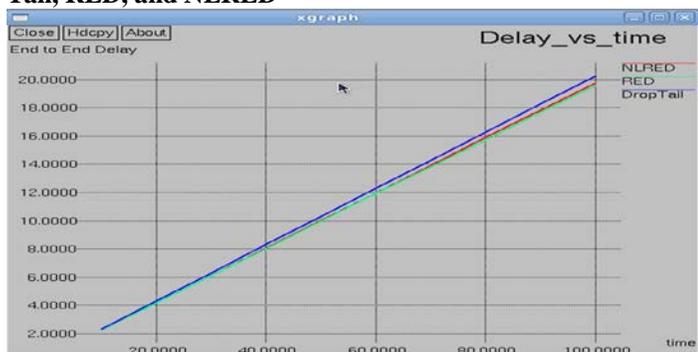


Figure 6: Comparing the Variation of End-to-End Delay for Drop Tail, RED, and NLRED



Figure 7: Comparing Variation of Packet Drop for Drop Tail, RED, and NLRED

B. Experiment 2

Table 1. Throughput Analysis and Results

Simulation Time	Drop Tail	RED	NLRED
10	0.988089	1.00004	1.00092
20	0.995385	1.00699	1.00952
30	0.997385	1.01123	1.01191
40	0.998974	1.01197	1.01361
50	0.999915	1.01202	1.01428

Table 2. End-to-End Delay Analysis and Results

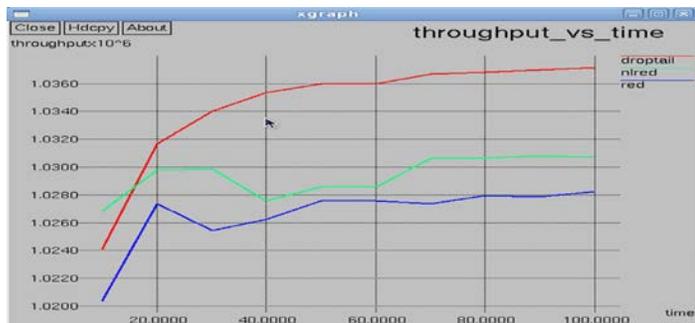
Simulation Time	Drop Tail	RED	NLRED
10	2.30797	2.25459	2.25353
20	4.30649	4.20411	4.1902
30	6.30824	6.09862	6.12759
40	8.30739	8.01948	8.0669

**Table 3. Packet Drop Tail Analysis and Results**

Simulation Time	Drop Tail	RED	NLRED
10	61	57	56
20	96	74	77
30	131	89	98
40	163	118	117
50	163	118	117

**Table 4. Packet Delivery Ratio (PDR) Analysis and Results**

Simulation Time	Drop Tail	RED	NLRED
10	96.7187	96.9272	96.9811
20	97.5541	98.1006	98.0282
30	97.8134	98.4997	98.354
40	97.9767	98.5207	98.5382
50	98.0735	98.5249	98.6374



**Figure 9: Comparing the variation of throughput for Drop Tail, RED, and NLRED**

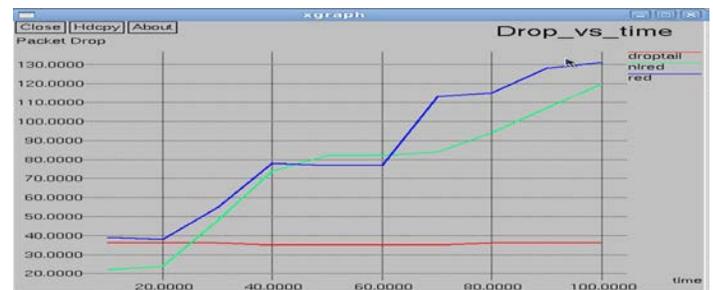
**C. Experiment 3**

Here simple dumb-bell topology is used in wired network. There are three nodes at each side of bottleneck link 3-4. Node 0 is acting as a RA source to send real audio traffic and node 6 as dump, while node 2 is acting as TCP source to send FTP traffic and node 6 as sink. Bandwidth at bottleneck link 3-4 is 1.7 MB. Packet size is 1000 bytes, CBR flow rate is 1Mbps, whereas queue limit is 15 packets. All four end-to-end delay, performance metrics throughput, PDR and packet drop are same for all the three queues, as the bandwidth of the bottleneck link is so small 1.7 as compared to audio traffic. So we are getting same readings for all queues Drop-Tail, RED and NLRED. In this experiment, the values are chosen same as in experiment-1, but instead of CBR and FTP traffic we are using real audio traffic just to check

the performance in a network where packets are highly aggressive and bandwidth is not sufficient to send the packets.



**Figure 10: Comparing the Variation of End-to-End Delay for Drop Tail, RED, and NLRED**



**Figure 11: Comparing Variation of Packet Drop for Drop Tail, RED, and NLRED**

**D. Experiment 4**

Simple dumb-bell topology is used in wired network. There are three nodes at each side of bottleneck link 3-4 where node 0 is acting as a RA source to send real audio traffic and node 6 as RA dump, while node 2 is acting as TCP source to send FTP traffic and node 6 as sink. Bandwidth at bottleneck link 3-4 is now increased to 10 MB. CBR flow rate, packet size and queue limit are kept same as in experiment 3. Here, all other parameters are same as in experiment 3, but the bandwidth is chosen in such a way to provide a sufficient amount of width to the packets to pass on (Figures 13, 14, 15, 16; Tables 9, 10, 11, 12).



**Figure 12: Comparing Variation of Packet Delivery Ratio (PDR) for Drop Tail, RED and NLRED**

**Table 5. Throughput Analysis and Results**

Simulation Time	Drop Tail	RED	NLRED
10	1.02411	1.02037	1.0268
20	1.03166	1.02735	1.02978
30	1.03401	1.02545	1.02986
40	1.03535	1.02624	1.02756
50	1.03598	1.02758	1.02856

**Table 6. End-to-End Delay Analysis and Results**

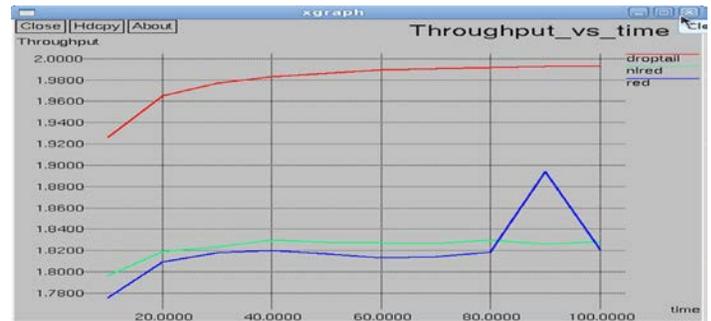
Simulation Time	Drop Tail	RED	NLRED
10	2.7992	2.60668	2.57713
20	5.25303	4.87861	4.99981
30	7.70504	7.27161	7.2506
40	10.1535	9.51449	9.69648
50	12.605	11.7855	12.0177

**Table 7. Packet Drop Analysis and Results**

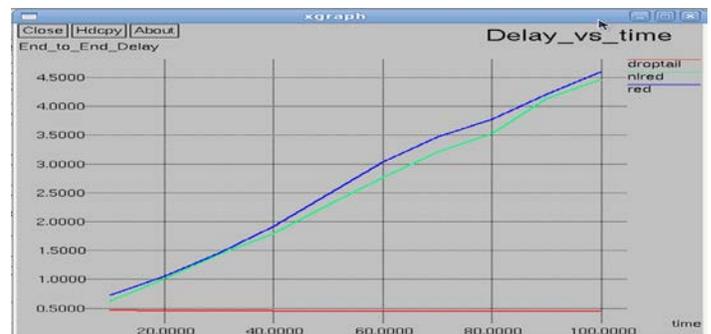
Simulation Time	Drop Tail	RED	NLRED
10	36	39	22
20	36	38	24
30	36	55	48
40	35	78	74
50	35	77	82

**Table 8. Packet Delivery Ratio (PDR) Analysis and Results**

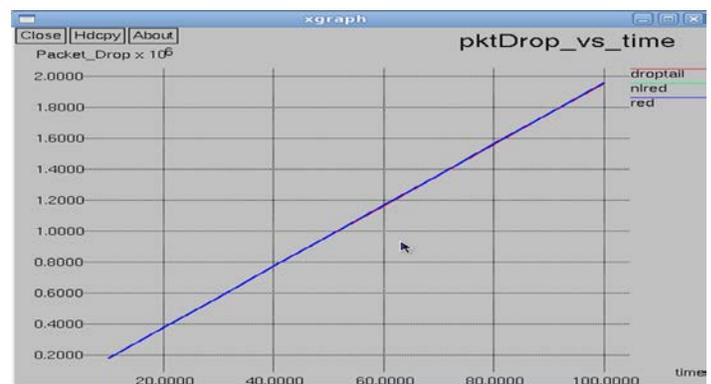
Simulation Time	Drop Tail	RED	NLRED
10	98.3629	98.1402	98.9499
20	99.226	99.1358	99.4613
30	99.4932	99.1828	99.2928
40	99.6336	99.1371	99.1925
50	99.7085	99.3210	99.2873



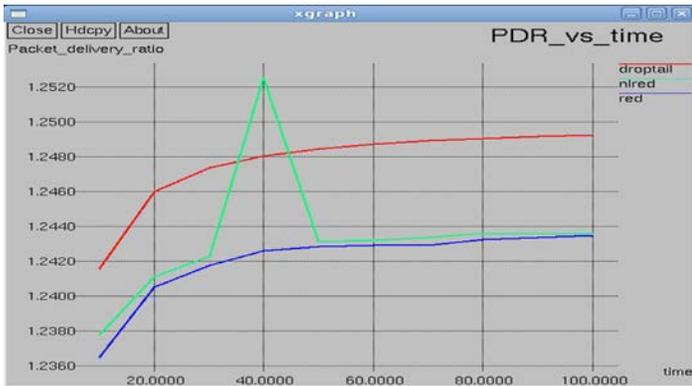
**Figure 13: Comparing the variation of throughput for Drop Tail, RED, and NLRED**



**Figure 14: Comparing the Variation of End-to-End Delay for Drop Tail, RED, and NLRED**



**Figure 15: Comparing Variation of Packet Drop for Drop Tail, RED, and NLRED**



**Figure 16: Comparing Variation of Packet Delivery Ratio (PDR) for Drop Tail, RED and NLRED**

**Table 9. Throughput Analysis and Results**

Simulation Time	Drop Tail	RED	NLRED
10	1.92612	1.77568	1.79623
20	1.96501	1.80912	1.81885
30	1.97707	1.81817	1.82350
40	1.98295	1.82042	1.82987
50	1.98643	1.81689	1.82803

**Table 10. End-to-End Delay Analysis and Results**

Simulation Time	Drop Tail	RED	NLRED
10	0.475924	0.72372	0.61625
20	0.457026	1.05407	1.01802
30	0.451199	1.46259	1.44238
40	0.448364	1.91779	1.79257
50	0.446688	2.47312	2.2949

**Table 11. Packet Drop Analysis and Results**

Simulation Time	Drop Tail	RED	NLRED
10	177862	178042	178017
20	375362	375767	375748
30	572863	573507	573492
40	770363	770948	771210
50	967864	969031	968966

**Table 12. Packet Delivery Ratio (PDR) Analysis and Results**

Simulation Time	Drop Tail	RED	NLRED
10	1.24155	1.23647	1.23774
20	1.24599	1.24052	1.24110
30	1.24737	1.24174	1.24228
40	1.24805	1.24259	1.25252
50	1.24844	1.24283	1.24312

## V. CONCLUSION

In computer network, it is of great importance to know which congestion control mechanism is suitable for each network and traffic. After the analysis of Drop Tail, RED, and NLRED on the basis of the simulation result, it was proven that in a congested network NLRED maintains good link utilization and small queue size. Its performance is better than RED and Drop Tail. It maintains high throughput, low packet drop, low delay, and high packet delivery ratio than Drop Tail and RED. Significantly, fairness between flows achieved with NLRED is better than that achieved from Drop Tail and RED. NLRED is not much sensitive to parameter like maxp. Congested networks performance of NLRED holds better than that of Drop Tail and RED, though Drop Tail performance is better than RED.

In experiment 1 there is a congested network so NLRED performed best, but on increasing the bandwidth at the bottleneck link, which is, decreasing the network congestion in the experiment 2, we see that Drop-Tail performs better than RED and NLRED. In experiment 3, where real audio packets are used and bandwidth chosen was not sufficient to pass any of the packet, all the queues performed equally. But, on increasing the bandwidth here NLRED and RED performed better because here packets are heavy so this much bandwidth is not sufficient to remove the congestion. The network is still congested and it gives results similar to experiment number 1. Therefore, when congestion is low, simple Drop-Tail mechanism achieves better throughput as compared to RED and NLRED because of the unnecessary computations involved in RED and NLRED to

avoid congestion will decrease the overall performance. By comparing the network packet drop, delay and packet delivery ratio in both the traffics, it could be stated that RED uses the network bandwidth less effectively than Drop-Tail. When congestion is high, NLRED and RED perform better than Drop Tail. However, in every case NLRED performed better than RED. This is because the uniform packet drop distribution from the random early packet drop behavior of RED will result in more application packet losses.

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# Assessment of the Impacts of Solar Radiation and Wind Speed on the Performance of Solar Thermal Oven

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DOI: 10.29322/IJSRP.8.8.2018.p8070  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8070>

## Abstract

A solar baking oven was successfully constructed with cheap and locally available materials and was tested. Data was collected during the experiment and was also recorded. The effect of wind speed to the system have become a major concern, due to this limitation, this paper present the effects of solar radiation and wind speed on the performance evaluation of a solar thermal oven. The performance evaluation of the oven in terms of figures of merits and oven efficiency was evaluated based on Indian Standard (IS 13429:2000). The results obtained reveals that the highest temperature of the bread was 78<sup>0</sup>C around 1:20pm at an ambient temperature 40<sup>0</sup>C at about 2:00pm when the solar radiation was 988.3w/m<sup>2</sup> and also the wind speed was 4.8m/s respectively. It actually shows that the wind speed has effect to the system because the values obtained were high. Further research on this study more alternative material for thermal storage should be investigated to come up with one that can give the most optimal system performance.

**Keywords:** *Solar radiation, Thermal storage, temperature, efficiency and phase change material.*

## Introduction

The continuous process of using firewood in the rural area for baking, cooking and heating had also resulted to deforestation, health hazard, desert encroachment, soil erosion and the reduction or shortage of firewood. The recent research for alternative ways of baking technology in which solar energy becomes a good energy source for baking and other processes in Nigeria. This reason is because our great nation is endowed with abundant sunshine at least 9 hours per day for the whole year depending were the position near the equator. Further, more, solar energy can also be use as water pump for farm and in our various house for water heater, this process of using solar energy can save the forest reserves in the Nigeria. (Bald *et al.*, 2000).

## Methodology

### Materials/Apparatus Use

The following are the instrument and apparatus use in construction of solar oven;

- (1) Plywood
- (2) Plank
- (3) Reflectors made of mirror (two pieces)
- (4) Plane glass
- (5) Sand paper
- (6) Black paint
- (7) Nail
- (8) Galvanize sheet
- (9) Top gum/silicate gum
- (10) Thermometer
- (11) Bread container
- (12) Pyrometer
- (13) Anemometer

### General Assembling and Finishing

The wood casing was joint using a hinges together with the reflectors and a bating was used in holding the plane glass. Also the oven was painted and the absorber was black in colour. The reflectors (two mirror) of the same size where hugged separately on the box each side, therefore all necessary movement is possible to reflect as much as solar radiation that can be attained into the oven chamber, these reflectors help to increases the intensity of solar radiation falling into the baking chamber.

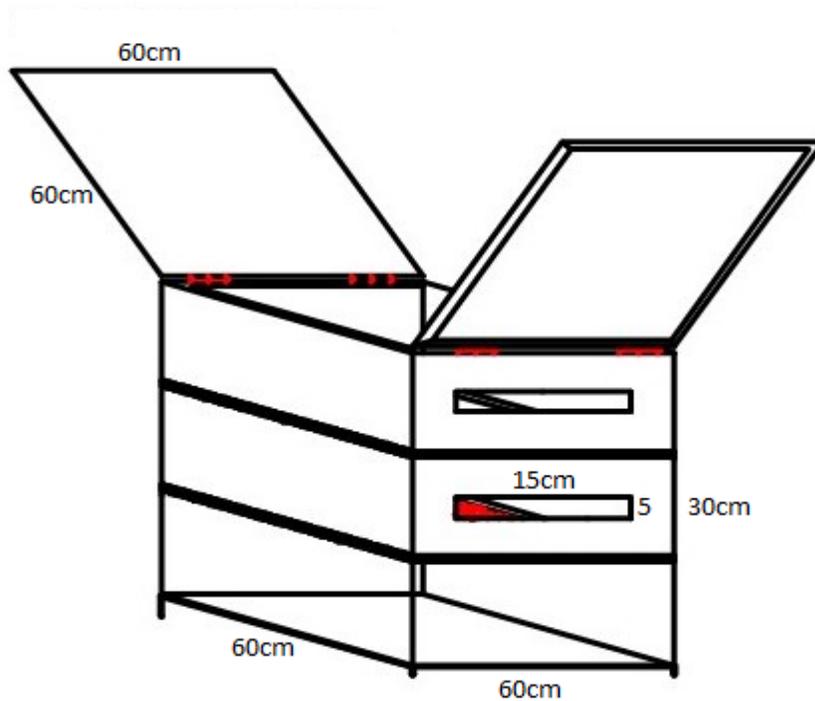


Figure 1.1 The General Assembling

**Properties of Materials**

Table 1.1 Properties of Materials

S/N	MATERIAL DESCRIPTION	QUALITY/PROPERTIES
<b>A</b>	<b>REFLECTOR (MIRROR)</b>	
	Number	Two (2)
	Thickness	4mm
	Emittance	0.92-0.94
	Length and breath	60cm by 60cm
<b>B</b>	<b>WOOD</b>	
	Plywood	One and Half sheet
	Plank	six pieces of 2 by 2
<b>C</b>	<b>ABSORBER PLATE</b>	
	Inner plate	Galvanized sheet
	Thickness	0.9mm
	Color	Ash in color
	Thermal conductivity	19w/mk
<b>D</b>	<b>PAN FOR BREAD</b>	
	Number	One
	Material	Aluminum
	Height of the pan	2m
	Specific heat	0.996kj/kg °c

**Data Collection**

The India standard provides testing based on thermal test procedures for solar oven. The performance of the reflector based solar oven implemented in this study was done based on India standard, (IS 13429: 2000 Ayoola *et al.*, 2014). The method highlighted two tests,

the test of stagnation test (test without load) and a load test. The thermometer is used to measure temperatures and pyrometer was used to measure solar radiation and also weighing balance to measure the bread weight, however wind speed was measured by using digital Anemometer and also relative humidity was recorded respectively. The test on solar oven was done on the month of October and it started around 8:00 am to 6:00 pm. Every twenty (20) minutes data was collected and recorded.

**Data Evaluation**

The performance evaluation of the solar oven involve estimation of the following parameters; first figure of merit (F<sub>1</sub>), Second figure of merit (F<sub>2</sub>) and oven’s efficiency (η). The first figure of merit (F<sub>1</sub>) has an equation which is given below

$$F_1 = \frac{T_{ps} - T_{as}}{H_s} \tag{1}$$

Where T<sub>ps</sub>, T<sub>as</sub> and H<sub>s</sub> are stagnation plate temperature, average ambient temperature and intensity of solar radiation respectively Purohit and Purohit, (2009).

Therefore, the second figure of merit (F<sub>2</sub>) is given below

$$F_2 = \frac{F_1(M_b C_b)}{At} \ln \left\{ \frac{1 - \frac{1}{F_1} \frac{(T_{b1} - T_a)}{H}}{1 - \frac{1}{F_1} \frac{(T_{b2} - T_a)}{H}} \right\} \tag{2}$$

Where F<sub>1</sub> is first figure of merit (Km<sup>2</sup>w<sup>-1</sup>), M<sub>b</sub> is the mass of the bread as load (kg), C<sub>b</sub> is the specific heat capacity of the bread (J/kg°C), T<sub>a</sub> is the average ambient temperature (°C), H is the average solar radiation incident on the aperture of the oven (W/m<sup>2</sup>), T<sub>b1</sub> is the initial bread temperature (°C), T<sub>b2</sub> is the final bread temperature (°C), A is the aperture area (m<sup>2</sup>) and t is the time difference between T<sub>b1</sub> and T<sub>b2</sub> (s) Mohod and Powar, (2011).

Finally, the overall efficiency of the system is given below

$$\eta = \frac{M_b C_b \Delta T}{I_{av} A_c \Delta t} \tag{3}$$

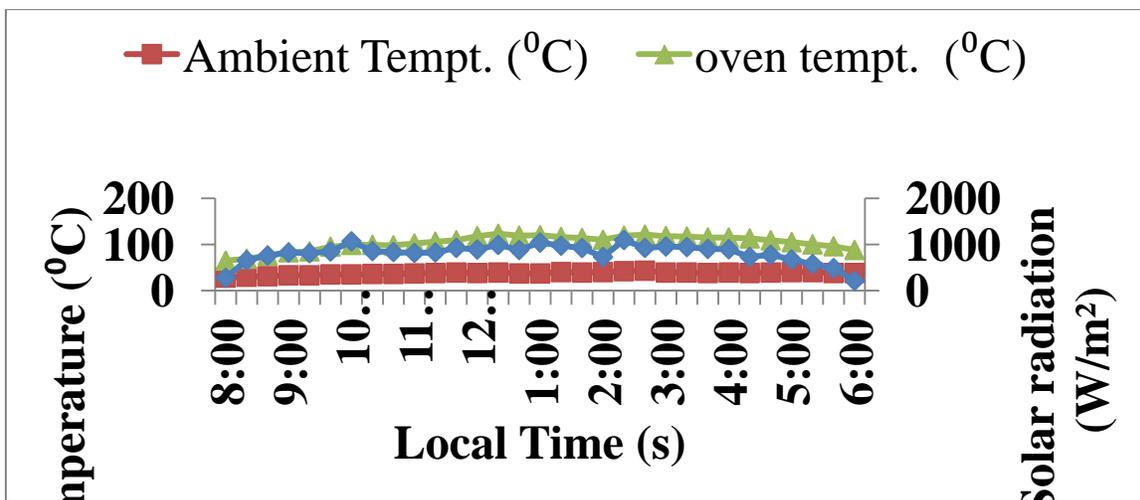
Where η<sub>u</sub> represents overall thermal efficiency of the solar cooker; M<sub>b</sub> mass of the bread (kg); C<sub>b</sub>, Specific heat of the bread (J/kg°C); ΔT, temperature difference between the maximum temperature of the bread and the ambient air temperature; A<sub>c</sub>, the aperture area (m<sup>2</sup>) of the oven; Δt, time required to achieve the maximum temperature of the bread; I<sub>av</sub>, the average solar intensity (W/m<sup>2</sup>) during time interval Δt khalifa *et al*, (2005) and reported by El-Sebail and Aboul, (2005).

**Performance Evaluation**

The experiments were performed in October using the solar oven in order to test the performance of the oven for baking. The experiment was set up and started around 8:00 am and end around 6:00pm. The first figure of merit (F<sub>1</sub>) was calculated by using equation (1) above. Where T<sub>ps</sub>=90°C, T<sub>as</sub> = 37°C and H<sub>s</sub>= 961.3. Hence F<sub>1</sub>=0.05. The second figure of merit (F<sub>2</sub>) was also calculated by using equation (2) above. Where F<sub>1</sub>= 0.05, M<sub>b</sub> = 1kg, C<sub>b</sub>= 251 kj/kg°C, At= 43.2m<sup>2</sup>/s, T<sub>b1</sub>=20°C, T<sub>b2</sub>= 40°C, T<sub>as</sub>= 37°C and H = 654.4 W/m<sup>2</sup> Therefore F<sub>2</sub>=1.54. and the overall efficiency (η<sub>u</sub>) of the system was calculated by using equation (3) above. Where M<sub>b</sub> = 1kg, C<sub>b</sub>= 251 kj/kg°C, ΔT = 50°C, Δt = 360s, A<sub>c</sub>= 0.36m<sup>2</sup> and I<sub>av</sub> = 654.4W/m<sup>2</sup> Therefore η<sub>u</sub>=14%.

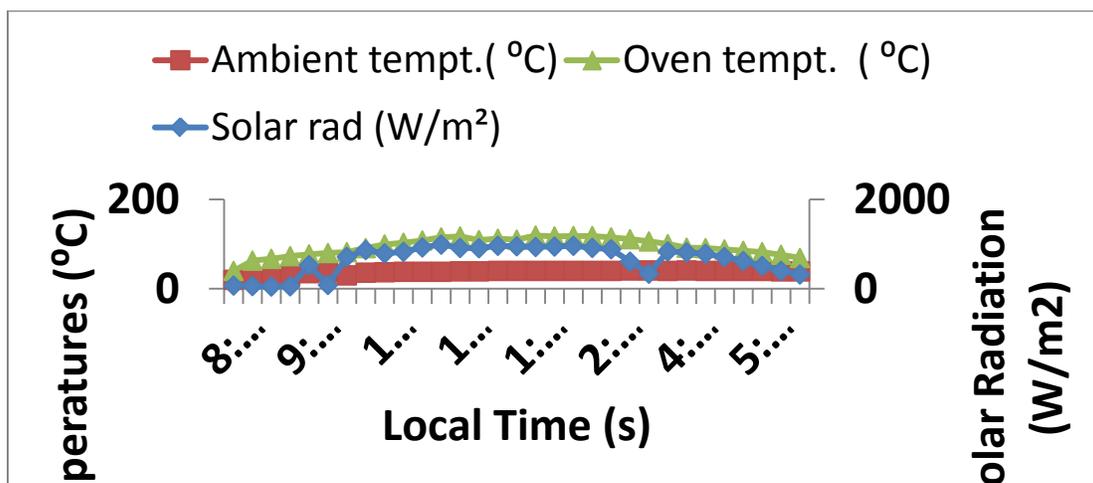
**Results**

The results of the variation of the solar radiation, ambient temperature and oven temperature with time as shown in Figure 1.2 while the primary vertical axis shows the values of the temperature on the 17<sup>th</sup> October, 2017, the secondary vertical axis shows similar result but for solar radiation. The Figure reveals that the solar radiation begin to increase from 8:00 am, reaching a peak value of about 1095w/m<sup>2</sup> around 2:20 pm, after which it began to decrease. During this period the oven temperature and ambient temperature increase and a peak value was recorded to be 83°C and 37°C. Further observations from the Figure shows that the decrease in solar radiation from 2:20 pm -6:00 pm was consistent with time and oven temperature decrease around 1:00 pm. Similar observation was also made around 1:00 pm when the ambient temperature maintained it steady peak value until around 4:00 pm it decrease. This indicates an inverse relationship between the two parameters at particular intervals.



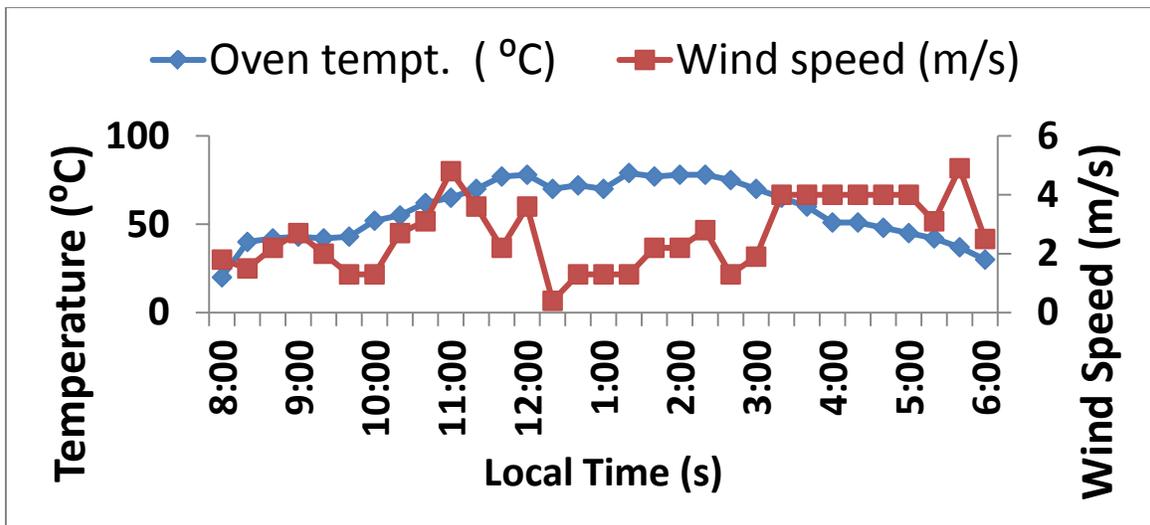
**Figure 1.1 The stagnation test**

The results of the variation of the solar radiation, ambient temperature and oven temperature with time as shown in Figure 1.2 while the primary vertical axis shows values of the temperatures on the 18<sup>th</sup> October, 2017, the secondary vertical axis shows similar result but for solar radiation. The Figure reveals that the solar radiation begins to increase from 8:00 am, reaching a peak value of about 988.3W/m<sup>2</sup> around 11:40 am, after which it began to decrease. During this period the oven temperature and ambient temperature increase and a peak value was recorded to be 79<sup>o</sup>C and 40<sup>o</sup>C. Further observations from the Figure shows that the decrease in solar radiation from 12:00 pm -6:00 pm was consistent with time and oven temperature decrease around 1:20 pm. Similar observation was also made around 1:00 pm when the ambient temperature maintained it steady peak value until around 4:00 pm it decrease. This indicates an inverse relationship between the two parameters at particular intervals.



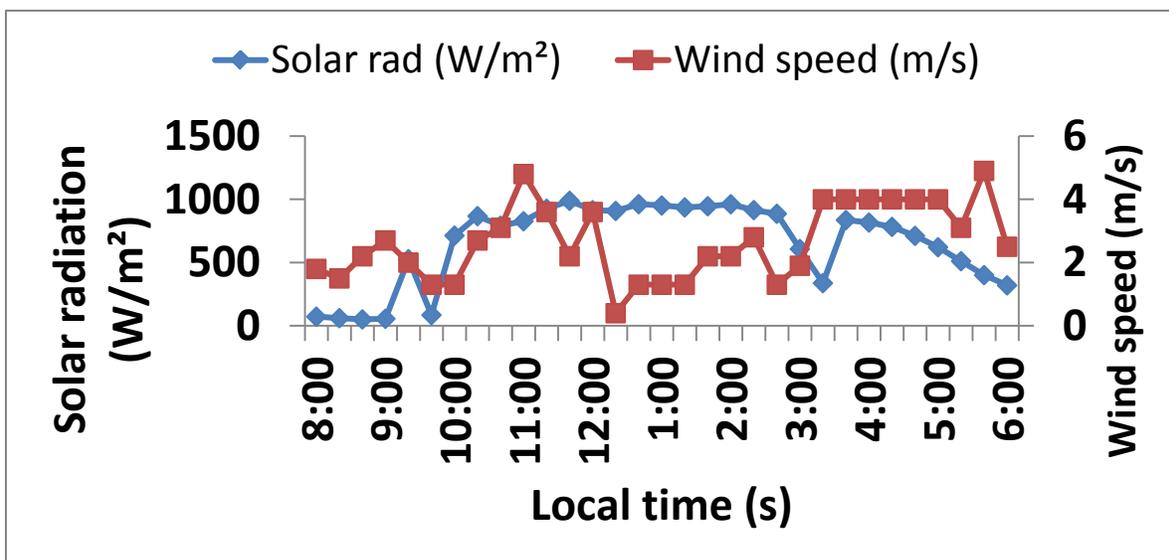
**Figure 1.2 The Result of the Oven**

The results of the variation of oven temperature with time as shown in Figure 1.3 while the primary vertical axis shows the values of the temperature on the 18<sup>th</sup> October, 2017, the secondary vertical axis shows similar result but for wind speed. The Figure reveals that the temperature begins to increase from 8:00 am, reaching a peak value of about 79<sup>o</sup>C around 1:20 pm, after which it began to decrease. During this period the wind speed increase and a peak value was recorded to be 4.8m/s. Further observations from the Figure shows that the decrease in temperature from 1:40 pm -6:00 pm was consistent with time and wind speed decrease and started fluctuating around 12:00 noon which was the exact time solar radiation was high.



**Figure 1.3 Result of Oven Test**

The results of the variation of the solar radiation and wind speed with time as shown in Figure 1.4 while the primary vertical axis shows the values of the solar radiation on the 18<sup>th</sup> October, 2017, the secondary vertical axis shows similar result but for wind speed. The Figure reveals that the solar radiation begins to increase from 8:00 am, reaching a peak value of about 988.3W/m<sup>2</sup> around 11:40 am, after which it began to decrease. During this period the wind speed increase and a peak value was recorded to be 4.8m/s. Further observations from the Figure shows that the decrease in solar radiation from 12:00 pm -6:00 pm was consistent with time and wind speed decrease and started fluctuating around 12:00 noon which was the exact time solar radiation was high.



**Figure 1.4 Results of Oven Test**

**Discussion**

In this study, a solar oven was constructed and used to bake bread. The performance of the oven was tested based on the relationship between the solar radiation, oven temperature, ambient temperature and wind speed of the oven was also computed. The result from this study reveals that solar radiation, oven temperature, ambient temperature and wind speed increased with time from 8:00 am to 2:00 pm because of the sky is clear while the wind speed fluctuate because of the solar radiation reduced and started fluctuating from the system, however, the oven temperature decrease as solar radiation decreased because of cloud cover when the ambient temperature maintained a peak value because the effect of wind speed to the system. This discussion was from Figure 1.2 to 1.4.

**Conclusion**

From the experiment that was carried out it was observed that the system worked perfectly well and attained the highest temperature 78°C around 1:00pm that will be able to bake bread. So therefore if solar oven is adopted it will provide a cheap simple and

alternative way for cooking, baking and it will go a long way to reduce the cutting down of trees for fire wood as the solar energy will serve as an alternative energy source to the firewood used by our local people as source of energy for domestic use.

### **Recommendation**

Although limitation was encountered during the execution of this research but it gives room for further research. Therefore the following recommendations are given for further researcher.

- (1) To use aluminum sheet in constructions of solar oven instead of galvanized sheet to compare the oven efficiency of the two materials.
- (2) Further tests should also be carried out during more sunny days or periods of the year.
- (3) More alternative material for thermal storage should be investigated to come up with one that can give the most optimal system performance.
- (4) The size of the reflectors can also be increased for additional solar radiation.

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# Assessment of Properties of Fadama Soils in Jos North Local Government Area of Plateau State

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DOI: 10.29322/IJSRP.8.8.2018.p8071

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8071>

## ABSTRACT

The study was conducted in Jos North L.G.A of Plateau State, Nigeria to assess the properties of Fadama soils. Soil samples were collected from Federal College of Forestry Jos, Federal Department of Forestry, Farin Gada and ECWA Staff Fadama sites at two depths (0 – 15cm and 15 – 30cm) using simple random sampling methods. The parameters assessed for were particle size distribution, P<sup>H</sup>, total Nitrogen, organic carbon, organic matter, available phosphorous, total exchangeable bases, exchangeable acidity, cation exchange capacity, base saturation percentage, exchangeable sodium percentage and sodium absorption ratio. Results obtained indicate that the soils were generally clay to clay loam in texture. The organic carbon ranges from 0.082 – 1.68%, total nitrogen 0.041 – 0.084%, available P 6.70 – 24.5ppm, Calcium 2.50 – 4.35ppm and available potassium 0.22 – 0.48ppm. These contents studied were very low. Magnesium and Cation exchange Capacity varied from medium to high, while soil P<sup>H</sup> ranges from 6.11 – 6.69, Exchangeable Sodium Percentage (0.24 – 0.38%) were very low indicating no salinity/sodicity risks. The slightly acidic reaction and low nutrient status of these soils could culminate into acid soil fertility. Declined in soil fertility have capitulated decreased in food production. A guide to the achievement of sustainability of crop production entails application of organic manure, inorganic fertilizer and liming materials simultaneously to boost and stimulate soil fertility as well as raising the soil PH. This study outlines the role of fadama soils as an answer to sustainability and renewability of crop production for economic development in the study area.

**Key words:** Physico-chemical properties, Fadama farm soils, Ekiti State, Nigeria.

## INTRODUCTION

Fadama soils are low-lying areas including stream channels and stream less depressions, which are waterlogged or flooded in wet season (Turner, 1977). They are found scattered in the arid and semi-arid tropical regions. In Nigeria today, the need for increased food production to feed the ever-increasing human population and to diversify the export base of the country

is more recognized now than ever before. This has turned the attention of both farmers and governments to the exploitation of Fadama lands which are believed to have more agricultural potential than the associated upland soils (Esu, 1999, Kpamwang and Esu, 1990). Due to massive production of agricultural produce on the Jos, Plateau, excessive washing away of the topsoil layer through erosion has drastically reduced the food productivity in Plateau State. According to Walsh (2003) the presence of salts in the soil that has accumulated over the years has affected crop productivities, excessive mining activities, climatic trends that favour salts disposition, salt from underground water, heavy rainfall, soil erosion, pedagogical and morphological properties of the soil are the fundamental factors generating soil sodicity and salinity in all Fadama soils of Jos (Juo, 1979).

Until recently, little attention has been given to Fadama lands. However with the realization that population in Nigeria is growing at an alarming rate while food supply is slow, utilizing the use of the limited land resources become more pronounced. Therefore, soil fertility is affected by salinity, sodicity, water holding capacity in Fadama soils of Jos and its environments. It is of great significance to utilize the fadama soil for effective agricultural production (Kwowa, 1972) since the climate favours agricultural production on the Plateau, it is therefore essential to put into use the gift of nature. The fadama soils are highly rich in nutrients deposits in the plains as the flood water recede. According to (Ipinmidum, 1997) large volumes of sediments are seasonally discharged into the floodplains which helps to renew the fertility of the soils.

Importance of Fadama soil is that it has high moisture content (ground water and residual moisture) even during seasons as well as drought. The ground water is at the soil surface which aid plant growth and development and enable farming activities suitable throughout the year (Singh, 2003). The need for an effective use of Fadama soil cannot be overemphasized especially when viewed against the realization that such information forms the background to the efficient and judicious use of the resources. Fadama soil varies widely in their physiochemical properties. This is attributed in the different deposition of materials eroded from the surrounding upland and those transported from elsewhere during the raining seasoning (Singh *et al.*, 1996).

## **Materials and Methods**

### **Soil Sample Preparation**

Soil samples were taken from two Fadama farms located at Federal College of Forestry demonstration farm and Farin Gada Vegetable farm in Jos North L.G. A. of Plateau state.

soil samples were collected from a depth of 0-15cm and from 15-30cm using soil auger and was put into a polythene bag and each of the soil were labelled accordingly from the four different sites in each location where the soil samples were taken. The bulk soil samples collected were air-dried in the laboratory for several days. Sample were crushed gently with porcelain pestle and mortar and passed through a 2mm sieve to remove coarse fragments. The fine earth separates (2mm soil portion) were stored in polythene bags for analysis. The gravely portion retained on the 2mm sieve (stones and gravels) were weighed and its percentage to the whole soil; were also calculated. Particle size distribution was determined by the hydrometer method (Gee and Bauder, 1886).

## PHYSICAL AND CHEMICAL ANALYTICAL METHODS:

### Physical Properties

In the laboratory, undisturbed samples were air dried, crushed and passed through 2mm diameter sieves for analysis will be used to carry out the process, this was determined by direct sieving followed by weighing. Sand, silt and clay were determined by dispersing the soil samples in 5% Calgon (sodium hexametaphosphate) solution. The dispersed samples were shaken on a reciprocating shaker after which particle size distribution were determined with the aid of Bouyoucouos hydrometer at progressive time intervals. The textural classes were determined with the aid of USDA textural triangle.

### Chemical Analysis:

The following chemical analysis shall be carried out:-

#### Soil pH

The soil was determined, both in water and 0.01M CaCl<sub>2</sub> solution, using a soil to solution ratio of 1:2.5 (IITA, 1979). On equilibration, pH was read with a glass electrode on a pyeunicam model 290Mk pH meter. Delta pH (dpH) values were determined as follows:

$$dp^H = P^H (CaCl_2) - p^H (H_2O).$$

1 exchangeable bases.

#### Exchangeable Bases

Exchangeable Ca, Mg, N, and K were extracted with 1M Ammonium Acetate (1M NH<sub>4</sub>OAc) solution buffered at pH 7.0, as described by Anderson and Ingram (1998).

Potassium and Sodium in the extract would be read on a Gallen Kamp flame Analyzer. The extract was diluted two times with the addition of 2ml of 6.5% Lanthanum chloride solution to prevent ionic interference before Ca and Mg were read. The Ca and Mg were read on a PyeUnicam model SP 192 atomic absorption spectrophotometer (AAS) at 423 and 285nm wavelength respectively. The sum of Ca, Mg, Na, and K were total M KCl extract would be

#### Exchangeable Acidity

The soils were leached with 1M KCl solution. Exchange acidity (Al + H) in the determined by titrating with 0.1M sodium hydroxide solution as described by (Anderson and Ingram, 1998).

#### Effective CEC

Effective CEC was calculated from the summation of exchangeable bases determined by 1M NH<sub>4</sub>OAc extraction and the exchange acidity by 1M KCl extraction (Anderson and Ingram, 1998).

$$E_{CEC} (Cmol\ kg^{-1}) = Exch. (K^+ + Ca^{++} + Mg^{++} + Na^+ + Acidity)$$

#### Base Saturation (BS)

Percentage saturation was calculated by dividing the total exchangeable cat ion (Ca, Mg, K and Na) by the cat ion exchange capacity (CEC) obtained by the 1M NH<sub>4</sub>OAc (pH 7.0) method as follows:

$$\% BS = \frac{\text{Total exchange bases}}{\text{CEC (NH}_4\text{OAc)}} \times 100$$

### Exchange Sodium Percentage

The exchangeable sodium percentage was calculated as the proportion of the CEC ( $\text{NH}_4\text{OAC}$ ), occupied by exchangeable sodium as follows:

$$\text{ESP} = \frac{\text{exchangeable sodium}}{\text{CEC (NH}_4\text{OAC)}} \times 100$$

### Organic Carbon

The organic carbon was determined by the wet oxidation method of Walkley -Black as described by Nelson and summer (1982) the reaction was activated with the addition of concentrate sulphuric acid as a catalyst.

### Total Nitrogen

The total nitrogen content of the soil was determined using the micro-kjeldahl technique as described by Bremner (1982). Free ammonia liberated from the solution by steam distillation in the presence of 10M NaOH was collected. The distillate was then titrated with 0.1M  $\text{I}^- \text{SO}_3^-$ .

### Available Phosphorus

Available phosphorus was extracted using the Bray No. 1 method (Bray and Kurtz, 1945). Phosphorus in the extract was determined calorimetrically by the Molybdophosphoric - blue method using ascorbic acid as a reducing agent (Murphy and Riley, 1962).

### Organic Phosphorus

Organic phosphorus was determined by ignition method as described by Anderson and Ingram (1998). The soil organic matter was destroyed by igniting the soil samples at  $550^\circ\text{C}$  in a muffle furnace. The difference between the acid extracted P of an ignited soil sample and unignited soil sample, gives the measure of soil organic P.

### Total Sulphur

Total sulphur in the soil water was determined by the conversion of sulphur containing compounds into  $\text{S(V}^2)$  by oxidation as described by Agbenin (1995). The sulphur in the extract was turbidimetrically determined on a colorimeter at 470nm.

## RESULTS AND DISCUSSIONS

### 4.1 Physical properties

The physical properties of fadama soil presented in Table 1 shows that, the soils in FCF and Farin Gada area are dark grey (7.SYR 4/0) at the surface (0 – 15cm) and subsurface (0 – 30cm) in colour respectively while at FDF and ECWA staff showed grey (80.75 YR 5/0) colouration at both surface and sub surface horizons .

Table 1: Physical Characteristics

Location	Depth	Horizon/Colour	Sand%	Silt%	Clay %	Textural class
FCF	0-15	7.5 YR 4/0 Dark grey	34	27	39	Clay loam

FCF	15-30	25-43 YR 4/0 Dark grey	32	26	42	Clay
FDF	0-15	43-80.75 YR 5/0 Grey	38	24	38	Clay loam
FDF	15-30	80-100 7.5 YR 6/0 Grey	35	24	41	Clay
Farin-gada Farin-	0-15	0.27 7.5 YR 4/0 Dark grey	37	24	39	Clay loam
gada ECWA	15-30	27-50 25-43 YR 4/0 Dark grey	34	25	41	Clay
STAFF ECWA	0-15	43-80.75 YR 5/0 Grey	36	28	36	Clay loam
STAFF	15-30	80-100 7.5 YR 5/0 Grey	30	28	42	Clay

The surface soils (0-15cm) in both locations were of clay loam textural classes while the subsurface soils were observed to have clay textural classification. This may be attributed to leaching of the fine textured particles down the profile. In all the locations, sand percent was found to have a decreasing distribution pattern with soil depth whereas soils were observed to have an irregular distribution pattern. Similarly, clay had an increasing distribution pattern with soil depth.

## 4.2 CHEMICAL PROPERTIES

### 4.2.1 Soil P<sup>H</sup>

The average P<sup>H</sup> value for ECWA staff fadama area was 6.57 as shown in table 2, 6.44 for Farin Gada, 6.25 for FCF and 6.16 for FDF fadama sites. This indicates that the P<sup>H</sup> value for the study area is slightly acidic according to Esu (1999) rating. Similar trend were also observed and reported by Enokela and Salifu (2012) having a pH value of 6.50. The soil pH is found to increase with depth.

### Total Nitrogen

The total percentage nitrogen in at the sites shows FCF having 0.078%, FDF has 0.061, ECWA staff has 0.051 and Farin Gada with 0.045%. The result indicates that high percentage nitrogen was recorded at FCF. Similar result to ECWA staff of low nitrogen values as reported by Kparmwang (1996) having nitrogen value of 0.051% was obtained in Bauchi state. The total nitrogen of the area shows an irregular pattern of distribution vertically down the soil profile, similar result were also reported by Sharu *et al.*, (2013) in Sokoto state. These irregular changes could be as a result of continuous cultivation, a practice which is common in the area, which is accompanied by nearly crop residue removal (Noma *et al.* 2011).

### Organic Carbon

The organic carbon in the four locations was found to be generally low, according to London (1991) rating. Federal College of Forestry farm has a mean value of 1.56% 1.22% at Federal Department of Forestry, 1.15% at ECWA staff and 0.53% at Farin Gada. The surface mean is

Table 2: **CHEMICAL CHARACTERISTICS**

Location	Soil Depth (cm)	Available										CEC cmol/kg	ESP %	SAR %		
		PH		Total % Nitrogen	Organic Carbon %	Organic matter %	Phosphorus (ppm)	Exchangeable Base in (ppm)							Exchangeable acidity cmol/kg	
		H2O	CaCl2					K	Ca	Mg	Na					
																0
FCF	0-15	6.18	5.12	0.084	1.68	2.92	24.5	0.36	4.00	2.00	0.02	1.63	7.98	79.94	0.25	0.008
FCF	15-30	6.32	5.20	0.071	1.43	2.45	17.5	0.48	4.35	2.10	0.026	1.60	8.56	81.26	0.30	0.01
<b>Average</b>		<b>6.25</b>	<b>5.62</b>	<b>0.078</b>	<b>1.56</b>	<b>2.68</b>	<b>21.0</b>	<b>0.42</b>	<b>4.18</b>	<b>2.05</b>	<b>0.023</b>	<b>1.62</b>	<b>8.27</b>	<b>80.6</b>	<b>0.28</b>	<b>0.009</b>
FDF	0-15	6.11	5.06	0.062	1.24	2.14	14.0	0.24	2.30	1.00	0.014	1.65	5.20	68.35	0.27	0.008
FDF	15-30	6.20	5.18	0.059	1.19	2.06	17.3	0.32	2.45	1.10	0.021	1.67	5.56	69.98	0.38	0.011
<b>Average</b>		<b>6.16</b>	<b>5.12</b>	<b>0.061</b>	<b>1.22</b>	<b>2.10</b>	<b>15.61</b>	<b>0.28</b>	<b>2.38</b>	<b>1.05</b>	<b>0.018</b>	<b>1.66</b>	<b>5.38</b>	<b>69.17</b>	<b>0.33</b>	<b>0.01</b>
Farin gada	0-15	6.31	5.04	0.049	0.99	1.70	7.00	0.29	2.50	1.00	0.017	1.59	5.00	73.33	0.31	0.009
Farin gada	15-30	6.50	5.24	0.041	0.082	1.42	6.70	0.39	2.80	1.70	0.024	1.64	6.53	74.95	0.37	0.011
<b>Average</b>		<b>6.44</b>	<b>5.14</b>	<b>0.045</b>	<b>0.53</b>	<b>1.36</b>	<b>6.85</b>	<b>0.3</b>	<b>2.65</b>	<b>1.35</b>	<b>0.21</b>	<b>1.61</b>	<b>5.97</b>	<b>74.14</b>	<b>0.34</b>	<b>0.01</b>
ECWA																
STAFF	0-15	6.45	5.22	0.062	1.24	2.41	14.0	0.22	2.25	1.15	0.013	1.72	5.35	67.91	0.24	0.007
ECWA																
STAFF	15-30	6.69	5.02	0.053	1.06	1.82	7.00	0.27	2.50	1.35	0.018	1.77	6.07	68.17	0.30	0.009
<b>Average</b>		<b>6.57</b>	<b>5.12</b>	<b>0.051</b>	<b>1.15</b>	<b>2.11</b>	<b>10.5</b>	<b>0.24</b>	<b>2.37</b>	<b>1.25</b>	<b>0.015</b>	<b>1.74</b>	<b>5.71</b>	<b>68.04</b>	<b>0.27</b>	<b>0.008</b>



significantly decreased with the soil depth as suggested by Browaldh (1995). The organic carbon tends to be more in surface depth as opined by Sharu et al,(2013), who also reported similar results having a value of 1.38% organic carbon. The high organic carbon at the surface soil in the study area could be as result of leaching.

### Organic Matter

The mean organic matter (%) for F.C.F is 2.68% and 2.11% for ECWA staff. while for FDF and Farin Gada are 2.10% and 1.36% respectively. The low organic matter content of soils has been attributed to factors such as continuous cultivation, frequent burning of farms, and plant residues commonly carried out by farmers in the area which tends to deplete organic materials that could have been added to the soil, Yakubu (2001) reported the same result having the organic matter of 2.36%. Furthermore, Agbu and Ojanuga(1998) stated that low organic matter content in soils could be due to rapid decomposition and mineralization of organic materials contributed by sparse vegetation in the Guinea savannah region as promoted by radiation.

### Available Phosphorus

Federal College of Forestry has a mean value of 21.00ppm and 15.61ppm at FDF, ECWA staff has 10.50ppm while in Farin Gada the value is 6.85ppm. The available phosphorus content varies from each of the locations and has an irregular phosphorus distribution pattern. Aluko (2000), stated that plant depend mainly on phosphorus for biomass production, plant growth and development. The phosphorus content in Farin Gada is recorded as significantly very low in both surface and subsurface horizons in the study area. Same result were also obtained from Sharu *et al.*, (2013) with a value of 15.35 (ppm) of available phosphorus in Sokoto state. Brady and Weil, (2002) stated that the lower level of available phosphorus, particularly in fadama soils could be due to phosphorus fixation into unavailable forms such as calcium phosphate, which could be attributed to large quantities of calcium deposited in the farm through irrigation water and flooding water.

### Cation Exchange Capacity

The result also indicates that at F.C.F the CEC is 8.27cmol/kg and farin Gada a value of 5.97cmol/kg<sup>-1</sup> while at ECWA staff it is 5.71cmol/kg<sup>-1</sup> and 5.38 cmol/kg at FDF. CEC in the study area has an irregular distribution pattern in both surface and subsurface horizon as shown in table 2. Generally the cation exchange capacity ranges from low to very low, according to rating by Ilaco (1985). Sharu et al (2013) also reported similar result, having a CEC of 6.81cmol/kg in Kano State. The low exchange capacity of the soils may be as a result of the nature of clay (kaolinite) minerals (Opuwaribo and Odu, 1988; Juo and Moorman, 1981, Hassan et al., 2011). Yakubu et a; (2011) opined that organic matter content of soils may normally influence CEC which is generally low and therefore the low CEC values may be attributed to the amount of organic matter.

### Exchangeable Bases

**Available Potassium:** Available potassium ranged from 0.42ppm to 0.24ppm at in the study area. Available potassium increases downwards along the horizon. The available potassium in the study area is very low due to organic matter content which is known to have influence in its availability. Ipinmidun (1970) also reported that potassium is the most deficient elements in fadama soils. Ilaco (1985) ratings shows that all the soils are generally low in potassium. Sharu *et al* (2013), stated that, magnesium problem are frequent when the soil K:Mg ratio exceed 1.5:1, high Mg soils cause K deficiency in plant and soils with high Mg tends to have poor structure.

### Calcium and Magnesium Status

Calcium contents in the four locations indicates a range of 4.18ppm – 2.37ppm. From the results obtained, it shows the calcium content is higher in F. C. F compared to other locations. Similar results of 3.50cmol/kg<sup>-1</sup> of calcium were obtained in Bokkos, Mustapha and Nnalee (2007) in Jos Plateau fadama soils.

Magnesium content of 2.05ppm to 1.05ppm in the four locations. These patterns of distribution vary with soil depth, this shows that magnesium content is dominant in FCF compared to the three other sites. According to rating by Ilaco (1985) the soil in FCF has high magnesium content compared to that of three other sites with high accumulation of magnesium content. Magnesium was found out to be relatively high in the study area and have a dominant base in Fadama soil (Kowal and Knabe, (1978). Similar results were obtained from Mustapha and Nnalee having a similar results of 1.61 cmol/kg of magnesium in Bokkos (2007) in Jos Plateau Fadama Soils.

### Sodium Status

The Farin Gada mean value of 0.21ppm was obtained and FCF has a value of 0.023ppm while in FDF and ECWA staff the mean value of 0.018ppm and 0.015ppm respectively were obtained as shown in table 2. It then means that, the fadama soils have low sodium on its exchangeable cation complex according to rating by Ilaco (1985).

### Exchangeable Acidity

The exchangeable acidity refers to the amount of acid cations (aluminium and hydrogen) occupied on the cation exchange capacity (CEC), the range of exchangeable acidity is 1.59 to 1.64cmol/kg at the two locations. For Federal College of Forestry at a depth of 0 – 15cm and in Farin Gada at the same depth the exchangeable acidity has a mean value of 1.63 and 1.59 respectively. At the same depth of 15 -30cm it is 1.60 and 1.64 at both locations as shown in table 2.

### Base Saturation

The base saturation in ECWA staff was found to be 1.74, 1.66 for FDF, 1.62 for FCF and 1.61 for Farin Gada. These shows a decrease in the subsurface of the horizon due to the accumulation of organic matter and rock deposition brought about by weathering of parents material in relation to the increased alluvial deposition down the soil depth. FAO (1999) reported that soils with base saturation of greater than 50% are regarded as fertile soils while soils with less than 50% are regarded as infertile soils. Based on these facts therefore, the soils in all the two locations are generally fertile.

### Exchangeable Sodium Percentage (ESP)

The range of values for exchangeable sodium percentage in the soils in the four locations was 0.34% - 0.27%. Yakubu et al (2001) having an ESP of 0.31% also reported similar result in soils of Sanyinna area of Sokoto state.

### Sodium Adsorption Ratio (SAR)

SAR ranges from 0.01 at Farin Gada and FDF respectively to 0.09 at FCF and ECWA staff as shown in Table 2. Sodium Adsorption Ratio (SAR) are for the locations fall below the threshold value of 13 for sodic soils (Sanda *et al.*, 2007). Similar results were obtained by Sharu *et al.* (2013) having an SAR of 0.014% in the soils of Dingyadi district of Sokoto State.

### Conclusion

The slightly acidic reaction and low nutrient status of these soils could culminate into acid soil fertility. Declined in soil fertility have capitulated decreased in food production. A guide to the achievement of sustainability of crop production, entails application of organic manure, inorganic fertilizer and liming materials simultaneously to boost and stimulate soil fertility as well as raising the soil PH. This study outlines the role of fadama soils as an answer to sustainability and renewability of crop production for economic development in the study area.

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# Design and Analysis of Solar Paddy Dryer by Natural Convection

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DOI: 10.29322/IJSRP.8.8.2018.p8072

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8072>

**Abstract-** Myanmar is an agricultural country and has a population of about 50 million. In Myanmar, rice is one of the major crop and the need for drying facilities at the site of the rice production is essential if post production losses to be kept to a minimum. Some dryers are run by diesel or gasoline engines and natural source of sun. In this paper, the drying system will be powered by solar energy sources. It is noted that the designed dryer has advantages over traditional sun drying. Moreover, paddy was free from impurities such as dirt, there was a low incidence of losses from mold or insects, and paddy was not exposed to rain or dew. This dryer can reduce moisture content from 22 % to 14 % (w.b) during 2 days. This solar paddy dryer is designed such as depth of paddy bed, size of paddy box, size of solar collector, air velocity and inlet area, and chimney cross section area. And then, the designed dryer is analyzed by varying the drying capacity with same chimney height.

**Index Terms-** Paddy bed, paddy box, size of solar collector, chimney cross section area and analysis.

## I. INTRODUCTION

IN Myanmar, main crop is rice and there are three types of rice such as early duration rice, medium duration rice and late duration rice. Summer rice is the type of early duration rice and it ages 120-140 days. Summer rice is harvested paddy consists of the right gain, germ and bran, converted with a shell or hull. Its moisture content is ranging from 20% to 30% wet basis (w.b). The rice production process are involved include harvesting, threshing, drying, storing and milling the grain. If the rich moisture content of paddy during storage, the paddy is spoiled by fungi and insects. Therefore, drying process is essentially required for rice production. Summer paddy is harvested in raining season in Myanmar. Drying can result to get good quality and are protected from attacks of destructive agents. And then, paddy drying can storage long time without deterioration. For drying rice after the harvest, sun drying in the open air is the traditional method used by farmers in Myanmar. In this traditional method, considerable losses can occur in the range from 10% to 25%. For control drying and better quality of grains, use solar dryer with collectors. Collectors are generally made of high absorptivity (black body) material. A solar dryer is an enclosed unit, so the grain is safe from damage by birds and insects. In this dryer, chimney height is used 3 m from the ground level. For the month of May, solar insolation is received 6.525 MJ/day m<sup>2</sup> including the average possible sunshine. The main objective of this paper is to design the solar paddy dryer with improvement of the quality of grain.

## II. BASIC INFORMATION OF PADDY DRYING

Drying is the process of removing the excess moisture from the paddy. Its moisture content should be reduced as much as possible to about 14% w.b for much longer storage. The drying air temperature is usually kept below 45°C for paddy drying. Moisture content is the water contained in the paddy measured as a proportion of the total weight of the paddy. The moisture content of the paddy is interpreted in two ways: moisture contented with wet basis and dry basis. Table 1 shows the moisture contented of the paddy and storable days.

Table I: Storable Day of Paddy

Paddy's moisture contents (%)	12	14	16	17	18	19	20	21	22
Storable day	1825	365	60	38	25	16	11	7	5

In wet basis of paddy, the percentage moisture content of a sample of grain is defined by the following formula.

$$m = \frac{W_m}{W_m + W_d} = \frac{w - d}{w} \times 100$$

In dry basis of paddy, moisture contents are defined by the following formula.

$$M = \frac{W}{W_d} \times 100 = \frac{m}{100 - m} \times 100$$

In moisture content, dry basis is frequently and preferably expressed as moisture ratio, that is, pounds of moisture per pounds of dry matter or  $M/100$ . The quantity of moisture percent at any time is directly proportional to the dry-basis moisture content or moisture ratio.

The equilibrium moisture content of paddy depends upon its variety, temperature and relative humidity of surrounding air. For example at 30 °C and 75% relative humidity, paddy usually has an equilibrium moisture content of about 14 % wet basis. The approximate values of the EMC of paddy are represented by the curves shown in the Fig 1.

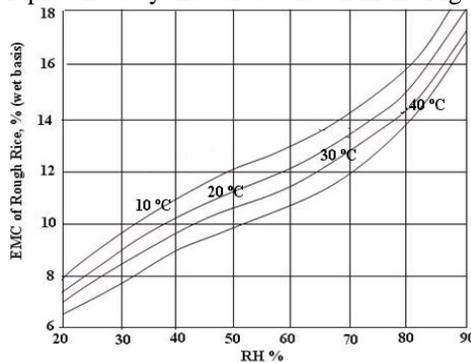


Fig 1. EMC Curve of Paddy

In drying system, there are three main types: (1) Traditional sun drying (2) Solar drying (3) artificial drying. In solar drier, solar radiation would be allowed to pass through a transparent sheet where heat absorbent are placed and in turn heat the air. The heated air is conveyed into the drying platforms where grain drying is taking place. Simple single-glazed solar collection systems are used to slightly raise the temperature of drying intake air, thus it speeds up the drying process. Solar drying are two types. There are direct solar dryers and indirect solar dryers.

Direct solar dryers are cheap to make and easy to use, but allow almost no way to control the temperature. It is hard to protect the product that is drying from external factors.

Indirect solar dryer has a flat plate collector and a separate drying chamber. In this type, the paddy is placed on trays inside an opaque drying chamber to which is attached an air type solar collector. It can result in higher temperature than the sun drying, and can produce higher quality product. The indirect dryer is more efficient than the direct dryer.

### III. SOLAR GRAIN DRYER

#### A. Type of solar collector

In solar collection systems, there are two main categories: (1) focusing collectors and (2) flat plate collectors. The flat-plate collector requires no tracking device to capture the sun's energy and absorbs solar radiation typically is a flat metal surface with a black coating. This collector type is capable of providing temperatures up to 150 to 200 degrees F and is relatively simple to build. Because of these factors, the flat plate collector is chosen logically for agricultural space heating needs. There are many different designs for flat plate collectors, but they all have two basic characteristics: (1) A flat plate to absorb energy from the sun and (2) A circulating medium to pick heat up from the plate and transport it to storage. The two media most commonly used for absorbing and transferring the heat are air and water.

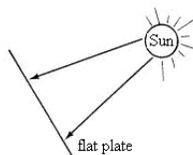


Fig 2. Flat plate collector

#### B. Collector efficiency

The efficiency of a solar collector is the ratio of the amount of useful heat collected to the total amount of solar radiation striking the collector surface during any time period. One of the problems with flat plate systems is the relatively low efficiency compared to other heating systems because of the high losses in collection and transport of solar energy. Heat is lost through the front, sides and back of the collector, by reflection from the cover, and by direct radiation from the heated flat plate. Typical day-long efficiencies for different types of flat plate collectors are presented in Table II.

Table II: Collection efficiencies for flat plate collectors

Type	Day-long efficiency
Plastic tube type	25 percent
Bare plate	30 percent
Covered plate	35 percent
Suspended plate	40 percent
2-cover suspended plate	45 percent

### C. Parts of Solar Paddy Dryer

The solar paddy dryer is composed of three important components. These are solar collector, paddy box and the chimney, as shown in the Fig 3.

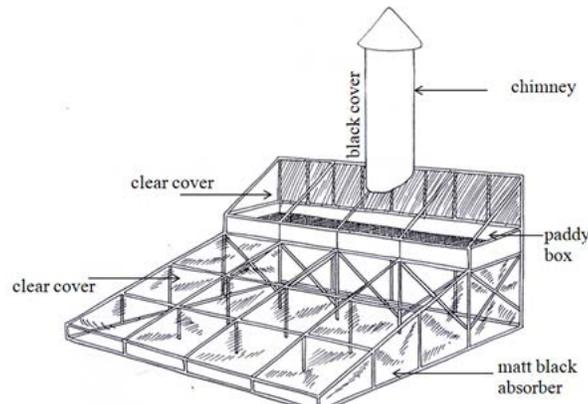


Fig 3. Parts of solar paddy dryer

#### (i) Solar Collector

The solar collector is heart of the dryer. It consists of a matt black substance spread on the ground, and has a clear material as a cover and on the sides. The clear cover slopes up from the air inlet towards the paddy box to direct the heated air through the grain. Supporting structure is used to support and provide enough incline for the clear cover, so that no water pools will form on it. A low-cost material for the structure is bamboo and high-cost structures have frames of wood, concrete, or metal.

#### (ii) Paddy box

The height of the paddy box is at waist level. The bottom must be made of perforated material which allows the air to pass through easily, but does not allow the grain to fall through. The sides of the box should be made of material strong enough to resist grain pressure. There is a door to load and unload paddy at the back. The roof and sides are covered with clear material. The perforated area floor should be 10 % or more of the total surface area in order to that the pressures drop though the perforations may be neglected.

#### (iii) Chimney

The chimney consists of a light, strong frame covered with a matt black substance, and a cover above the chimney keeps out the rain. The base of the chimney is at the highest part of the roof. The chimney structure may be made from bamboo, wood, or metal. The black materials used for the chimney must have high durability and be weather resistant and air proof. The materials may be plastics, galvanized iron sheet painted dull black, metal or concrete pipes painted black, etc. A cap mounted 150 mm above the top of the chimney must be provided.

#### (iv) Working Principle of Solar Paddy Dryer

Solar radiation, both direct radiation from the sun and indirect radiation from the sky, passes through the clear substance and warms the air inside the collector. The matt black substance changes the solar radiation into heat and transfers the heat to the air. Since the warm air has a low density, it passes up through the bed of the paddy and the drying starts gradually from the bottom layer into the middle. Solar radiation passes through the clear roof and increases the buoyancy of the moist warm air over the rice bed. The remaining solar radiation directly heats the top layer of paddy and then the middle layer, and in this way drying starts from the top and continues into the middle layer. Hence, the drying in the solar dryer proceeds both from the top and the bottom into the middle layer. Solar radiation absorbed by the black chimney provides a full column of warm air to increase the air flow through the bed by natural convection.

## IV. DESIGN CALCULATIONS OF SOLAR PADDY DRYER

The following calculations are the basic design for half ton solar paddy dryer. The basic calculation is to determine the required energy to remove the moisture content of the paddy. And then required solutions are thickness or depth of the rice bed, size of the paddy box, size of the collector area, size of the air inlet and the chimney cross-section area. In this paper, the size of paddy box is calculated for 500 kg capacity.

Drying capacity = 500 kg

Initial moisture content of the paddy = 22 %

Final moisture content of the paddy = 14 %

Drying period = 2 days

Density of the paddy = 600 kg/m<sup>3</sup>

Type of collector = Flat plate solar collector

Specific latent heat of vaporization of water, L = 2.5 MJ/kg

The amount of heat required to evaporate the water the drying equation is

$$Q_w = m_w L \quad (1)$$

Where, the weight of water removed from paddy is

$$m_w = \text{initial weight} \times \frac{M_{\text{initial}} - M_{\text{final}}}{100 - M_{\text{final}}} \tag{2}$$

The required parameters of rice bed thickness of dryer are shown in Fig 4.

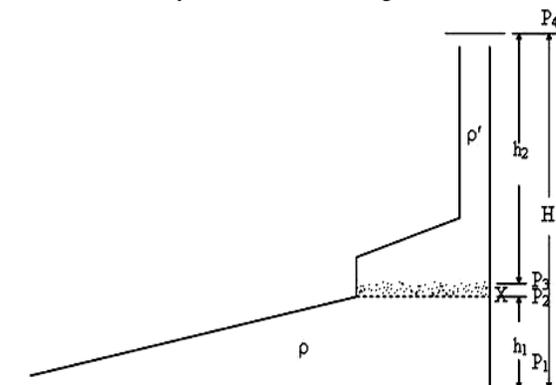


Fig 4. Parameters of rice bed thickness of dryer

The following calculation indicates the appropriate bed depth of paddy in relation to temperature difference. From the Fig 4, the following equations hold:

$$P_2 = P_1 - h_1 \rho' g \tag{3}$$

$$P_3 = P_4 + h_2 \rho' g \tag{4}$$

$$P_4 = P_1 - (h_1 + h_2) \rho g \tag{5}$$

The pressure loss across the rice bed can be divided from the above equations and the result is that;

$$P_2 - P_3 = (h_1 + h_2)(\rho - \rho') g \tag{6}$$

$$\Delta P = H \Delta \rho g \tag{7}$$

The relation between depth of the paddy bed X and the air velocity entering and leaving the rice bed V is;

$$V = k \frac{\Delta P}{X} \tag{8}$$

Where, k is constant and 0.03 m<sup>2</sup>/min.Pa

For one cubic meter of paddy spread to a depth of X meter. The cross-section area is;

$$A = \frac{1}{X} \text{ m}^2 \tag{9}$$

The air flow rate, with an air velocity V m/min passing through a cross-section area of A m<sup>2</sup>, will be;

$$Q = VA \tag{10}$$

From equation 6 to 9,

$$Q = \frac{0.03 \Delta \rho}{X} \times \frac{1}{X} = \frac{0.03 H \Delta \rho g}{X^2}$$

$$X = \left( \frac{0.03 H \Delta \rho g}{Q} \right)^{\frac{1}{2}}$$

In the case of drying, Q should be in the range from 1.5 to 8 m<sup>3</sup>/min base on cubic meter of paddy.

Chimney height, H = 3 meters (from the ground level)

Ambient air temperature = 30 °C

Warm air temperature = 45 °C

Density of the ambient air, ρ = 1.1514 kg/m<sup>3</sup>

Density of the warm air, ρ' = 1.1014 kg/m<sup>3</sup>

$$\therefore X = \left( \frac{0.03 H \Delta \rho g}{1.5} \right)^{\frac{1}{2}} \text{ to } \left( \frac{0.03 H \Delta \rho g}{8} \right)^{\frac{1}{2}}$$

This range is the depth of the paddy bed for 1 m<sup>3</sup> of paddy. Using this data, depth of the paddy bed is assuming 100 mm for 0.83 m<sup>3</sup> of paddy.

The volume of a 500 kg of paddy bed is calculated from the bulk density of rough rice. The bulk density is expressed in Appendix F. This depends on the variety of rice, the moisture content of rice, and the packing.

$$\text{Half ton of paddy volume} = \frac{\text{mass}}{\text{density}} \tag{10}$$

And then, the floor area of the paddy bed can be calculated by the following equation.

$$\text{The floor area of the paddy bed} = \frac{\text{volume}}{\text{depth of the paddy bed}} \quad (11)$$

Where, one side of the paddy box height is 70 cm and other side of the paddy box height is 30 cm.

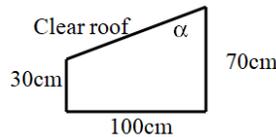


Fig 5. Dimension of the paddy box

Thus, the angle between the clear roof and side of paddy box is  $\alpha = \tan^{-1}(100/40)$  and clear roof is inclined  $68^\circ$  from the chimney base. Solar insolation for May (summer paddy is harvest in April-May) and average possible sunshine is 0.4 for Yangon. Where,

$$\text{Total solar radiation, } I = 16.3125 \times 0.4$$

$$\text{Received energy from the collector} = I \times t \times \eta_c \quad (12)$$

Where, the collector efficiency,  $\eta_c$  is 0.35 from Table II. Thus, collector area is

$$\text{Collector area} = \frac{\text{required energy for the dryer}}{\text{received energy from the collector}} \quad (13)$$

The perforated floor should be placed at waist level, or about 80 cm from the ground. If the width of a paddy box suitable range is 100 cm, then the collector wide is 300 cm. The slope of the inclined clear cover is 10 degrees or over. In this design, clear cover inclines 10 degrees from the perforated floor.

$$\text{The air inlet height} = (\tan 10^\circ \times 300) = 12 \text{ cm}$$

$$\text{The air inlet area} = 12 \text{ cm} \times 830 \text{ cm} = 0.996 \text{ m}^2$$

The area is approximately 0.1 times of the paddy false floor area.

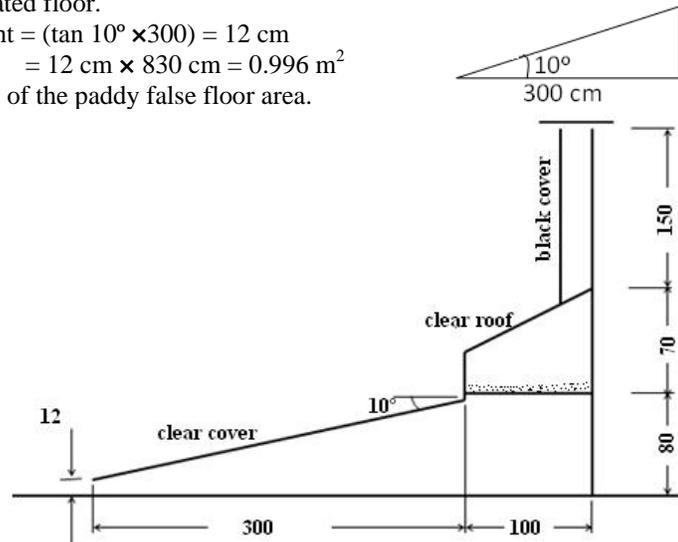


Fig 6.Dimension of the dryer

Where, the range of air flow rate  $Q$  is from 1.5 to 8  $\text{m}^3/\text{min}$  for 1  $\text{m}^3$  of paddy. Thus, the maximum air flow rate of 0.83  $\text{m}^3$  of paddy is

$$Q_{\max} = 0.83 \times 8 = 6.64 \text{ m}^3/\text{min}$$

$$\text{air inlet velocity} = \frac{Q_{\max}}{\text{air inlet area}} \quad (14)$$

The pressure loss due to abrupt contraction and gradual expansion is

$$\text{pressure loss} = C_r C_1 \left( \frac{V^2}{2g} \right) \quad (15)$$

In this equation,  $C_r$  and  $C_1$  are loss coefficient for area change. These values are expressed in Appendix A.

$$\text{Pressure loss in Pa} = C_2 \rho g \left( \frac{\text{chimney air velocity}}{2g} \right) \quad (16)$$

After that, the cross-sectional area of chimney can be calculated by using chimney air velocity and maximum air flow rate. This area is approximately 0.02 times of the false floor area of the paddy. The total area of the air outlet should be at least equal to the cross-section area of the chimney.

V. SUMMARY OF DESIGN AND ANALYSIS OF THE SOLAR PADDY DRYER

In order to dry paddy from the initial moisture content of 14 % wet basis within 2 days in the wet season, the dryer will have

Depth of the paddy bed	100 mm
Collector area	3 times that of the paddy floor area
Air inlet area	0.1 times that of the paddy floor area
Air outlet area	0.02 times that of the paddy floor area
Chimney cross section area	0.02 times that of the paddy floor area
Height of the chimney	3 meters from the ground level

The solar paddy dryer is analyzed by changing the drying capacities with same chimney height. The calculation are based on the drying capacities are 500, 1000 and 1500 kg .The following table III shows the required energy, depth of the paddy bed, size of the paddy box, collector area, air inlet area and chimney cross-section area, for various drying capacity at the same chimney height. These calculations are the same.

Table III. Results of Solar Paddy Dryer for Various Drying Capacity with Same Chimney Height

Drying capacity	(kg)	500	1000	1500
Required energy	(MJ)	116.28	232.5	348.837
Depth of the paddy bed	(cm)	10	13	15
Size of the paddy box	(m <sup>2</sup> )	8.3	12.85	16.67
Collector area	(m <sup>2</sup> )	25.458	50.903	76.372
Air inlet area	(m <sup>2</sup> )	0.996	1.542	2
Chimney cross-section area	(m <sup>2</sup> )	0.23897	0.23897	0.23897

VI. CONCLUSION

In this paper, the design of indirect solar paddy dryer with chimney is calculated. These calculations consists of the required energy to remove moisture of the paddy, thickness or depth of the rice bed, size of the paddy box, size of the collector area, size of the air inlet and the chimney cross-section area. From the design calculation for 500 kg of solar paddy dryer, it can be seen that the required energy to remove moisture content from 22 % to 14 % for paddy is 116.28 MJ. The received energy from the collector is 6.525 MJ/day m<sup>2</sup> for May. The depth of the rice bed is 100 mm. So, the floor area of the paddy bed is 0.83 m<sup>2</sup>. The required collector area is 25.458 m<sup>2</sup>. The size of the air inlet area is 0.996 m<sup>2</sup> and the chimney cross-section area is 0.23897 m<sup>2</sup>. In this design, solar chimney height is used 3m from the ground level. And then, solar paddy dryer is analyzed by changing the drying capacities with same chimney height. Due to increase in drying capacity, the amount of paddy volume is increased. But by keeping the width of paddy box constant, the length of paddy box and depth of paddy is changed for its increase in volume. Without changing the chimney height, the new collector area form more heat to dry up and outlet air become slow which can cause overheat to the paddy. The effect of overheated, due to the same chimney height, the paddy can be broken and the quality of rice can be poor. Hence to avoid overheat problem it should be suggested to change the outlet air move faster by increase of chimney height. According to the results data from table III, it can be seen that, much energy require for greater drying capacity. So, the collector area will increase and the temperature inside the dryer will also be increased. From the calculation, chimney cross-section area is based on the pressure loss, which is also based on the chimney height. So, for the same chimney height, the chimney cross-section areas will be the same. For the larger collector area with same chimney height can cause overheating effect. To eliminate this effect, the chimney height should be increased.

Appendix

Table A 1. Monthly Average Sunshine Hour for Yangon

Month	Average Sunshine Hour
Jan	9.43
Feb	9.95
March	9.27
April	9.85
May	6.3
June	2.88
July	2.37
Aug	2.59
Sep	4.21
Oct	6.54
Nov	8.79
Dec	8.94

Table A2. Loss Coefficient for Area Changes

Type	Illustration	Conditions	Loss Coefficient	
		$A_1/A_2$	$C_1$	$C_2$
Abrupt Expansion		0.1	0.81	81.00
		0.2	0.64	16.00
		0.3	0.49	5.00
		0.4	0.36	2.25
		0.5	0.25	1.00
		0.6	0.16	0.45
		0.7	0.09	0.18
		0.8	0.04	0.06
		0.9	0.01	0.01
Gradual Expansion		$\theta$	$C_1$	
		5°	0.17	
		7°	0.22	
		10°	0.28	
		20°	0.45	
		30°	0.59	
Abrupt Exit		$A_1/A_2 = 0$	$C_1 = 0$	
Abrupt Contraction Square Edge		$A_2/A_1$	$C_2$	
		0.0	0.34	
		0.2	0.32	
		0.4	0.25	
		0.6	0.16	
		0.8	0.06	
Gradual Contraction		$\theta$		
		30°	0.02	
		45°	0.04	
		60°	0.07	
Equal Area Transformation		$A_1 = A_2$	$C_1$ OR $C_2$	
		$\theta \leq 14^\circ$	0.15	

Source: ASHARE (1969)

ACKNOWLEDGMENT

The author would like to expressed his special thanks to Dr. Nyi Nyi, Professor, Department of Mechanical Precision Engineering, University of Technology (Yadanarpon Cyber City) for his kind supervision, encouragement, suggestion and valuable guidance of this paper.

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# Numbers; Alpha – Omega – The Natural Numbers

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DOI: 10.29322/IJSRP.8.8.2018.p8073

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8073>

## Abstract

The paper focus on the newly found numbers which shows the actual numbers in spite of present numbers 0,1,2,3,4,5,6,7,8,9,10. These newly found numbers are  $\alpha$  alpha and  $\Omega$  omega.  $\alpha$  alpha means beginning and  $\Omega$  omega means ending in reference to numbers  $\alpha$  alpha can be meant as the beginning of numbers and  $\Omega$  can be meant as ending of the numbers. If we take simple series of numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and other series of numbers 4, 5, 6, 7, 8, 9, 10 in actual starts from  $\alpha$  alpha because  $\alpha$  alpha means the beginning therefore it is  $\alpha$ , 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and in second series it is  $\alpha$  alpha 4, 5, 6, 7, 8, 9, 10. The number  $\Omega$  omega cannot be put before  $\alpha$  alpha but can be put as 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10  $\Omega$  omega and in second series 4, 5, 6, 7, 8, 9, 10  $\Omega$  omega

There is  $\alpha$  alpha before 0 or any number so  $\Omega$  omega can not be put before  $\alpha$  alpha because  $\alpha$  alpha is beginning of numbers and  $\Omega$  is ending of numbers

Simply natural numbers can be written as

$\alpha$ , 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10  $\Omega$

Where  $\alpha$  is alpha (the beginning)

0, 1, 2, 3, 4, 5, 6, 7, 8, 10 are numbers

Where  $\Omega$  is omega (the ending)

## OR

Simply natural numbers can be written as

$\alpha$ , 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,  $\Omega$

Where  $\alpha$  is (the beginning) containing numbers like -2, -1, 0, 1, 2, 3

4, 5, 6, 7, 8, 9, 10 are numbers

Where  $\Omega$  omega (the ending) contains 11, 12, 13, 14, 15 and so on

## Keywords

$\alpha$  alpha, numbers, natural numbers, counting,  $\Omega$  omega

## Introduction

$\alpha$  alpha and  $\Omega$  omega are already present in nature as numbers  $\alpha$  alpha beginning of numbers  $\Omega$  omega as ending of numbers but were not noticed

## Description

Currently when we write numbers we start from 0 , 1 , 2 , 3 , 4 , 5 , 6 , 7 and so on , neglecting the numbers before 0. and neglect  $\alpha$  alpha(the beginning) which is present in nature but not written anywhere.

Currently when we continue numbers after like 7 , 8 , 9 , 10 , 11 we say numbers are infinite but neglect  $\Omega$  omega (the ending) which is present in nature but not written anywhere

$\alpha$  alpha : The number  $\alpha$  alpha means the beginning in reference to mathematics it is generally there before zero when we move into the negative – or minus side and decimal side before 0 zero but positive number and decimal and whole numbers after 0 can also be put in  $\alpha$  alpha but by one rule that is **BEFORE  $\Omega$  OMEGA** ,  $\alpha$  alpha can not be put after  $\Omega$  omega is has to stay before  $\Omega$  omega.  $\alpha$  alpha is there before 0 zero the beginning of numbers

There are types of numbers before 0 zero

Type 1 : Type 1 is the decimal before 0 that is 0.1 , 0.2 , 0.3 and so on all these are before zero and can be represented by  $\alpha$  alpha

Type 2 : Type 2 is the negative or minus before 0 that is -1 , -2 , -3 , -4 and so on all these are before zero and can be represented by  $\alpha$  alpha

$\Omega$  omega : The number  $\Omega$  means the ending in reference to mathematics it is generally there after  $\alpha$  alpha or 0 zero or any positive number greater than  $\alpha$  alpha but by one rule that is  **$\Omega$  omega always comes after  $\alpha$  alpha** . All numbers after  $\alpha$  alpha may fall in  $\Omega$  omega because it shows ending

## Example Cases for $\alpha$ alpha and $\Omega$ omega

Following are few cases how  $\alpha$  alpha and  $\Omega$  omega can be used

Case 1 :

We can write numbers as

$\alpha$  -  $\Omega$

$\alpha$  alpha and  $\Omega$  omega

It would include all numbers from beginning till ending

When we open it

It becomes

$\alpha$  alpha , 0 , 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10 , 11 , 12 , 13 ,  $\Omega$  omega

$\alpha$  alpha the beginning

Then

0 , 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10 , 11 , 12 , 13

Then

$\Omega$  omega the ending

Case 2 :

We can also write it as

$\alpha$  , 7 , 8 , 9 , 10 ,  $\Omega$

Where

-3 , -2 , -1 , 0 , 1 , 2 , 3 , 4 , 5 , 6 ,

fall in  $\alpha$  alpha (the beginning)

Then

7 , 8 , 9 , 10

fall in numbers

Then

11 , 12 , 13 , 14 , 15

fall in  $\Omega$  omega (the ending)

When  $\alpha$  alpha is put before a number it would mean all the numbers and beginning before that specific number

Example:  $\alpha$  , 3 , 4 , 5 means - 3, -2 , -1 , 0 , 1 , 2 , all the numbers before 3 and beginning

When  $\Omega$  omega is put after a number it would mean all the numbers and ending following that specific number

Example: 10 , 11 , 12 ,  $\Omega$  omega means 13 , 14 , 15 , 16 , 17 , 18 all the numbers after 12 and ending

**OMEGA CAN NOT BE PUT BEFORE ALPHA**

**ALPHA CAN NOT BE PUT AFTER OMEGA**

It is up to us how much we open alpha or omega

Example : the numbers are  $\alpha$  , 0 , 1 , 2 , 3 ,  $\Omega$

We open  $\alpha$  upto 3 places it becomes

-3 , -2 , -1

Then

$\alpha$

OR

0.3 , 0.2 , 0.1

We open  $\Omega$  upto 3 places it becomes

4 , 5 , 6

**$\alpha$  alpha ,  $\Omega$  omega and mathematical operators DMAS**

Mathematical operators like Division , Multiplication , Addition and Subtraction does not effect  $\alpha$  alpha and  $\Omega$  omega because when we write  $\alpha$  alpha and  $\Omega$  omega many values like 0.1, 0.2, 0.3, -2, -1 , may come in single number  $\alpha$  alpha similarly values like 4 , 5 , 6 , 7 and others may get included in  $\Omega$  omega exact value is not there so it is difficult to apply mathematical operations on  $\alpha$  alpha and  $\Omega$  omega

**Conclusion**

$\alpha$  alpha is a number which means the beginning

$\Omega$  omega is a number which means the ending

If we write counting it should start from

$\alpha$  , 0 , 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9 , 10 ,  $\Omega$

$\alpha$  alpha contains all the numbers before 0 zero and the beginning

$\Omega$  omega contains all the numbers after 10 ten and the ending

The beginning of counting / numbers is  $\alpha$  alpha

The ending of counting / numbers is  $\Omega$  omega

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# Nature of Scanning, Analysis, Response and Assessment (SARA) Based Response Strategies in the Management of Youth Radicalization in Nairobi County, Kenya

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DOI: 10.29322/IJSRP.8.8.2018.p8074

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8074>

**Abstract:** Globally, the debate around religious extremism and radicalization has re-emerged as a topical issue, notwithstanding the reality that a complete metamorphosis of the process of radicalization always matures to heinous acts of terrorism. Terrorism poses grave threats to national, regional as well as global peace and security. In spite of this, there have been lapses in the management of radicalization in Kenya. Existing literature globally has demonstrated that POP initiatives are effective in reducing gang violence, robberies and drug trafficking among other forms of crime. Similarly, relevant studies have acknowledged its application in policing without comprehensively linking it to the management of youth radicalization. The study interrogated the nature SARA based response strategies in the management of youth radicalization in Kenya. The findings revealed an outstanding variation in the nature of SARA based response strategies in Nairobi County as initially developed for use in policing.

**Index Terms:** Analysis, Assessment, Kenya, Management, Problem Oriented Policing, Scanning, Radicalization, Terrorism

## 1.0 Introduction

Over the last decade, Al-Qaeda was the focal point of youth radicalization. But in the last six years, since the carnage of the Arab Spring, the Islamic State (ISIS) has taken center stage on global youth radicalism and extremism. The explosion of ISIS has been attributed to political instability in Iraq and Syria which has provided optimum breeding ground for their activities (Gerges, 2016). On the continental front, *Boko Haram* of Nigeria epitomizes a radical group that is supra-secretive and hyper-reactive and hell bent on atrocious killings of Nigerian Christians. In response, the government of Nigeria continues to react through military actions to demolish the uprising (Aseulime & David, 2015). Such response strategies have perpetually failed to address the underlying issues of radicalization in Nigeria.

On the regional front, anarchy in Somalia resulted to the dawn of Al-shabaab militants in the Horn of Africa. With lack of a stable government in Somalia, the international community has made a number of attempts to intervene in Somalia. The latest being African Mission in Somalia (AMISOM), which the Al-shabaab has responded to by conducting retaliatory attacks in neighboring countries and Kenya in particular (Bruton *et al.*, 2010). The instability in Somalia is impacting on the security of Kenya (Mwilu, 2015). Kenya is now a hotbed of youth radicalization and

terrorism. According to Rabasa (2009), huge unemployed youthful populations, a relatively cheap and accessible internet, good infrastructure, technological advancement and a highly corrupt system of government among other factors have made the infiltration of youth radicalization relatively easy. Since 2011, Nairobi has experienced at least 10 terrorist attacks. In these attacks, around 120 deaths and 550 injuries have been registered. However, it is the response approaches towards Youth radicalization in Nairobi that have been largely ineffective due to their over reliance on traditional policing approaches. These approaches include arrest, incarceration, investigation, charging and imprisonment depending on the notions of guilty or innocent (Ridley, 2014).

SARA problem solving model has informed the choice of application of effective response strategies in the management of different criminal activities and vices-homicide, prostitution, weapon violations, drug activity and intoxication, underage drinking, shoplifting, assaults, residential and commercial robberies and loitering among others (Maguire *et al.*, 2010). However, the persistent growth of radicalization as well as terror related activities in the global realm, and Nairobi County-Kenya in particular implies that the response strategies put in place have not been as effective as envisaged (Miller and Hess, 2008). In addition, the SARA model was attributed to a general increase in security in Nairobi County without linking it to

the management of youth radicalization (Chumba, 2013). This paper sought to examine the nature of SARA based response strategies in the management of youth radicalization in Nairobi.

## 2.0 Theoretical Framework

The study was premised on the Social Identity theory by Henri Tajfel and the Conflict theory by Karl Marx. According to Tajfel (1979), social identity through membership of a group gives individuals a sense of belonging. Membership to social movements are important sources of pride and self esteem and increases our self image by holding prejudice against members of the out group. In a nutshell, there are three mental processes that take place in evaluating others as “us versus them” or the in-group versus the out group”. These processes are: Social Categorization, Social Identification and Social Comparison. Social identity theory holds that the in-group will discriminate against the out-group in a bid to enhance their self-image. The central tenet of social identity theory is that group members of an in-group will seek to find demeaning aspects of an out-group, thus enhancing their self-image. This theory is key in explaining how youths in Kenya identify themselves with the ideologies of social movements in the form radical and terrorist groups. However, a part from social identity, the theory fails to account for the underlying reasons why social movements advocate for change in the society through the use of unorthodox means as is in the case of this study- terrorist attacks.

According to the Conflict Theory, conflicts arise when resources, status, and power are not evenly distributed between groups in society and that these conflicts become the engine for social change. Marx theorized that this system, premised on the existence of a influential minority class (the *bourgeoisie*) and an oppressed majority class (the *proletariat*), created class conflict because the interests of the two were at odds, and resources were unjustly distributed among them. Within this imbalanced system, social order was maintained through ideological coercion. Marx reasoned that as the socio-economic conditions worsened for the *proletariat*, they would develop a class consciousness that revealed their exploitation at the hands of the wealthy capitalist class of bourgeoisie, and then they would revolt, demanding changes in the social structures. Similarly, youth radicalization in Kenya is as a result of high youth unemployment, social and economic marginalization with development only impacting on a few rich individuals in the society. Class consciousness is what makes these youths to join social movements and consequently conduct a number of terrorist attacks in a bid to alter changes in the status quo. The independent variable in this study is the SARA problem solving model which can be used to address the underlying socio-economic determinants of youth radicalization in Kenya.

## 3.0 Methodology

The study adopted a descriptive research design. The study population comprised 93 police officers, 256 community members, 10 youths, 2 chiefs, 4 assistant chiefs and 25

heads of *Nyumba Kumi*. The key informants included 4 intelligence officers, 3 security experts and 3 Officers in Charge of Stations. Members of the community and police officers were selected using simple random sampling techniques. Purposive and snowball sampling was used to select the key informants. Questionnaires were used to collect primary data from community members, police officers, chiefs and heads of *Nyumba Kumi*. Interview schedules were used to collect data from Officers in Charge of Stations, intelligence officers and security experts. Additionally, one focus group discussions comprising of ten youths was used for the study. Secondary data were collected from online sources, official security reports, books and journals. Quantitative data were analyzed descriptively by computing measures of central tendency, frequency counts and percentages. Qualitative data were analyzed thematically and presented through narratives and verbatim quotations. The output of data analysis was presented in charts, graphs and tables and discussions were made based on the research findings.

## 4.0 Study Findings

### 4.1 Models of Crime Prevention in the Management of Youth Radicalization

In the quest to understand the nature of SARA based response strategies, the study sought to establish the current police based strategies used in Nairobi County in the management of youth radicalization. Understanding the current response strategies enables law enforcement agencies as well as stakeholders to either improve on or retain the current approaches. Data on the current police based response strategies were collected, analyzed and presented in Figure 4.1.

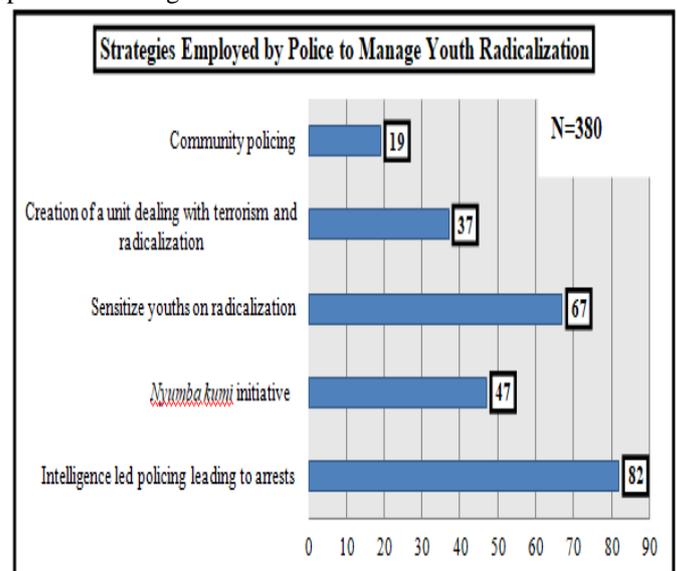


Figure 4.1: Police Based Response Models to Youth Radicalization in Nairobi County, Kenya

Source: Author, 2017

The findings of the study indicated that 82.5% (330) of the community respondents revealed that intelligence led

policing was the most used response model to manage youth radicalization, 48.6% (194) of the community respondents indicated that the *Nyumba kumi* initiative was an effective model, 67% (268) of the community respondents indicated that sensitizing the youth on the dangers of youth radicalization was a good response model, 37% (148) indicated that the creation of a special department that exclusively deals with terrorism related activities was a good model and less than 20% (80) of the community respondents indicated that community policing was an effective response strategy towards the management of youth radicalization in Nairobi County. An interview with a security expert confirmed the results of the questionnaires by giving the following account of events:

Proper intelligence gathering is attributable to the reduced cases of terrorism in the city. Therefore, proper intelligence structures are necessary in the fight against youth radicalization...they have averted many attacks (Field Data, 2017).

Proper intelligence has enabled the police to avert a number of terrorist attacks. Intelligence led policing (ILP) is a key policing approach that is semi-proactive and semi-reactive in nature. ILP does not eliminate or minimize the causes of crime, but averts the intended effects of a crime to both the police and the community as is the case of the current study. ILP in Nairobi County since its inception has led to lower crime rates, reduced policing costs and kept police officers safe. In practice, the model better prepares police officers in the field (Kenya Police, 2014). The aim of ILP therefore is not to replace but to enhance the traditional policing approaches.

Cordner (2012) adds that this approach allows security analysts to classify crime data. This makes it easy for police officers and investigators to work with an intelligence product that is finished rather than over reliance on basic crime information. Concisely, raw data is given to an analyst who takes the data and makes sense of it and then provides clear and succinct information for something usable by the police officers on the ground (Cordner, 2012). Similarly, Pickering *et al.*, (2007) study on Counter Terrorism policing reveals that ILP frees up police officers to do what they do best. It gives officers adequate time to perform real police work which simply increases police presence in a "would be" crime hotspot and reduces crime in an area. Lower crime rate translates to a safer environment for both the police and the community. More police hours on the beat means the job is being done without relying so heavily on overtime, lowering labor cost. Less overtime can also equate less exhausted officers, improving both quality of life and safety for those involved.

The findings of the study revealed that 82% of the respondents indicated that ILP is an effective way of addressing youth radicalization in Nairobi County because it leads to arrest of offenders. However, the study is premised on the principle that arrest and prosecution of offenders does

not solve problems facing the community and the police. Goldstein (2015) views that arrest and prosecution alone does not address crimes which is the premise of this study disagrees with Pickering *et al.*, (2007) views which advocate for the means rather than the ends of policing.

An interview with a security expert revealed that:

The *Nyumba kumi* initiative was effective when it was nascent, possibly this is because of the numerous attacks and public awareness campaigns then. However, city residents and Kenyans at large being who they are, the initiative is already facing an impending threat of collapsing. A majority of *Nairobians* do not even know who their neighbor is; leave alone their *Nyumba kumi* elders (Field Data, 2017).

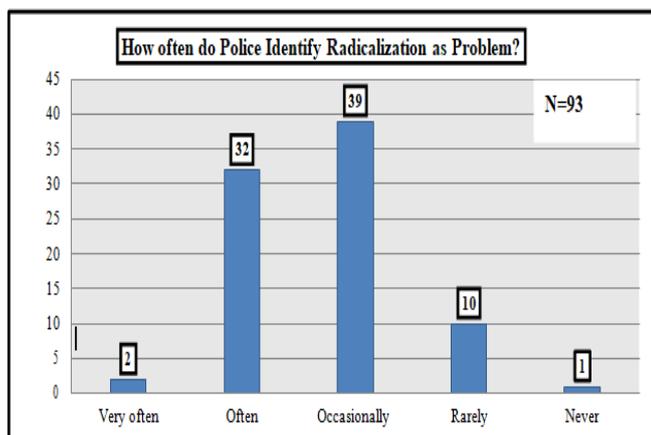
The response clearly shows that the initiative was at some point effective but is currently faced by numerous challenges. In April 2005, the Government of Kenya launched the community policing initiative. However, the implementation of the initiative has been faced with an avalanche of challenges such as lack of trust between the police and the community, fear of victimization and general hostility between the police and the members of the community (Masese & Mwenzwa, 2012). To this end, the *Nyumba Kumi* initiative was launched in 2013 in order to cut on some of the challenges that community policing faced.

Despite the challenges that the newly launched *Nyumba Kumi* initiative faced, it managed to reduce fear of crime and social disorder. In addition, it established an active partnership between government policing agencies and the community which is a salient feature in POP. Increased partnership between the community and the government agencies has had a domino effect on enhancing democratic openness in policing, transparency as well as accountability (Kenya Police, 2014). These are core principles in the practice of POP (Miller, 2017). However, the current study also notes that, of the five most preferred police-based response strategies, none really manages the underlying causes of radicalization. SARA based response strategies requires comprehending the causes of youth radicalization and developing appropriate response strategies to mitigate, limit and or eliminate the threats of the problem.

#### 4.2 Incidences of Reports on Youth Radicalization in Nairobi County

The first and most basic tenet of the nature of SARA based response strategies is the identification of a recurrent problem that affects both the police and the community (Goldstein, 2015). Data collected and analyzed indicated that the police identified youth radicalization as a problem occasionally at 46.4% (185), 38.1% (152) of the police respondents indicated that youth radicalization was often identified as a problem in Nairobi County. In addition,

11.9% (48) of the police respondents indicated that youth radicalization was rarely identified as a problem. Only 2.4% (10) and 1.2% (6) of the police respondents indicated that youth radicalization was identified very often and rarely as a recurrent problem in Nairobi County.



**Figure 4.2: Incidences of reports on youth radicalization in Nairobi County, Kenya**

Source: Author, 2017

An interview with an OCS revealed that:

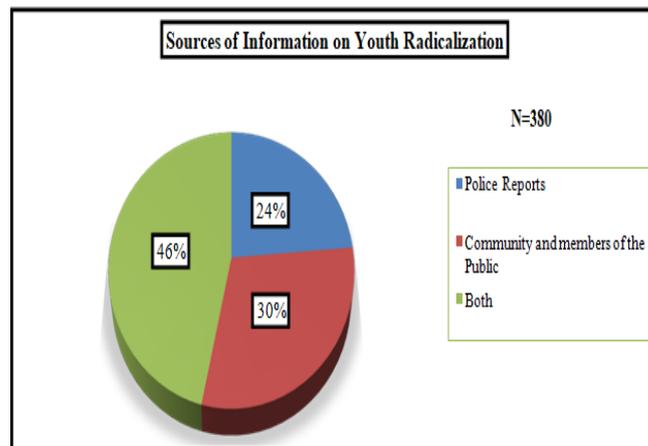
Our intelligence officers tip the station on possible radicalization activities at least twice weekly. In my view, with such consistency, I would say that in Eastleigh Police Post, we deal with the problem on an occasional basis (Field Data, 2017).

The response clearly indicates that, reports on youth radicalization at least twice weekly is not as high as any other across the country. The findings are in agreement with Farah (2011) indicating that Eastleigh has the highest population density of the Somalis and migrant Somalis in Kenya thus making it susceptible to youth radicalization. In addition, a report on *Organized Criminal Gangs in Kenya*, by the National Crime Research Center (2012), identified Eastleigh not only as the local headquarter but also as a focal point of operation for the Al-shabaab militia. This could be used to justify why youth radicalization is “occasionally” identified as a recurrent problem in Nairobi County.

### 4.3 Sources of Police Information on Youth Radicalization in Nairobi County

The sources of information inform on the reliability of policing models. Various sources of information are more reliable as opposed to single or limited sources of information (Goldstein, 2015). To this end, therefore, data were collected, analyzed and presented in Figure 4.3 the results indicated that the sources of police information were mainly of three types: the police investigative reports which are recorded in a book commonly referred to as the Occurrence Book (OB); reports from the members of the

public and the community and a hybrid from both the investigative reports from the police and the members of the public.



**Figure 4.3: Sources of Police Information on Youth Radicalization in Nairobi County, Kenya**

Source: Author, 2017

The results reveal that 46% (184) of the community respondents indicated that both the police and members of the public were sources of most of the information on youth radicalization, 24% (96) of the community respondents indicated that the police relied on the usage of the OB as a source of information on youth radicalization. 30% (120) of the community respondents indicated that the community and members of the public constituted the sources of information on youth radicalization in Nairobi County. The results are in agreement with Eck and Spelman (1987) on the nature of SARA based response strategies whose first step involves determining whether a problem really exists and whether the problem prompts further action by police.

An interview transcript by an intelligence officer revealed that:

Occasionally, we rely on what members of the public give us and what the intelligence officers on the ground give us. It is a collective responsibility that we cannot win without the involvement of the community, especially when collecting information on any act of crime (Field Data, 2017).

The response indicates that the police predominantly rely on a hybrid of information that combines what the public give and what the intelligence officers gather before proceeding to the next phase of SARA based response strategies in Nairobi County.

An FGD with youth respondents however gave mixed responses on scanning of information on youth radicalization in Nairobi County. The youths’ experiences were captured as follows;

Youth one:

I have volunteered to give the police information on youth radicalization since I joined Eastleighwood, before that I would not. Eastleighwood changed my perception in the fight against violent extremism (Field Data, 2017).

Youth two:

The police have never approached me to give them such information and I personally would have never volunteered to give them information on youth radicalization despite being in possession of crucial information, I would not set up a fellow youth to go rot in jail (Field Data, 2017).

Youth three:

I cannot, I won't and I will never. Youths have suffered in the hands of the police and I can never give them such information about my fellow youths (Field Data, 2017).

Youth four:

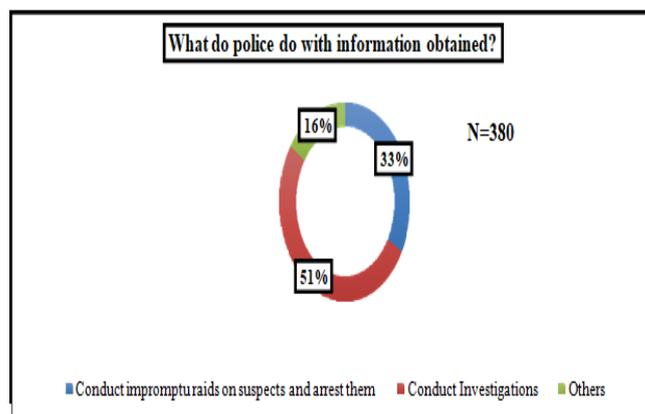
If I would be paid to give information to the police, I would. But again, these youths are into radicalization because they are hopeless and have no one to look up to. Let the police and the government of the day do their work. The government of the day in particular should deliver on the promises of the youths (Field Data, 2017).

The FGD excerpts reveal strained relationships between youths and the police who are the key subjects of the current study. The findings disagree with Clare *et al.*, (2010) study that emphasizes the need for cordial police-community relationships to ensure the full realization of POP and consequently the SARA model. In addition, the findings of this study concur with Rogers (2010) on his analysis of a decade on the problem oriented approach in England. He argues that the source in part echoes the level of engagement between the police officers, the community members and partners in the identification of policing priorities for response purposes. According to Rogers (2010), the police sources of information accounted for a 48% of the sources information across the three stations, members of the public accounted for 23% of the information whereas other agencies accounted for 29% of the sources of information. Similarly, Maguire *et al.*, (2015) in their analysis of 753 POP cases in Colorado Springs USA established that police information accounted for the highest prevalence (68%) of problem identification in their study

area. Members of the public accounted for 17% of the sources of information whereas 15% of the sources of information were unaccounted for. The results of this study on sources of police information concur with those of Maguire *et al.*, (2015).

#### 4.4 Police Action/Reaction to the Information Scanned on Youth Radicalization

The study sought to identify what police action or reaction followed the information collected from the various sources of information. Data collected and analyzed on the same is presented in Figure 4.4 where 51% (204) of the community respondents indicated that the police conducted investigations after collecting information on youth radicalization, 33% (132) of the community respondents indicated that the police conduct impromptu raids to arrest the suspects of youth radicalization and only 16% (64) of the community respondents indicated that the police used "other" approaches which mainly cited routine patrols in the crime location as a reaction towards the information collected.



**Figure 4.4: Police Action/Reaction to Information Obtained on Youth Radicalization in Nairobi County, Kenya**

**Source: Author, 2017**

An interview with an OCS confirmed the results from the questionnaires:

The police force is a law enforcement agency of the government and is guided by law and standard operating procedures once they receive information on possible criminal activities. Once information has been obtained, the police usually conduct investigations to ascertain the authenticity of the information (Field Data, 2017).

The response is in tandem with the police responses that indicated that 51% (204) of the police officers conducted investigations to verify the information received from the various sources before warranting further action. Mwazige (2012) in his study on legal responses to terrorism in Kenya established that the police officers strictly adhere to the existing pieces of legislation to fully realize their mandate.

Section 31 of the Prevention of Terrorism Act of 2012, states that: “a police officer may arrest a person where he has reasonable grounds to believe that such person has committed or is committing an offence under this Act.” The powers of arrest that are vested in police officers under this clause are subject to legal oversight. Police officers in Kenya are required to base all arrests on reasonable grounds, and the suspect is to be either taken to court or released within 24 hours as provided by the Constitution. Any continued custody has to be authorized by the courts of law. The officer need not have a particular offence in mind in order to arrest an individual; it’s entirely based on his perception and whatever he considers a terrorist act at that moment. The current study disagrees with Mwazige (2012) because the SARA model is not means but is end oriented (Eck & Spelman, 1987).

Conducting investigations is what SARA based response strategies refer to as analysis. Analysis, according to Goldstein (2015) is the phase that succeeds scanning. This phase challenges police officers to analyze the causes of problems behind a series of crime incidences. Once the underlying conditions of a crime are known through the conduct of thorough investigations, police officers ought to develop and implement appropriate response strategies (Eck & Spelman, 1987). However, what constitutes analysis in the conventional model greatly differs from what constitutes analysis within the framework of traditional policing in Nairobi County where investigations are solely focused on places and times where particular offenses are likely to take place and then identifying the offenders who are most likely to be responsible for the crimes with the view of arresting them for further legal action.

Customarily, police departments have a tendency to view problem solving as being the implementation of enforcement tactics such as arrests or high visibility patrols. On average, Rogers (2010) established that law enforcement tactics were used by police officers to deal with problems with a prevalence of 55%, the police only embraced problem solving methods 35% of the times while it was unclear what techniques the police used 10% of the time to solve problems facing them and the community. The results of the current study are in agreement with Rogers (2010) that the police implementation of SARA based response strategies are heavily centered on law enforcement techniques which at best do not eliminate or reduce the underlying causes of criminal problems. However, the results of the current study as well as those of Rogers (2010) fail to demonstrate the correct usage of the SARA model. The elimination or drastic reduction of crime and disorder problems is the goal of SARA based response strategies.

#### 4.5 Determination of Response Strategy to Youth Radicalization

The study sought to establish whether the response strategies used in the management of youth radicalization were developed in relation to the crime incident being handled or whether the response strategies were already pre-determined. Data were collected, analyzed and the results presented in Figure 4.5. The results indicated that only 37%

(34) of police respondents were in agreement that there was a mode of operation in the determination of the response strategies. A majority, 67% (59) of the respondents indicated that there was no specific criterion to determine effective response strategies.

As revealed by a key informant to this study:

Once the problem has been identified and information collected, what do you expect us to do? We are law enforcers and once we have all these information, we arrest suspects. Sometimes, once our “intel” furnishes us with information, we basically arrest suspects and let them stay in police custody as investigations proceed (Field Data, 2017).

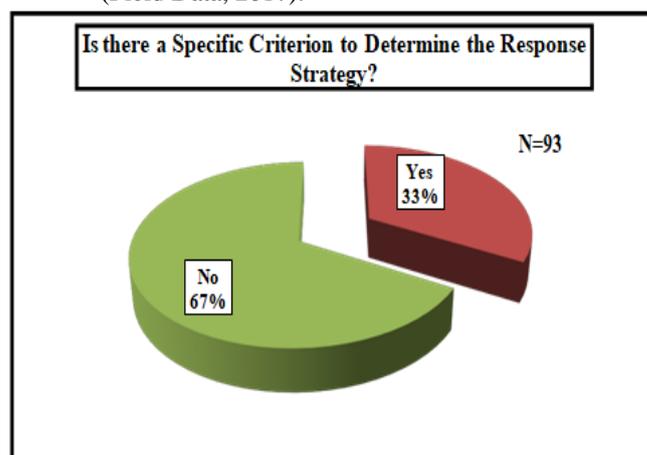


Figure 4.5: Criterion to Determine Response Strategy to Youth Radicalization in Nairobi County, Kenya

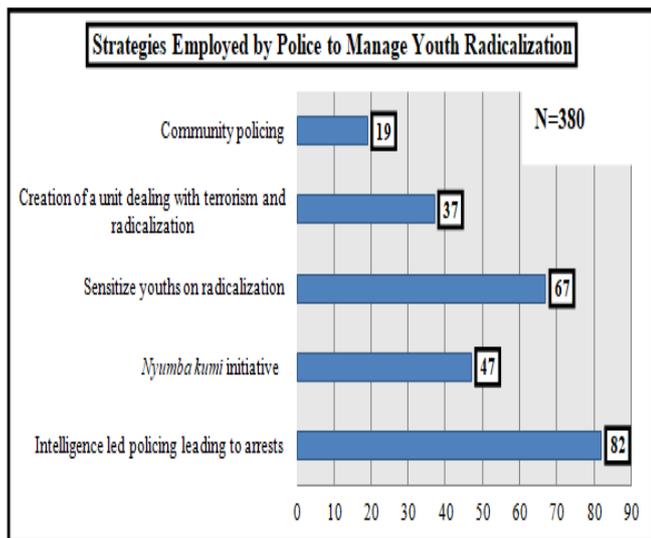
Source: Author, 2017

From the results, it is clear that there is no specific criterion to determine effective response strategies. The study findings deviate from Cordner and Biebel (2005) study which sought to establish from the police officers the methods they used to develop response strategies. By far, the most common method used was personal experience (62%), brainstorming (26%), and the only other method used more than 10% was holding informal discussions with fellow police officers. However, the current study notes that the response strategies are pre-determined perhaps as provided by the existing pieces of legislation which do not support POP and once the information obtained has been analyzed or what is traditionally referred to as investigations, arrest of offenders is the best alternative. Determination of response strategies ought to be a shared function of the police, members of the community as well as other stakeholders who are affected by a particular crime problem in an area (Goldstein, 2015). This however, is not demonstrated by the findings of this study as well as findings by Cordner and Biebel (2005).

#### 4.6 Police Based Response Strategies to Youth Radicalization in Nairobi County

The study sought to find out the police based response strategies to youth radicalization in Nairobi. Data were

collected, analyzed and presented in Figure 4.6.



**Figure 4.6: Police Based Response Strategies to Youth Radicalization in Nairobi County, Kenya**

Source: Author, 2017

The findings reveal that 32% (29) of the respondents indicated that conducting regular and routine patrols as the most used police based response strategy to the management of youth radicalization. Use of community spies and informers stood at 20.2% (18), raiding suspects’ hideouts at 14.3% (13), intelligence gathering at 17.9% (16) and spiv and infiltration at 15.5% (14). An interview with an intelligence officer revealed that:

Spiv and infiltration is simply disguising one of our own and letting them be part of the community either in Eastleigh, Pumwani or Majengo with the aim of getting first-hand information from the ground. Despite the challenge it faces as a result of corruption just like all other response approaches, it has averted so many would be terror attacks (Field Data, 2017).

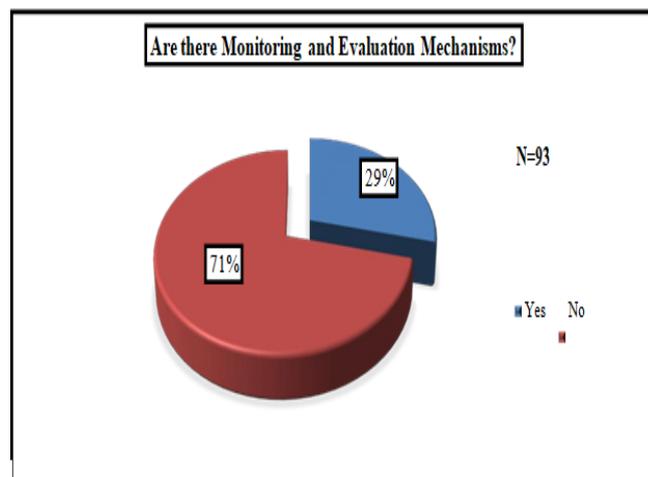
The result of the interview indicated that despite the challenge infiltration faces as a result of corruption, it has been effective in getting offenders behind bars. Knowledge of the aforementioned response strategies is a crucial element in the SARA based response strategies because the response strategies inform the success and limitations of the current response approaches. The findings of this study are in tandem with Cordner and Biebel (2005) in San Diego, US that asked officers to describe their actual responses to POP projects. The most commonly used approach was targeted enforcement by uniformed patrol officers (46%). Two traditional responses of a directed or saturation patrol (21%), targeted investigations (18%) and three community based responses such as altering physical environment (27%),

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8074>

collaborating with other agencies (24%) and conveying information (23%). Overall, the findings revealed that officers tend to rely on their own favorite response approaches over and over again- in this study, arrest and prosecution of offenders is the most common strategy. This explanation exhibits a lack of creativity and has not been given much attention. However, it seems to firmly fit on the notion that human beings are creatures of habit. Probably, this is an oversight in POP and deserves better attention in future studies as well as for the enrichment of the POP process.

#### 4.7 Assessment of SARA Based Response Strategies in Nairobi County

Assessment or what is generally referred to as monitoring and evaluation is a key practice in all management and administrative procedures. This is because, it is only through assessments that organizations are able to tell whether progress is being made, failure is being realized or the management practices have stagnated. To this end, therefore, the study sought to establish whether the police force had assessment mechanisms of SARA based response strategies in place in Nairobi County. Data on the same were collected, analyzed and presented in Figure 4.7.



**Figure 4.7 Whether there is Assessment of SARA Based Response Strategies in Nairobi County, Kenya**

Source: Author, 2017

The results revealed that 71% (66) of the respondents indicated that there were no assessment mechanisms whereas only 29% (27) acknowledged the presence of such mechanisms. An interview an OCS on assessment mechanisms reveals:

Most of our tasks end with arrest of offenders. Once the case is handed over to the courts of law, then it moves from our jurisdiction. We rarely follow up on what the courts do- they are an independent arm of government, you know.... (Field Data, 2017).

From the results, it is clear that the police rarely do

assessment of their response strategies or that the assessment mechanisms are nonexistent. A complete metamorphosis of SARA based response strategies entails scanning, analysis, response and assessment (Eck & Spelman, 1987). However, the results of the study clearly indicate that SARA based response strategies usually end at the response stage. An explanation that is given for this is that, the police play a crucial role in law enforcement only as their main response avenue. Interpretation of the existing law is usually left for the courts of law and the offenders will be declared guilty or innocent based on the interpretation of the existing laws at this stage.

Rogers (2010) study findings in San Diego, US are in agreement that assessment was rarely done following POP projects. According to the cited study, in as much as the SARA efforts were successful 85% of the time, there were outstanding gaps in the assessment phase. The study does not demonstrate clear evidence as to how rigorous assessment was employed. For instance, in some areas they state that the measurement most frequently employed were changes in the numbers of incidents, and assessments of success were otherwise ‘informal’, such as the statement ‘things are quieter now’. In the context of this study, reduced terrorist attacks does not imply reduced radicalization. This is particularly disappointing concerning the fact that the assessment phase is critical in the ‘feedback’ or experiential model that SARA adopts, and that this phase of the process has long been identified as being one of the fundamental weaknesses within the model itself.

Similarly, the results of the current study are in disagreement with Cordner and Biebel (2005) which established through the interview items that though cursory in nature, assessment was done in POP projects. The results of the cited study revealed that personal observation (51%), analysis of radio calls (14%) and speaking to residents and businesses (13%) were the most common assessment approaches used. The second assessment question was that officers were asked to characterize the results of their POP efforts, 83% of the officers indicated that the problem was significantly reduced, only 3% of the interviewees indicated that they had accomplished no impact on the targeted problem (Cordner & Biebel, 2005).

#### 4.8 Community Involvement in Scanning, Analysis, Response and Assessment in Nairobi County

SARA based response strategy is a core philosophy in community policing (Miller, 2017). This implies that at the heart of the SARA problem solving model is the utility of the community members across all the four phased process. Data on community involvement in SARAsame were collected, analyzed and the results presented in Figure 4.8.

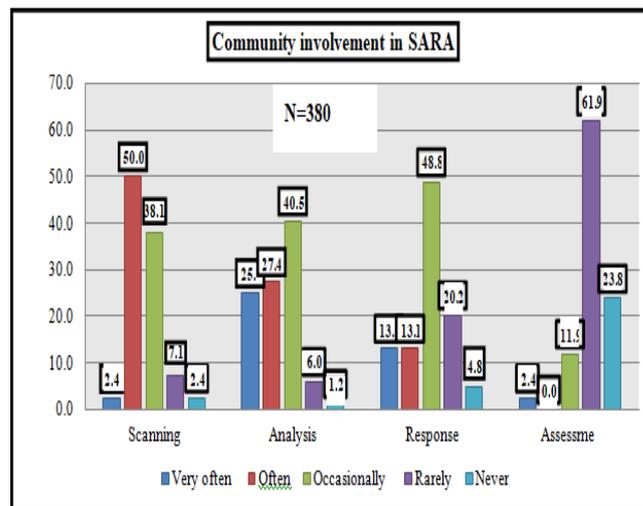


Figure 4.8: Community usage on SARA based response strategies in Nairobi County, Kenya

Source: Author, 2017.

The results revealed that on scanning, 50% (200) of the respondents indicated that they were ‘often’ involved, 40.5% (162) respondents indicated that they were ‘occasionally’ involved in analysis, 48.8% (195) of respondents indicated that they were ‘occasionally involved in response while a majority of 61.9% (247) of respondents indicated that they were rarely used involved in assessment. Police community collaboration is a salient feature of the SARA based response strategy. This implies that failure of the police to involve the community across all the four stages could lead to undesired results and hinder the effectiveness of the strategy.

Youth experiences on community engagement by the police in the fight against youth radicalization are captured as follows:

Youth one:

In the fight against youth radicalization, I am not aware of any police- youth neighborhood programs. I am a fence sitter when it comes to engaging police officers in my area or any other area in Nairobi County. I neither trust nor fear them (Field Data, 2017).

Youth two:

There is no convergence between the youths and the police officers here. We have no common projects with the officers on the ground. However, on three occasions, I have been approached by them to provide information in ongoing criminal activities in my area and I did not comply in all those situations (Field Data, 2017).

Youth three:

Generally, the youth police relationship in my area (Majengo) is pathetic. Most youths in my hood are jobless and are often profiled as “suspects” by the Kenya Police. It is that bad (Field Data, 2017).

The results from the FGD excerpts compound the fact that the police youth relationship is neither cold nor hot. Such a scenario implies that fear and lack of trust exists between the two groups. Good police youth relationship is a starting point to effective involvement since the issue at hand predominantly involves the youths. A lot has to be effected to establish optimum working conditions for the two very essential elements of the SARA based response strategies in Nairobi County.

Literature on the effectiveness of community involvement in the SARA model is hard to come by. This study therefore establishes that the SARA model assumes and acquires its’ involvement of the community from the basic concept of community policing. As a concept, community policing has a number of definitions, however, most scholars content that in practice, it requires the police and citizens to join together as partners in a venture to identify and deal with various issues (Espejo, 2014). In a nutshell, it promotes organizational strategies that support the usage of partnerships as well as problem solving techniques in a manner that is proactive in nature to address conditions that give rise to crime and social disorder as well as the fear of crime. This basic definition is inadequate to explain the usage of community in SARA problem solving process in the management of crime and disorder problems. The study concludes that community usage in the SARA model is unaccounted for by various scholars (Goldstein (1990): Eck & Spelman (1987)).

Similarly, community partnerships- a key philosophy of community policing attempts to explain community involvement without directly linking it to the SARA model. Community partnerships ought to be between the law enforcement agency and the individuals as well as the organizations they serve to develop solutions to the problems facing them as well as to increase public trust in police. Recognizing that the police alone rarely public safety problems, Miller (2017) encourages interactive partnerships with relevant stakeholders, often diverse. Miller (2017) argues that such partnerships can be used to realize two interrelated goals. First, developing solutions through collective problem solving and improving public trust. This study puts emphasis on the first goal of collective problem solving. According to Miller (2017), members of the public should play a role in prioritizing and addressing public safety. Partners include other government agencies, community members, service providers, private businesses and the media who assist in publicizing community problems as well as the available solutions. Additionally, the media can have a significant impact on public perceptions of the police, crime problems, and fear of crime. To this end, the study concludes that community involvement in the

SARA problem solving model is an area that needs further academic research.

#### 4.9 Police Awareness of Nature of SARA Based Response Strategies

The study sought to establish police awareness on the usage and nature of SARA based response strategies in Nairobi County. Data were collected, analyzed and presented in Figure 4.9.

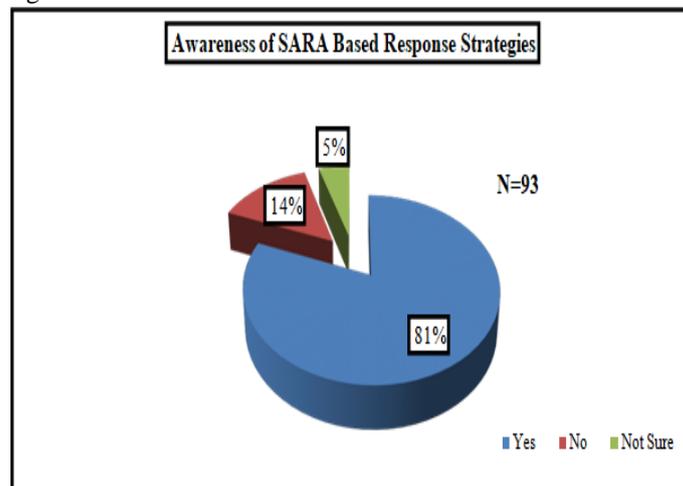


Figure 4.9 Police Awareness of SARA Based Response Strategies in Nairobi County, Kenya

Source: Author, 2017

The results in Figure 4.9 reveal that 81% (75) of the police officers indicated that they were aware of SARA based response strategies in the management of youth radicalization in Nairobi County, 14% (13) of the respondents indicated that they were not aware of the nature of SARA based response strategies while only 5% (6) indicated that they were not sure of the nature of SARA based response strategies. However, an FGD with the youths on SARA based response strategies revealed that the community members were not familiar with nature or had never even heard about the model. The youths’ responses in an FGD revealed the following differing experiences:

Youth one:

I am not aware of the SARA strategies or any new techniques of crime prevention in my area. I am only aware of community policing.... (Field Data, 2017).

Youth two:

SARA? I do not know any such policing approaches used in my area (Field Data, 2017).

Youth three:

SARA? What is it? How does it work and for what purposes is it used for?(Field Data, 2017).

Youth four:

No- I have never heard of SARA based approaches (Field Data, 2017).

This assertion is in tandem with the criticism that is put forth by Greene (2007) that, SARA problem solving model does not formally incorporate the community members. As such, it echoes a model that is predominantly a police function. If so however, the risk is that only problems that the police consider as important considered important by the will be attended to, only police data will be used to analyze the problems, only police led responses will be employed, and assessment will proclaim victory or defeat exclusively on the basis of police criteria. Because of these concerns, when problem solving is included within community policing, it is usually termed shared problem solving, in order to put emphasis on the importance of community involvement in each step of the SARA process.

The findings however, disagree with Katz and Web (2012) study on policing gangs in America which established that the unit officers were barely familiar with formalized problem solving in the Phoenix police department or with the SARA problem solving model. Some of the officers interviewed were asked to describe the SARA model but simply admitted that they knew nothing about the formal problem solving or SARA. A few indicated that problem solving occurred at higher levels such as the chief's level, while others knew of problem solving efforts carried out at precinct/district level. SARA problem solving model ought to be a model that is equally known to both the police as well as the community members for it to yield maximum results.

### Conclusion

Problem oriented policing (whose main model of operation is the SARA problem solving model) is an effective strategy in the management of youth radicalization and other crime problems facing the society. The results inform us that whereas it is an effective strategy in the developed countries, it is still in early stages of implementation in Nairobi County. This study concludes that the police and the community are aware of the basic issues that accompany youth radicalization in Nairobi County. However, these are rarely taken into account in the implementation of SARA based response strategies. These basics include the respondents' knowledge on the drivers, indicators, consequences of youth radicalization in Nairobi County as well as the current response strategies. The study also concludes that SARA based response strategies are not consistent with the conventional model as they are law enforcement centric as opposed to problem solving oriented. Therefore, the nature of SARA based response strategies in the management of youth radicalization in Nairobi County are overly compromised thereby minimizing its intended benefits.

### Recommendations

The study recommends that, the national government through the Ministry of Interior and Coordination of National Government should put up an appropriate problem oriented policing mechanism to work towards the common interest of public safety and security. There is need for implementing a more holistic approach to building awareness of the SARA problem solving model to both the

police departments and the community members. The establishment of community policing forums at every station in Nairobi County and beyond would be key in improving awareness of the SARA based response strategies. The Kenya Police should therefore develop a set of courses on public awareness programs on the management of violent extremism for both the police and the members of the public. The study also recommends that the police training colleges should fully incorporate the aspect of problem oriented policing in the syllabus used in colleges. Training the officers in colleges ensures that the culture of problem solving is inculcated at the most basic level of training. In addition, the government should aid police departments on job training on problem oriented policing through regular seminars which will go a long way in encouraging a culture of problem solving among the police officers.

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# A Case of Neurobrucellosis

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DOI: 10.29322/IJSRP.8.8.2018.p8075

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8075>

**Abstract-** A case of spinal brucellosis caused by *Brucella melitensis* and *Brucella abortus* . A forty-year-old male presented with weakness of both lower limbs with fever of 5 months duration. Neurological examination revealed spastic paraplegia with sensory impairment below T 8 . MRI scan of the spine showed a lesion in spondylodiscitis changes at multiple levels . He was started on Rifampicin and doxycycline along with laminectomy and D9-D10 screw fixation. Neurobrucellosis, should be treated early as it can result in irreversible changes. Hence it is important to consider the possibility of neurobrucellosis in endemic region and treat aggressively.

**Index Terms-** Neurobrucellosis, Paraplegia , *Brucella Melitensis* ,*Brucella Abortus* , Rifamicin and Doxycycline

## I. INTRODUCTION

The presentation of neurobrucellosis is varied. It can be either acute or chronic form. It can involve both central or peripheral nervous system . Acute form may present as meningitis or meningoencephalitis .Chronic form involves spinal roots, epidural granuloma , demyelination of long tracts etc.

Case report—A forty-year-old male patient from Saudi Arabia, shepherd by occupation , presented with history of fever and gradually progressive weakness of both lower limbs of 5 months duration . The fever was on and off , associated with

night sweats and significant weight loss. There was no history of trauma or past and family history of tuberculosis. Urinary bladder was not affected .Physical examination revealed a moderately built and nourished man. . He was febrile with a temperature of 99°F (37.2°C). Vital parameters were normal. He was conscious, alert and orientated. Cranial nerve examination was normal. There was no papilledema and meningeal signs were absent. He had spastic paraparesis with power 4/5 (MRC grade). He had impaired sensations(pain, temperature and vibration) in both lower limbs below the level of T8. .Investigations revealed a total white blood cell (WBC) count of 12,880/cu mm with neutrophil predominance. Erythrocyte sedimentation rate ESR (Westergreen) was 50 mm in 1 hour. Magnetic Resonance Image (MRI) scan (picture 1 & 2) shows multiple level spondylodiscitis D9 - D 10 , L2-L3, and L4-L5 , Tests for tuberculosis were negative. Brucellosis was suspected because of his occupation.. *Brucella* serology was positive for IG M & IG (*Brucella melitensis* and *Brucella abortus*) (ELISA). He was treated with rifampicin and doxycycline , and laminectomy (D 9 –D10) and spinal screw fixation . After surgery patient improved symptomatically . MRI Spine after treatment ,Marrow odema decreased in the vertebral bodies adjacent to the D 9 & D 10 , L2-L3 ( picture 2) .

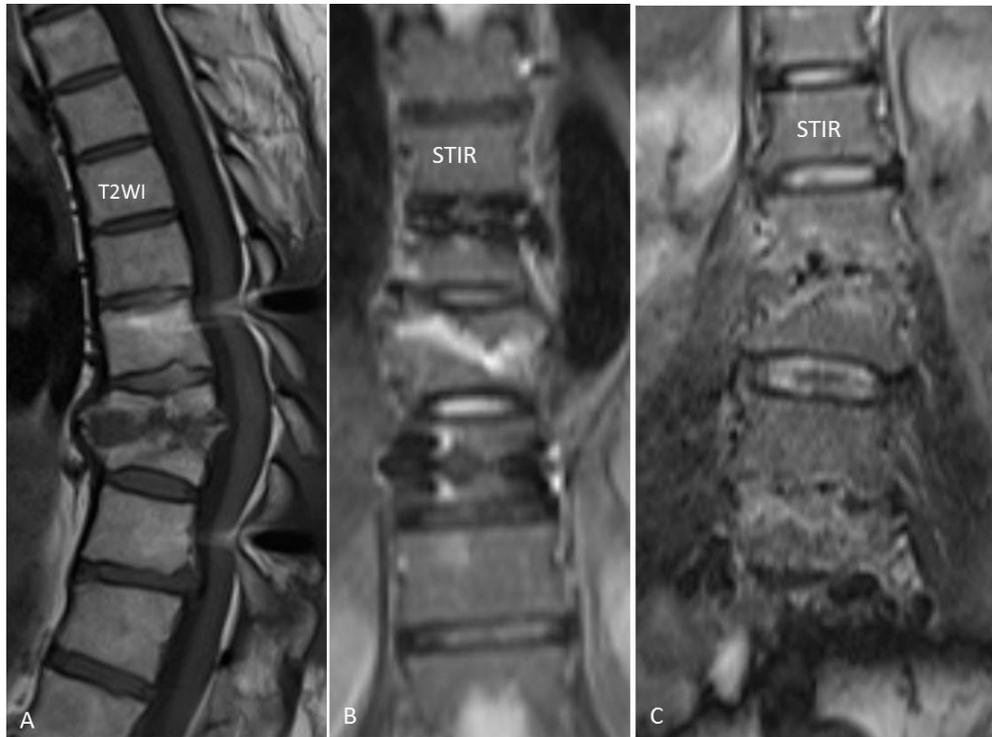
Picture(1)



Brucellosis with multicentric spondylodiscitis. T1W(A), T2W(B),STIR(C) sagittal images reveal marrow edema at D9 and D10 with decreased height of both the vertebral bodies and loss of intervening disc space. Destruction and irregularity of endplates. Increased soft tissue signal in the pre and paravertebral

regions with intraspinal extension causing extradural cord compression and cord edema. Similar changes noted at L2and L3 and at L4 and L5 with Indentation over the thecal sac. There is involvement of pedicles and facets at all these levels.

Picture (2)



Postsurgery follow up of multicentric Spondylodiscitis in brucellosis. T2W Sagittal(A) and STIR coronal(B) images of dorsal spine and STIR coronal(C) image of lumbar spine show significant resolution of marrow edema with involved vertebral bodies becoming nearly isointense with rest of the spine.

## II. DISCUSSION

Brucellosis is a zoonotic disease . The true incidence of human brucellosis is unknown. Brucellosis can affect both central nervous system and peripheral nervous system . The exact pathogenesis is not clear. Various mechanisms have been observed. Brucella organisms are capable of prolonged intracellular survival within phagocytes . Decreased host immunity allows the organisms to proliferate. The organism may act directly or indirectly through its endotoxins .

The clinical features of Brucellosis includes nonspecific symptoms and signs such as fever, weight loss, loss of appetite, night sweats. It may be confused with other diseases due to nonspecific nature of signs and symptoms .

Bone and joint involvement are the most common manifestation of this disease which accounts to 10 % to 85% of the cases . The frequencies of spondylitis with musculoskeletal involvement, has been found to be varied, ranging from 10% to 58% . The most common vertebral involvement is the lumbar vertebra, followed by cervical and thoracic involvement respectively. L4-L5 involvement is more common .

Radiologic changes in spinal brucellosis are first seen in superior end plate ( rich in venous drainage), followed by involvement of the adjacent discspace and adjacent disc body. The osteophyte formation develops during bone recovery .

Development of sclerosis at the vertebrae and formation of osteophytes are other characteristics observed on x –ray. Narrowing of intervertebral spaces, Erosion, sclerosis , vertebral Collapse, and osteomyelitis leading to abscess formation may occur as the disease progresses. Fusion of vertebrae may develop during late stage .

The duration of treatment varies from 3 months to 2 year depending upon individual cases, surgical or medical line of treatment and response to the treatment. Drugs such as rifampicin, doxycycline and trimethoprim-sulfamethoxazole have been found effective due to their good CNS penetration and synergistic actions . Despite its poor CNS penetration, Tetracycline and streptomycin are used for systemic brucellosis. However, as most of these patients have systemic brucellosis as well, they should be covered with these antibiotics, especially in initial stages. In the present case, rifampicin and doxycycline was advised for 6 months with the surgical correction involving laminectomy and D9 –D10 screw fixation.

## III. CONCLUSION

Neuro brucellosis shares its clinical features with a large number of other central and peripheral nervous system disease. Hence neuro brucellosis should be considered as one of the differential diagnosis for fever of unknown origin, meningitis/meningoencephalitis with lymphocytic predominance in CSF, and other neurological manifestations especially when these occur with hepatosplenomegaly or a recent history of weight loss. Neurobrucellosis should be considered in a patient having a history of travel to an endemic country, contact with

cattle or consumption of infected dairy products. It should be treated as early as possible in order to prevent its complications.

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# Design of Cross Flow Turbine and Analysis of Runner's Dimensions on Various Head and Flow Rate

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DOI: 10.29322/IJSRP.8.8.2018.p8076

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8076>

**Abstract-** There are various natural resources such as water, air, wind and solar in Myanmar. Among them, water resource is the most abundant as there are many rivers and streams with rich electrical energy. Moreover, the cost of hydro-electric power is relatively cheaper compared with other resources. In hydropower systems, hydraulic turbine is one of the most important parts to generate electricity. This paper represents the runner design of Cross-flow turbine that will generate 100 kW output power from head of 28 m and flow rate of 0.5 m<sup>3</sup>/s. For these head and capacity, rotational speed is 600 rpm, specific speed is 95.39, runner diameter is 340 mm and runner width is 416 mm. In this paper, detail design drawing of runner are also clearly presented. Moreover, the runner's diameter and breadth are represented with various flow rate range of 0.2 to 1 m<sup>3</sup>/s and head range of 10 m to 50 m. Thus, it is easy to select the suitable runner's dimensions on the corresponding head and flow rate.

**Index Terms-** Cross-flow turbine, head, flow rate, output power, blade curvature, runner's dimensions

## I. INTRODUCTION

IN Myanmar, hydropower is the main sources of energy for electricity because there are many hilly regions with river and water falls. Myanmar, where 75% of the populations live in rural area has a low level of village access to electricity. It has abundant hydro energy sources and the Geography, Topography of the country is favorable for hydropower supply system. A hydropower classified into run-of-river type and reservoir type. The main advantages of hydropower are: (1) The power is usually available when needed, (2) The amount of energy proportional to the head, (3) No air pollution or radioactive-waste problem, (4) No contribution to global warming and (5) One of the most effective solutions of the production of electricity.

According to above mentioned particulars, there are three types of hydropower plants, such as micro, mini and small hydropower plants. The power depends on the amount of water flowing and the height from which it flows down the pipe to the turbine. There are two types of turbine used in hydropower plant, and these are impulse and reaction types. The Cross-flow turbine is an impulse type and it is used for low and medium head site. Moreover, it is very suitable for micro and mini hydropower generation because of the quite simple to construct and the capability following wide fluctuation of water flow.

## II. WORKING PRINCIPLE AND COMPONENTS OF CROSS-FLOW TURBINE

Cross-flow turbine type has a drum shaped runner made of a series of curved blades fixed on two parallel disks. In this turbine, the water velocity is compound of two stages. The jet of water flows firstly from outside to inside of the runner. After crossing the interior of the runner, it flows inside to outside of the runner again.

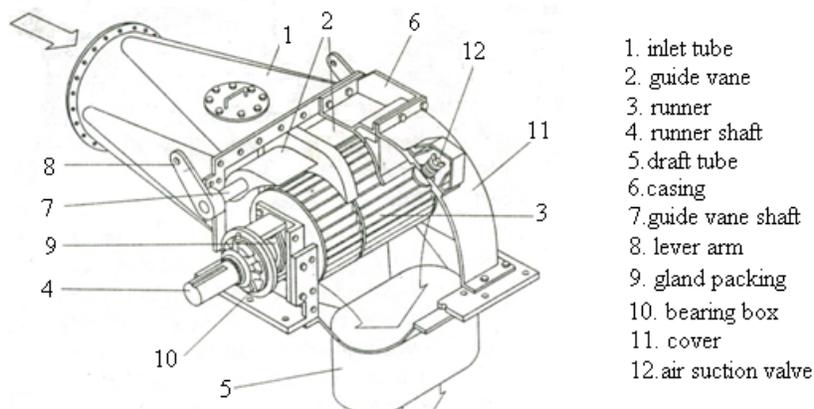


Fig. 1 Main Components of Cross-flow Turbine [1]

Before designing the turbine, the components, operation principle and performance characteristics must be studied. Main components of cross-flow turbine are nozzle, runner, shaft, bearing, casing, draft tube, guide vane and air valve. In this turbine, nozzle is rectangular shape that its width matches the width of runner. Its primary function is to convert the total available head into kinetic energy and simultaneously convey the water to the runner blades at a desired angle. The turbine casing must be well built and sturdy, as it manages forces of the incoming water as well as the outgoing shaft power. Casing shape and dimensions have a significant effect on efficiency. Draft tube is attached below the casing. In order to utilize the draft effect, the tube end is submerged under the tail water level. Its function to recover a major portion of the residual energy left in the water flow coming out of the runner, the head between the turbine and tail water. The shaft is the component of mechanical devices that is used to transmit power from hydraulic power to mechanical power. The runner is one of the most important parts of the turbine. The function of runner is responsible for the conversion of water energy into mechanical energy. Blades are curved and mounted between two rims parallel to the axis of the shaft. Their function is to change the direction of the incoming flow from the nozzle smoothly. The curvature of each surface, front and rear, determines how the water will push its way around until it falls away. All runners should be carefully balances to minimize vibration, a problem that not only affects efficiency but can also cause damage over time. The runner of the cross-flow turbine is made up of two end plates, a shaft and 24 to 30 blades arranged radially around the end plates.

The diameter of runner is an important and basic factor for the design of runner. It can be determined from the speed and water head. From the turbine speed, generator can be selected for the synchronous speed. In this paper, the inlet flow angle to the runner is taken as  $16^\circ$  according to Banki's design. When considering the design of runner, the curvature of blade, inlet blade angle, the pitch value and the thickness of blade must be considered. The thickness of blade depends on the diameter of the runner.

If the speed of turbine is too low, the speed increaser must be used to increase the speed. But it is necessary to consider not only the force of the water which strike the runner, but also own weight of the runner.

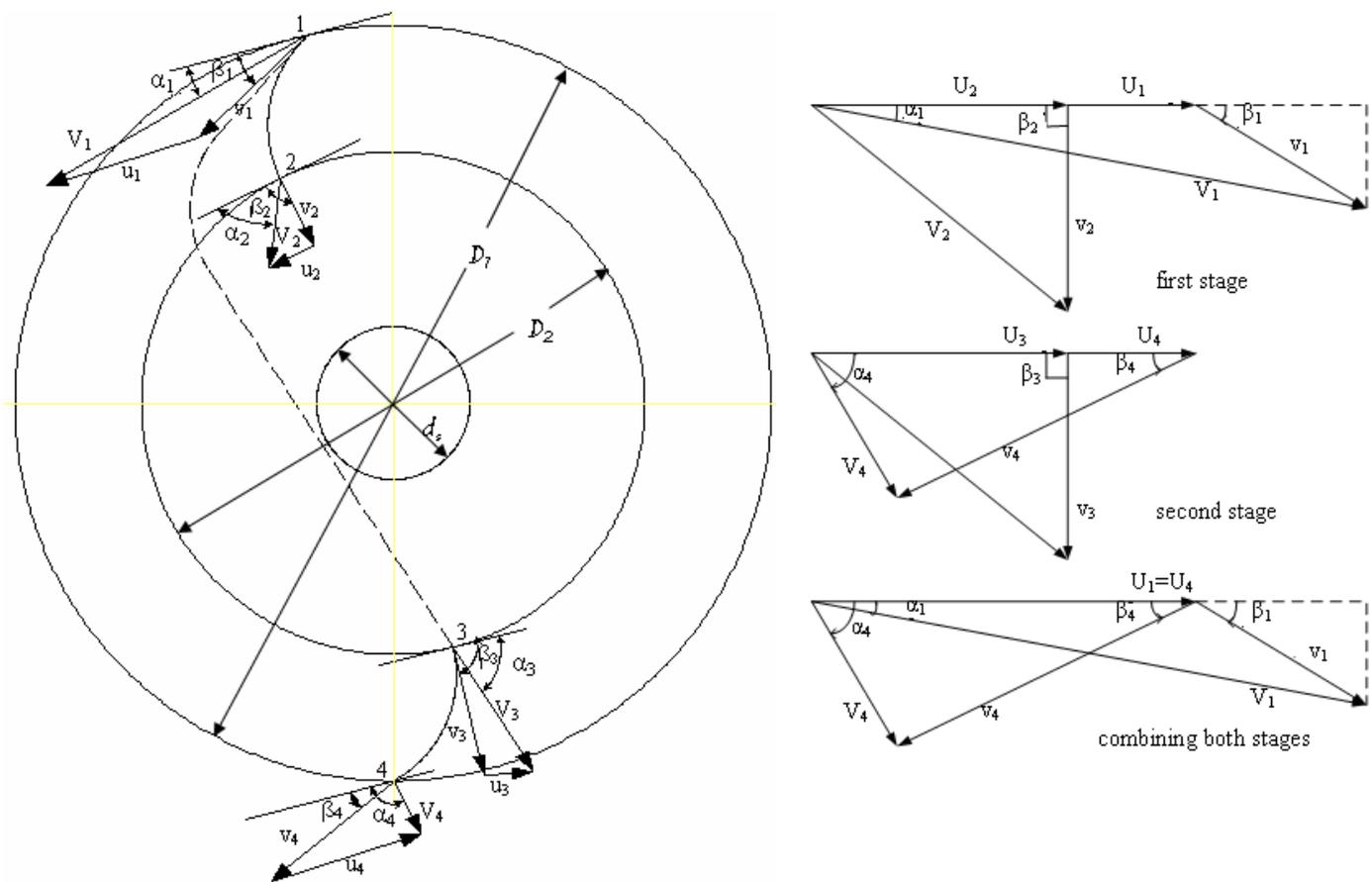


Fig.2 Water Flow Path through the Runner and Velocity Diagram [2]

According to this explanation, the entire flow that comes in from a part of outer periphery of runner to the first stage blades flows across the inner space at the center of runner than again flows out to the other side of outer periphery of runner via the second stage blades. The first stage turn-around flow is caused by a part of the flow along the upper portion of nozzle being unable to cross because of being pushed by the flow along the lower portion of nozzle. As a result, the flow at the nozzle outlet has considerable pressure and is not the free jet. There is also a measured data that the Cross-Flow accelerates from the first stage outlet to the second stage inlet in the inner space, so the velocity triangle of flow will not become homologous neither at the first stage outlet nor at the second stage inlet. The flow of Cross-Flow turbine is as complicated as mentioned that it cannot be treated as the simple impulsive flow [1].

### III. DESIGN OF CROSS FLOW TURBINE

In this paper, the required design data are based on Chi Chaung Hydropower project in Chin State, Myanmar and design specifications are as follow.

Effective head,  $H = 28$  m

Expected output power,  $P = 100$  kW

Efficiency of turbine,  $\eta_T = 80\%$

Efficiency of generator,  $\eta_G = 95\%$

Overall efficiency,  $\eta_o = \eta_T \times \eta_G = 76\%$

Density of water,  $\rho = 1000$  kg/m<sup>3</sup>

Acceleration due to gravity,  $g = 9.81$  m/s<sup>2</sup>

The 100 kW turbine is within the range of Mini-hydropower plant and the required flow rate of this turbine can be determined by using power equation.

$$\text{Flow rate, } Q = \frac{P_g}{\gamma H \eta_o} \tag{1}$$

By Equation (1), the required flow for expected output power is 0.5 m<sup>3</sup>/s.

#### A. Suitable Turbine Type Selection

Firstly, suitable type of turbine that will be used must be determined based on the design flow rate and effective head. According to the Fig. 3, the design turbine of effective head 28 m and flow rate 0.5 m<sup>3</sup>/s for the expected power 100 kW is within the ranges of Cross-Flow turbine type. Thus, for the design flow rate and head, Cross-flow turbine type is selected.

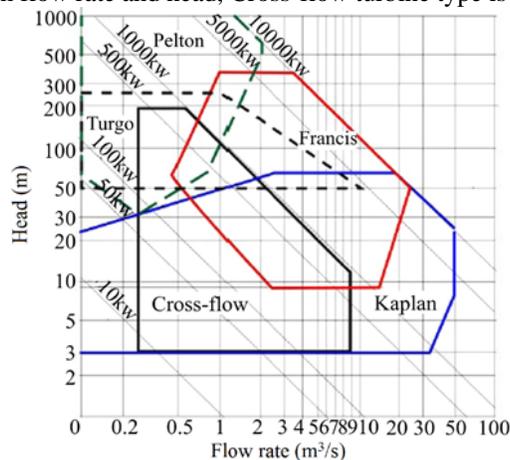


Fig. 3 Selection of Turbine Type [4]

#### B. Determination of Specific Speed and Rotational Speed

To determine the basic dimensions of turbine easily, the value of specific speed must be known. Specific speed of a turbine is the speed of a geometrically similar turbine which would develop unit power (metric) when working under a head of one meter. Specific speed also plays in an important role for the selection of turbine type. And also the performance of turbine can be predicted and the fundamental dimensions of the turbine can be easily estimated based on the specific speed value of turbine. For Cross-flow turbine, the range of specific speed is  $40 \leq N_s \leq 200$  [2]. Applicable maximum specific speed is

$$N_{s\max} \leq 650 H^{-0.5} \tag{2}$$

The applicable maximum specific speed is 122.8 and specific speed formula by Kpordze and Warnick, 1983, is

$$N_s = \frac{513.55}{H^{0.505}} \tag{3}$$

The calculated specific speed, 95.39 is within the range 40 and 200, and less than the applicable maximum value of specific speed 122.8.

The rotational speed of a turbine is directly relative to its specific speed, flow and net head. In the small hydro schemes, standard generators should be installed when possible, so in during turbine selection it must be considered that the generator either coupled

directly or through a speed increaser to the turbine, should reach the synchronous speed. The rotational speed of turbine is

$$N = \frac{N_s H^{5/4}}{\sqrt{P}} \tag{4}$$

In the hydro scheme, standard generator is installed when it is possible, either directly coupling or through a speed increaser should reach the synchronous speed. The number of pole for synchronous speed generator is always even number and it is expressed by

$$P_o = \frac{120 f}{N} \tag{5}$$

Where,  $f$  is frequency (50 Hz).

### C. Determination of Runner Diameter and Breadth

Runner is the main component of the turbine that converts water power to shaft power. So, the shape and dimensions of runner are very important in any turbine. For the maximum efficiency,  $\eta$  the periphery velocity of the wheel  $U$  is  $0.5V$ . However, in actual practice, the maximum efficiency occurs when the value of  $U$  is about  $0.46V$ . Therefore, the periphery velocity of the wheel can be determined as follow:

$$k_{u1} = \frac{U_1}{V_1} \tag{6}$$

$$U_1 = \frac{\pi D_1 N}{60} \tag{7}$$

$$V_1 = k_c \sqrt{2gH} \tag{8}$$

where,

$k_{u1}$ = coefficient of rotational velocity (0.4 ~ 0.5)

$k_c$ = coefficient of water velocity (0.92 ~ 0.99)

$D_1$ = diameter of runner (m)

When  $k_c$  and  $k_{u1}$  are chosen as 0.98 and 0.46 respectively, runner diameter  $D_1$  can be determined by Equations (6), (7) and (8).

Breadth of the runner depends on the jet thickness and water inflow velocity. The thickness of the jet,  $S_o$  is 0.1 to 0.2 times of runner diameter. By taking the average nearly,

$$S_o = 0.17 D_1 \tag{9}$$

The total area of jet can be determined by using continuity equation,

$$Q = AV_1 = S_o \times L \times k_c \sqrt{2gH}$$

Thus, the breadth of runner is

$$L = \frac{Q}{S_o \times L \times k_c \sqrt{2gH}} \tag{10}$$

In this design, the runner has middle disk and the real breadth of runner must be added 10% more [2]. Thus, Real breadth of runner is

$$L_1 = L + 0.1 L \tag{11}$$

After determining the dimensions of runner diameter and breadth, it needs to check the ratio of runner breadth to runner diameter. Not to poor the runner proportions, this ratio must be within the following range.

$$0.16 \leq \frac{L_1}{D_1} \leq \frac{21.24}{H^{0.85}} \tag{12}$$

If this ratio isn't within the range, runner diameter or breadth must be increased or decreased by trial and error method until it is satisfied.

### D. Required Parameters of Blade Curvature

The blade curve can be chosen from a circle whose center lies at the intersection of two perpendiculars, one to the direction of the relative velocity and other to the tangent to the inner periphery intersection. The drawing method of blade curvature is shown in Fig 4.

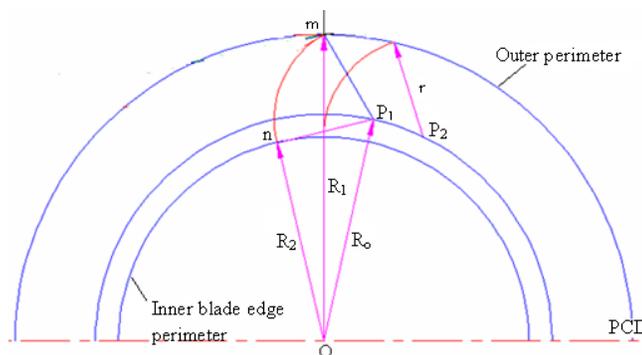


Fig 4. Curvature of Blade

Where, Outer radius of runner,  $R_1 = D_1/2$  (13)

Inner radius of runner,  $R_2 = D_1/3$  (14)

Radius of blade shaped arc,  $r = 0.16 D_1$  (15)

Radius of circle of center pitch of shaped arc,  $R_o^2 = R_2^2 + r^2$  (16)

Blade pitch,  $P_1P_2 = \frac{2\pi R_o}{Z}$  (17)

The number of blades,  $Z$  is ( $24 \leq Z \leq 30$ ) and the fewer blades may cause pulsating power, while a larger number of blades may cause excessive friction losses. So, the number of blades is chosen as 26 blades in this design.

*E. Blade Thickness (t)*

The thickness of the blade depends on the diameter of runner and the relationship between them is shown in Table I. In this design, the calculated runner diameter is 430 mm and so, the thickness of the blade is chosen as 6 mm.

Table I. Runner Diameter and Blade Thickness [2]

Runner Diameter (mm)	200	300	450	700	1000
Thickness of Blade (mm)	3.2	4.5 ~ 6	6	9	12

*F. Prediction of Shaft Diameter*

The turbine shaft will transmit the rotary motion of the runner to the generator via the drive system. In most cases, the shaft has a circular cross-section and it subject to either pure torsion or a combination of torsion and bending. The shaft diameter is estimated by

$$d_s = 150 \sqrt[3]{\frac{P}{N}} \tag{18}$$

Since it is difficult to predict the bending moment at this time, the shaft diameter will be increased slightly.

*G. Determination of Penstock Diameter and Thickness*

The required diameter of penstock ( $d_p$ ) can be estimated by the following equation.

$$d_p = \left[ \frac{Q}{0.785V} \right]^{0.5} \tag{19}$$

where,

$$V = 0.2 \sqrt{2gH}$$

$Q$  = discharge in the penstock ( $m^3/s$ )

$V$  = velocity of water in the penstock (m/s)

The thickness of penstock ( $t_p$ ) should be greater than 6 mm and it can be determined by the following expression.

$$t_p = \frac{d_p + 800}{400} \tag{20}$$

IV. RESULTS OF RUNNER DESIGN

Table II. The Calculated Result for Cross-Flow Turbine

Descriptions	Symbols	Value
--------------	---------	-------

Power	$P$	100 kW
Breadth of runner	$L_1$	415 mm
Diameter of runner	$D_1$	340 mm
Internal diameter of runner	$D_2$	227 mm
Radius of blade shaped arc	$r$	54 mm
Radius of circle of center pitch	$R_o$	126 mm
Blade pitch	$P_1P_2$	30.4 mm
Blade thickness	$t$	6 mm
No. of blades	$z$	26
Diameter of shaft	$d_s$	90 mm
Diameter of penstock	$d_p$	400 mm
Turbine speed	$N$	600 rpm
No. of pole	$P_o$	10
Expected Efficiency	$\eta$	88 %

The calculated results of especially runner design for 100 kW Cross-flow turbine based on head of 28 m, water flow rate of 0.5 m<sup>3</sup>/s and turbine rotational speed of 600 rpm are clearly expressed in Table II. Moreover, detail drawings of blade curvature and runner design are also shown in following figures.

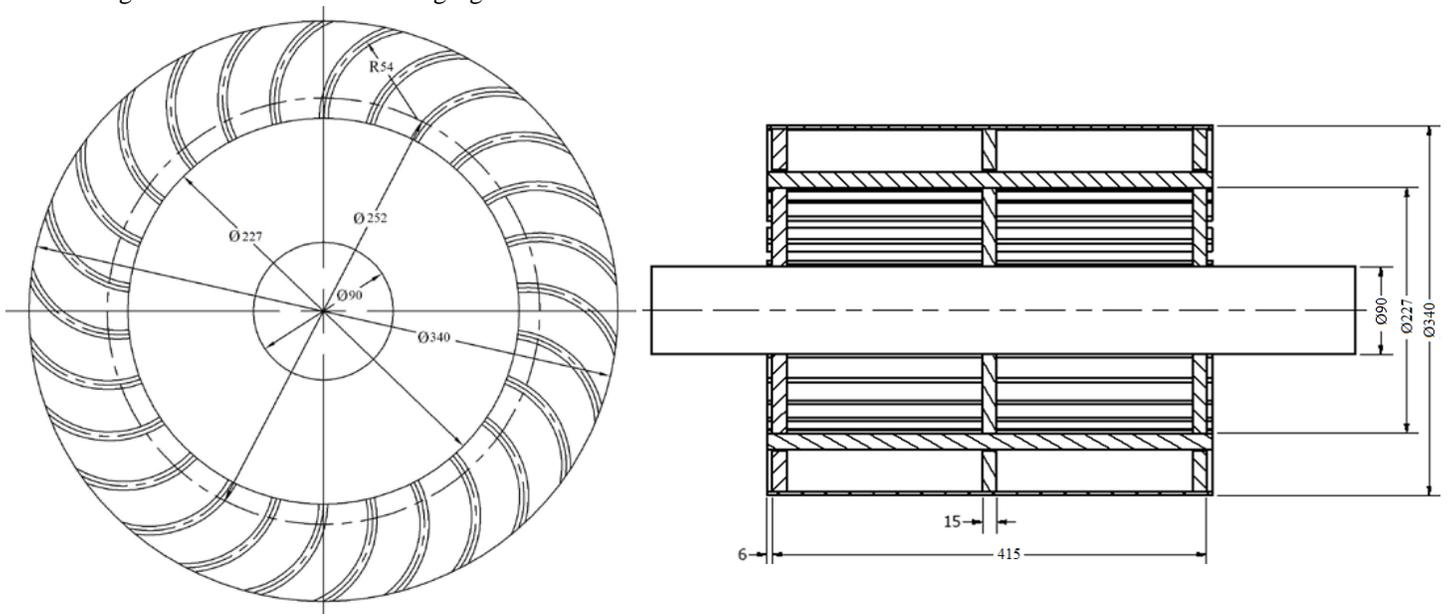


Fig 5. Side View and Front View of Runner

Parts List		
ITEM	QTY	PART NAME
1	1	SHAFT
2	3	DISCK
3	26	BLADE

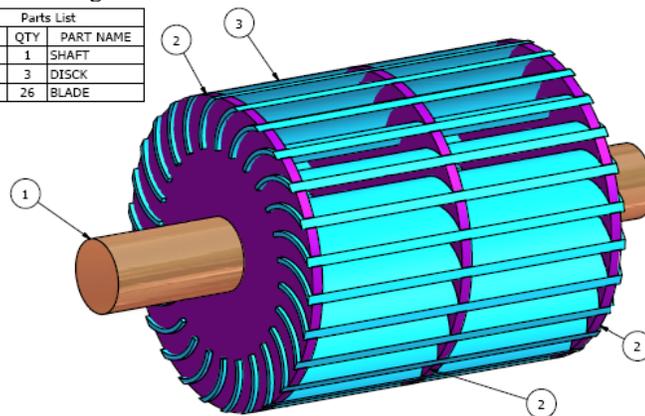


Fig 6. 3DView of Runner

### V. ANALYSIS OF RUNNER'S DIMENSION AND OUTPUT POWER

In this studying, runner diameter and breadth and output power are analyzed by varying flow rate and head. The range of flow rate is from 0.2 to 1 m<sup>3</sup>/s and the range of head is from 10 to 50 m.

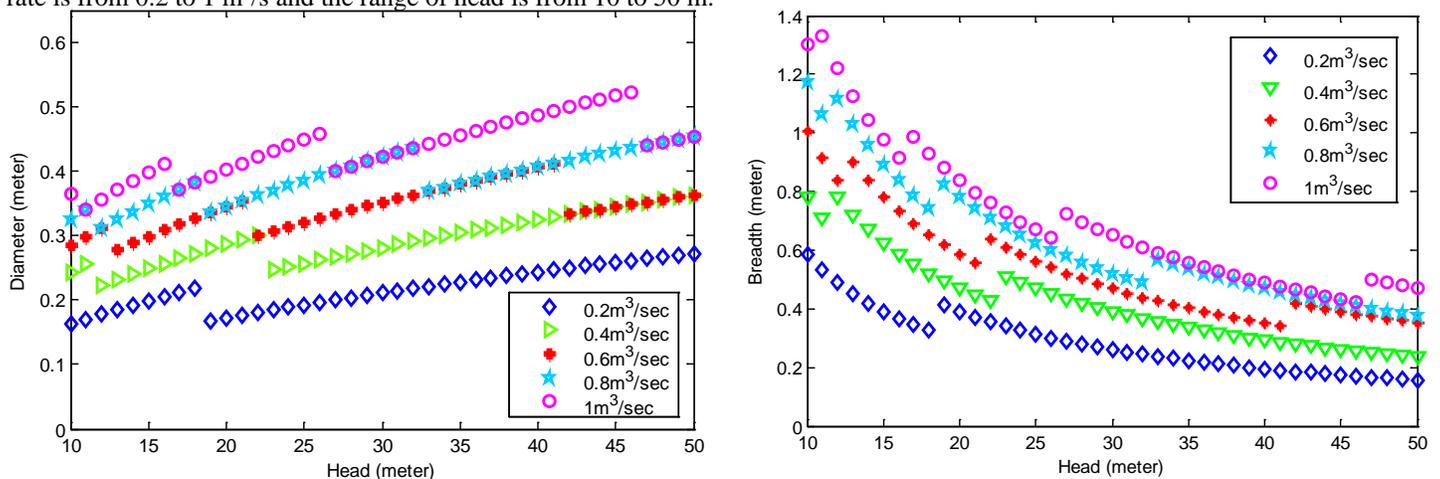


Fig 7. Runner Diameters and Runner Breadth on Various Head and Flow Rates

### VI. CONCLUSION

For high demand electricity, the Cross-flow turbine is used for rural areas and the place which is far from the grid system. It can be used for low and medium head of water using simple technology that can be locally designed and easily built, with mainly local materials at low cost. In this paper, Cross-flow turbine is designed for 28 m of head and 0.5 m<sup>3</sup>/s of flow rate to generate 100 kW. To design the runner, some parameters of Cross-flow turbine are assumed. In this design, the water inlet flow angle to the wheel is taken as 16° to get optimal efficiency according to Banki's design. By using this inlet flow angle, the inlet blade angle has been determined. The diameter of the designed runner is 340 mm and the breath of runner is 415 mm. In this turbine, the number of blade is 26 and the thickness is 6 mm. The blade can also be cut out of thin-wall tubes, or made of strips of thin sheet metal rolled around a pipe. The diameter of shaft is 90 mm and penstock is 400 mm for this turbine. A synchronous generator 10 pole will be used by the direct coupling system. Moreover, diameter and breadth of the turbine runner are also analyzed by varying the head and flow rate. In this studying, the varying head range and flow rate range are from 10 to 50 m and from 0.2 to 1 m<sup>3</sup>/s respectively. Because of this analyzing, the suitable runner's diameter and breadth can be chosen easily within these operation ranges for cross flow turbine type.

### ACKNOWLEDGMENT

The author especially thanks to Dr. Nyi Nyi, Professor, Department of Mechanical Precision Engineering, University of Technology (Yadanarbon Cyber City) for his kind supervision, suggestion and valuable guidance of this paper.

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# Brief Overview of Bioactive Compounds in Seaweeds, Their Properties and Practical Applications in Functional Foods.

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DOI: 10.29322/IJSRP.8.8.2018.p8077

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8077>

**Abstract** - Seaweeds are a rich source of bioactive compounds as discovered by many research studies in recent history. Even though there are numerous methods to generate certain bioactive compounds from chemical modifications, advantages of extracting them from natural seaweeds have exceeded the artificial synthesis. However, practical applications of seaweeds are mainly observed to pharmaceutical industry, drug development and functional foods so far. This is due to the bioactive properties such as antiviral, antitumor, anticancer, anti-inflammatory and antilipidemic beneficial for such industries. Functional food market has also indicated a steady growth due to the health-conscious consumption pattern of the people creating even more demand on seaweeds. Most of the countries surrounded by coastal regions have indicated a growth of research on seaweeds in order to utilize them as biofuel. Idea behind this review is to provide a brief but a comprehensive understanding of metabolites, bioactive properties and applications of seaweeds.

**Keywords:** Anti-cancer, Anti-viral, Bioactive compounds, Functional food, Seaweeds

## I. INTRODUCTION

Seaweeds are widely available source in the world. Even though seaweed is a broad term, it majorly signifies marine algae grown in bottom of the shallow depths of water. They are multicellular in nature and grow attached to rocks, dead corals, shells of the molluscs, pebbles, and other plant material that nourish them. Seaweeds propagate from very shallow depths to almost 0.2km in the shallow sea. But they are abundantly found in depths ranging from 35 – 40 in meters. Seaweeds have created consumer markets around the globe and countries such as Korea, China, Australia possess fast growing markets with variety of products specially under the food sector. As per common seaweed categorization, they are recognized as *Chlorophyceae* (green algae), *Rhodophyceae* (red algae) and *Phaeophyceae* (brown algae) [1].

Therapeutic usage of the seaweed and research related to biologically active beneficial compounds began in the late 90's. Today it is applied in broad areas such as foods and beverages, medicine, polymers etc. As per growing

carcinogenic substances in the environment, scientists have researched extensively to find a novel remedy with abundant resources. Seaweed was recognized as a source with anticarcinogenic chemical compounds [2]. Seaweeds consists with bioactive substance like lipids, polysaccharide, and polyphenols, with broad spectrum anti-fungal, anti-bacterial, and anti-viral properties [3] Currently, it is applied in variety of cancers. Seaweed extract is a new market for food consumers as extracts are nourished in so many vital micro and macro nutrients. These extracts traded directly as rich extracts of biostimulate [4].

Natural plant growth hormone and beneficial trace element are abundant in certain classes of seaweed. Hormones such as auxin, cytokines and gibberellins can be extracted for commercial use. Other phytochemical compounds extracted from seaweeds such as agar-agar, carrageenan and alginates being used as manure and animal fodder from decades. They are also used as additives in paper, dairy, textile and industries. Bioactive compounds in seaweed serve as additives in functional food. Seaweeds have certain physical aspects due to the manner they were built in molecular stage as they have both high molecular weight non-absorbing dietary fibres and low molecular weight easily absorbing compounds. [5] Brown seaweed variety, *Ascophyllum nodosum* is known to have the best extracts and they have indicated remarkable resistance to severe environmental stresses [6].

## II. ACTIVE COMPOUNDS FOUND IN SEAWEEDS

### A. Carotenoids

Carotenoids are natural pigments comprised with five isoprene rings. They are natural polymers with highly conjugated 40-carbon structures with almost 15 conjugated double bonds. Substitution of the oxo, hydroxy or epoxy groups at different position of the ring initiate formation of xanthophyll, yellow pigments in the carotenoid group [7]. Carotenoid pigments are abundant in higher plants, algae and photosynthetic bacteria absorbing wavelengths in the range of 400–550 in visible light. This cause the pigments to be in yellow, orange and red colours as they absorb violet to green

colour range in the visible spectrum. At least 600 different types of carotenoids play an important biological role in bacteria, algae, plants and animals [8]. Serving as an additional pigment of photosynthesis, stabilizing protein structures produced in photosynthesis, inhibiting photo and free radical oxidation are functions of carotenoids. Different seaweeds have different carotenoid pigments. Green seaweeds species consist of  $\beta$ -carotene, violaxanthin, zeaxanthine, neoxanthine and lutein. Brown seaweeds have  $\beta$ -carotene, fucoxanthine and violanxanthine while red seaweeds contain lutein,  $\alpha$  and  $\beta$  carotene and zeaxanthin [9]. Several specific variations in the structure of carotenoids are found in algal carotenoids with respect to plant and bacterial carotenoids. Changes in the number of carbon atoms and the presence of unusual groups (allene groups, lactones) found in carotenoids such as peridinin and fucoxanthine [10].

### B. Carrageenan

Carrageenan is widely utilized food additive. It is used as an emulsifiers and stabilizer in dairy industry. Carrageenan the common name used for the family of naturally occurring water soluble sulphated galactan. These galactans have alternative backbone with  $\alpha$  (1-4)-3, 6-anhydro-D-galactose and  $\beta$  (1-3)-D-galactose [11].  $\kappa$ - and  $\iota$ -carrageenan possess viscous and suspension qualities which makes it usable in many dairy products including chocolates, jells and concentrated milk. Carrageenan can also be used as a potential pharmaceutical as anti-tumour, anti-viral, anti-coagulant and immunomodulation activity [12] [13]. Also, carrageenan has the potential to treat STD, including HIV, herpes, gonorrhoea and genital warts [14]-[17]. Carrageenan is present under the commercial categories of  $\lambda$ ,  $\iota$ ,  $\kappa$ ,  $\mu$  and  $\nu$ -carrageenan due to their chemical differences at molecular levels. Due to the differences among compositions in seaweeds and the methods used in carrageenan extraction from seaweeds, there is about 20% weight to weight sulphate difference present among  $\kappa$  and  $\lambda$  Carrageenan. Due to the applicability in different fields and novel applications seaweeds are the only resource that can be used to supply the demand of carrageenan for future needs.

### C. Alginate

Commercial production of the alginate began at early 20th century and it was discovered in 1880. Brown algae is the main source of alginate. Chemical structure of the alginate consists with a linear polysaccharide which has 1, 4 linked  $\beta$ -D-mannuronic and residues of  $\alpha$ -L-guluronic acid [18]. Alginate is used in applications of food, pharmaceutical and textile industries. Alginate is a gelling agent as per its ability to form viscous solution and chelate ions. Alginate is available in two forms as acid and salt. Acid form of alginate is known as asalginic acid. Cell walls of the brown algae is rich in alginate salt and it is 45% dry weight of algal biomass [19] [20]. Alginate comprises of special type of dietary fiber unlike plants that has the functionality against excessive cholesterol, hypertension and toxic chemicals according to Murata and Nakazoe [21] [22] Also it has anti-cancer properties against the cancer-causing substances in intestine and stomach and hyperlipidemic properties [23]-[25].

### D. Phycocolloids

Phycocolloids present in the cell walls of the seaweed. Three categories of phycocolloides are alginates, carrageenan and agar. phycocolloide is a polysaccharide of high molecular weight commonly used in cosmetic and food industry [26]-[28]. They are functionally active compound in detection mechanism between seaweeds and pathogens [29].

### E. Polysaccharide

According to Holdt and Kraan, (2011) and Murata and Nakazoe (2001), Polysaccharides serve as major storage and structural components in marine algae. Large quantity of polysaccharides is available in the cell walls of algae. Polysaccharides are widely used to develop food additives such as stabilizers, emulsifiers and thickeners [30] [31]. They are also used as animal feed. According to Holdt, and Kraan (2011), Green algae species are known to have the highest amount of polysaccharide meanwhile *Ulva*, *Ascophyllum*, *Porphyra* and *Palmaria* contain higher quantity of polysaccharides with respect to other algae. Dietary fiber content in seaweed is quite high even though it cannot be digested by the human metabolism process. But they are beneficial in reducing the constipation and providing other medicinal remedies [32]. As seaweeds have higher polysaccharide content as 4 -76 % they have a very low amount of total fat and lipid comparatively. Hemicellulose amount in seaweed is ranging from 2 -10% of the dry weight. Each main algal species has inherent polysaccharide types. Red algae contain carrageenans and floridean starch. While green algae contain sulphated galactans, sulphuric acid polysaccharide. Holdt and Kraan, (2011) stated that brown algae carry laminarin, alginic acid and fucoidan.

### F. Agar

Agar is a formulation of agarose, agro-pectin and several other polysaccharides and it is the common name for of seaweeds galactans consists with  $\alpha$  (1-4)-3, 6-anhydro-L-galactose and  $\beta$  9(1-3)-D-galactose residues with considerably low amount of sulphate esterified. As it is a mixture of sulphated polysaccharides, brown algae serve as the main source of extraction apart from several red algae [33]-[35]. This viscous gelling agent possesses similar properties to carrageenan and also utilized for similar purposes. Depending on the quality of the agar, it is used for different purposes. The agar quality mainly depends upon the physiochemical property and additionally related to environmental factors, growth and reproductive cycle. Low quality agar is used in food production and for its additives. Also used in paper, textile and adhesive industries. Medium quality ones are used for biological culture production, and in pharmaceutical industry as bulking agents, anticoagulant agents. High quality ones are used for sensitive separation techniques of intermolecular biology such as electrophoresis. According to Murata and Nakazoe (2001) agar absorb ultraviolet light, most of the electrophoresis systems arrive with inbuilt UV light. Agar-agar can decrease blood glucose levels and it can serve as an anti-aggregation agent for red blood cells. Agar derivatives such as oligosaccharides has anti-inflammatory properties and also suppresses the enzyme

associated with production of nitric oxide [36]. Agar derivatives has indicated anti-cancer properties, antioxidant properties [37] [38].

### G. Dietary Fibers

Dietary fiber content found in seaweed is quite higher than plants [39] [40]. These fiber content range from 33 - 62% in their dry weight. Seaweed fibers consist of both water-soluble fibers as cellulose, mannans and water insoluble fibers as agars, alginic acid, laminarin, furonan and porphyrin. As mentioned under polysaccharides, these fibers have numerous health benefits as anticancer, anticoagulant, anticholesteremic, antiherpetic and antiviral activity. They can also assist in reducing the obesity via high fiber diets as they modify the digestibility protein and add bulk to the food content getting digested. [41]-[45]. The seaweeds dietary fibers contain some valuable nutrients that make them ideal as functional foods and nutraceutical for human consumption [46]

### H. Fatty Acids and sterols

Fatty acids are now commonly used in biomedical and nutraceutical due their unique chemical compositions. Other than curing cardiovascular diseases, one of the common application of fatty acids is reduction of obesity [47] [48]. EPA (Eicosapentaenoic) a precursor of hormones in higher plants and animals, has been found in wide variety of marine algae class but only some of them have the feasibility to meet the industrial production, limitations are caused mainly as per the fact that majority of marine algae have low specific growth rates and low cell densities when grow in autotrophic condition [49]. Seaweeds are not a good source for commercial fatty acid extraction like fish due to above reasons and additional reasons such as lower lipid content in algae.

Sterols are the major nutritional component found in seaweed as they comprise of many cells that utilize cholesterol as a structural sterol in cell wall. Despite of the criticism received worldwide, cholesterol is an essential nutrient to human body as they act as hormones and secondary messengers in signal transferring process. Certain sterols such as  $\beta$ -sitosterol and fucosterol leads to the decrease the concentration of cholesterol in the blood serum [50]. Number of sterols present inside each type of species varies due to many factors. Green seaweeds comprised of 28 isofucocholesterol types, 24 methylene cholesterol, cholesterol and  $\beta$ -sitosterol while brown seaweeds contain fucosterol, cholesterol and brassicasterol. Brown seaweeds contain fucosterol meanwhile Red seaweeds contain sterols such as desmosterol, sitosterol, fucosterol, cholesterol and chalinasterol [51].

## III. BIO-ACTIVITY OF SEAWEED

### A. Antiviral Activity

Rhodophyta such as *Aghardhiella tenera* and *Nothogenia fastigiata* comprise of certain sulphated polysaccharide that demonstrate antiviral activity against the viruses that are directly affecting human health [52]-[54]. Surprisingly they have indicated positive results towards HIV, HPV 1., HPV 2

viruses. The mode of activity of the polysaccharide is the key to prevent such viral infections at the first stage of the RNA replication on above viruses [55] [56]. One of the important requirements that a polysaccharide with above conditions must suffice is their lower cytotoxicity towards mammalian cells. Most of the seaweed extracts meet the need of lesser cytotoxins. Carrageenan also indicate antiviral activities against HIV and strains of HPV virus. Scientists have researched to develop a commercially available product which act as a barrier to prevent the transmission of HIV. As a result, Carragaurd was developed and it is a carrageenan-based microbicide to prevent HIV and other sexually transmitted diseases. Even though most of the polysaccharide from HIV capable of inhibiting RNA at the initial stage of the HIV RNA replication, a sulphated polysaccharide from *Schizymenia pacifica* can inhibit HIV at later stage in HIV replication [57] [58]. Fucoidan show another mode of antiviral activity by inhibiting the binding of viral particle to host cell [59]. Additionally, galactan sulphate in *Gracilaria corticate* can inhibit HSV 1 and 2 and Fucoidan mentioned above is antiviral against HIV, HSV 1, HSV 2 and human cytomegalovirus [60]-[63].

### B. Antibiotic Activity

Several organic compounds present in macroalgae species indicate broad-spectrum antibiotic activity. Alkenes, alcohol, aldehyde, ketone, halogenated alkanes, sterol, phenol, haloforms and hydroquinone are instances for such compounds present. It's a known fact that the alcohol and phenols are used for household and laboratory cleansing purposes as they possess antiseptic qualities. But one of the limitations about such compounds is that they can only impose lethal effects on microbes at toxic concentrations inside the body. As reported the antibacterial activity of such compounds have a mode of action to disrupt the intra and inter cell communication among bacterial cells [64]. They inhibit the furanone compounds on the quorum sensing mechanism in gram negative bacteria by imitating as intracellular signal antagonist. As an antibiotic agent, fimbrolide, lactones from *Delisea pulchra*, used effectively against bacterial anti-fouling [65] and against chronic *Pseudomonas aeruginosa* infection.

### C. Anti-Inflammatory Activity

Red seaweeds are plentiful in polyunsaturated fatty acids such as eicosapentaenoic and docosahexanoic. They are also known as poly unsaturated fatty acids [66] [67]. Among them, eicosanoid and its derivatives are received much more attention in research because of its anti-inflammatory properties [68]. Eicosanoids types such as leukotriens and hydroxyleicotetraenoic acid indicate biological activeness like chemo attraction of netrophills or smooth muscle cell. The combined effect of both prostaglandins and expansion of *Laminaria stipes* produced from brown seaweeds are well known as cervical dilators in obstetrics and gynecology [69]-[71].

### D. Anti-Thrombic and Anti-Coagulant Activity

Anti thrombic and anti-coagulant activity is present in fucoidan polysaccharide and their activity serves under both *in vivo* and *in vitro* conditions. Their activity is conducted via heparin cofactor II or anti-thrombin III which are blood coagulation inhibitors [72] [73]. Fucan and thrombin interaction result in anti-coagulant activity intensiveness of the activity increase with the amount sulphation [74]-[76]. *Fucus vesiculosus* and *Ascophyllum nodosum* are two reliable sources of anti-coagulant, sulphated fucan. It is also used as a substitute for heparin from cattle which has a disadvantage of transmitting bovine spongiform encephalitis [77]. Additionally, inhibition of thrombin from platelets and thrombin induced platelet accumulation is mediated according to the concentration of Fucan unlike heparin. Fucan indicates a dosage dependency in inhibition of thrombin induced thrombosis and also it lacks the hypotensive effect found in thrombin [78].

#### E. Antilipemic, Hypocholesterolaemic Activity

Cardiovascular diseases are on rise due to the eating patterns and busy lifestyles of the people. Causative factors behind cardiovascular diseases are high plasma cholesterol level and high blood pressure. Macro alga such as, *funoran*, *fucoidan*, *porphyrin*, *laminaran*, *ulvan* and alginate have been noted to produce bioactive materials that respond to reduced cholesterol absorption in gut. Those bioactive substances are known as hypolipidemic and hypocholesterolemic compounds according to Panlasigui et al. (2003). Hypocholesterolemic response is generated by increasing fecal cholesterol content and a hypoglycemic response [79] [80]. Hypolipidemic response is caused by lowering of systolic blood pressure and reduction of the total cholesterol, freely available cholesterol, phospholipids, and triglyceride in the liver. Ethanolic extracts of *Colpomenia sinuosa*, *Iyengaria stellata*, *Solieria robusta*, *Spatoglossum asperum* and *Caulerpa racemosa* demonstrate hypolipidemic activities [81]. Other than mediating the lipids, methanolic extract from *Pelvetia babingtonii* indicates positive results towards postprandial hyperglycemia and controlling glycaemic index [82]. These bioactive compounds have contributed to the nutraceutical industry.

#### F. Enzyme Inhibitors and Stimulants

There are several occasions where seaweed extracts act as enzymatic inhibitors. Also, their mode of action and mechanism differ according to molecular structure. In human, the phospholipase A2 enzyme involves in variety of inflammatory diseases by producing arachidonic acid [83]. The Phospholipase A2 enzyme therefore used to act as target for certain anti-inflammatory drugs. There are many active compounds that act against phospholipase A2 extracted from seaweed. Few of them are cyclocymopol, cymopol and prenylated bromohydroquinones from *Cympolia barbata*; rhiphocephalin from *Rhiphocephalus phoenix*; caulerpenynesquiterpene from *Caulerpa prolifera*; A fatty acid derivative from *Liagora farinose*; an orthoquinone from *Stytopodium zonale*, a macrocyclic enol-ether from *Phacelocarpus labillardieri* [84]. Additionally, *Caulerpa taxifolia* are used as inhibitors of pancreatic lipase [85]. Fucoidan has the ability to suppress snake venom as it inhibits

cytotoxic and myotoxic activities of PLA2 myotoxins which can result in muscle necrosis via snake bites [86].

#### IV. APPLICATIONS ON FUNCTIONAL FOOD

In general, foods that promote health conditions has resulted in the use of the term “functional foods”. They can provide health benefits by reducing the occurrence of chronic diseases and enhancing the ability to manage chronic diseases which improves the quality of life. Food science has moved from identifying nutritional deficiencies to convert into a developed food product that improve optimal health of the people. When developing functional foods, it is important to minimize losses in the nutraceutical properties, particularly during processing, in order to ensure retention of high levels of bioactivity in the final product. In addition, functional foods should have an acceptable sensory profile and consumer appeal, as in some cases the incorporation of bioactive components can influence the product flavour, aroma, or texture. A research study was conducted to study the results of incorporating *H. elongata* into pork sausages to replace animal fat and studied the effects on meat batter gelation [87]. Beef patties were developed in another study by adding *U. pinnatifida* in the sense of reducing salt and fat levels [88]. *U. pinnatifida* and *Sargassum marginatum* were added to pasta to increase antioxidant levels [89] [90]. The green seaweed *Monostroma nitidum* was incorporated into noodles to develop a new product; the resulting cooking yields were improved by up to one-third [91]. Another study incorporated the brown seaweed *Laminaria japonica* into pork patties in order to reduce fat content and increase DF levels; the resulting product had better sensory scores on overall acceptability when compared to the control [92]. It is also reported that *H. elongata* added to restructured poultry was found acceptable by sensory panels [93].

#### V. CONCLUSION AND SUGGESTIONS

It can be concluded that seaweeds are abundant source with a huge potential in pharmaceutical and food industries and they are vital components of sustainability in all ecosystems. Many researches have been conducted to reveal the capabilities and productive aspects of seaweeds since late 90's. Chemical substances of the seaweed extracts vary in the purpose of utilization. They can be used as treatments to severe disease conditions as well as to develop new technologies. Natural anti-foulants, and UV-sunscreens are some instances. Yet most of the treatments are in development stage but indicate promising results. There are many bioactive compounds in seaweeds which are not exploited for the betterment of the mankind. It is predicted that will be used as a source of minerals such as iron and other minerals which are important for our normal body function. Also, they will be used against viral infections such as HIV, HPV and against more bacterial strains as an antibiotic. Treatment methods for cancers and tumours will also be implemented upon them. Functional food

market will grow with the novel influence towards healthy food consumption among people.

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# Analysis on Feature Extraction and Classification of Rice Kernels for Myanmar Rice Using Image Processing Techniques

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DOI: 10.29322/IJSRP.8.8.2018.p8078  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8078>

**Abstract**— The paper presents the analysis on feature extraction and classification of rice kernels for Myanmar rice using image processing techniques. There are seven steps to analyze the image processing techniques. The classification of export-rice quality is a great challenge in agricultural industries. The development of modern technology-based methods for rice quality classification is currently necessary to provide a reliable and consistent rice quality to consumers. An image processing algorithm has been implemented the analysis and classification the rice kernels in Myanmar. The proposed method is based on real-field feature and KNN classifier. Then, a series of measurements were done using image processing techniques on three classes of Paw-San rice in Myanmar. The real-field feature of Paw-San rice is percentage of broken rice contained in the batch. At 30 tests are conducted for each class of Paw-San rice. The simulation results show that the proposed method can confirm the classification accuracy in the range of 83~100% for the three grades.

**Keywords** – Feature extraction, Image segmentation, KNN classifier, Rice quality classification

## I. INTRODUCTION

With the development of computing methods and computing devices, digital image processing technology become a popularly-used technology in nation security area, biomedical field, robot science and quality control of product in industries. Myanmar is the world's sixth-largest rice-producing country. However, it will be some years before the country can regain its former position as one of the world's largest rice exporters [1]. The rice industry is the oldest and most widespread industry in Myanmar. Traditionally, the quality of rice is defined from its physical and chemical characteristics by human vision.

The use of tradition rice quality inspection technique is normal. Quality inspection by human is neither objective nor proficient because sometimes of the results may not be reliable due to human errors or inexperienced inspectors. Besides, it is time-consuming. Therefore, to overcome the shortcomings occurred in traditional methods modernized and advanced technique i.e., automatic rice quality classification systems are being developed and efficient and reliable image processing techniques are being proposed.

Thus, there have been many researches in which computer vision is applied to estimate rice quality. Computer vision is a novel technology for acquiring and analyzing an image of a real scene by computers and other devices in order to obtain information or, to control machines or processes [2]. Figure 1 show automatic rice

quality inspection using flatbed scanning (FBS) for classification and grading of rice [3].

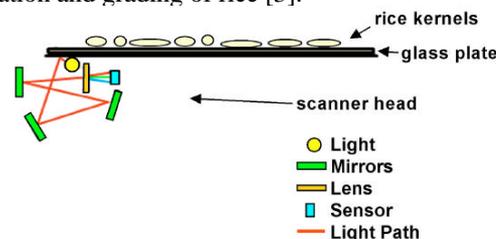


Figure 1. Rice quality test using flatbed scan

Agustin used image processing to analyze rice kernel using six features such as shape descriptors determine the quality of head rice, broken kernels, and brewers in rice samples base on flatbed scan using six features [4]. Bhagyashree Mahale presented a solution of grading and evaluation of rice grains on the basis of grain size and shape using image processing techniques [5]. Verma reported that an image analysis (IA) method using the back propagation through time to sort the rice into chalky, sound, cracked, broken and damaged kernels [6]. Liu Guangrong detected rice chalkiness based on image processing technique [7]. Mingyin Yao developed an inspection system of rice exterior quality [8]. Pabamalie and Premaratne focused on providing a better approach for identification of rice quality by using neural network and image processing concepts [9]. The proposed method applies KNN classifier for Paw-San rice classification based on flatbed scan (FBS).

The objective of this paper is to present an image processing method for classification of rice quality which minimizes the required time and cost. Section II discusses classes of Paw-San rice for export quality. Section III talks about the method proposed for classifying parameters such as number of grain, area ratio and percentage of broken rice. Section IV includes results and discussion based on quality analysis for number of grain, area ratio and percentage of broken rice. Section V provides the conclusion of the proposed method.

## II. CLASSES OF PAW-SAN RICE

There are three classes of export quality of Paw-San rice in Myanmar. These rice types are normally exported to Africa (Ivrycost), Turkey, Singapore, Japan, Philippines, India, Bangladesh. Mostly, the export rice are classified and tested by traditional method. The visual natures of three classes getting from this method are shown in Figure 3. Class A is shown in Figure 2 (a), Class B and Class C are shown in Figure 3 (b) and (c).

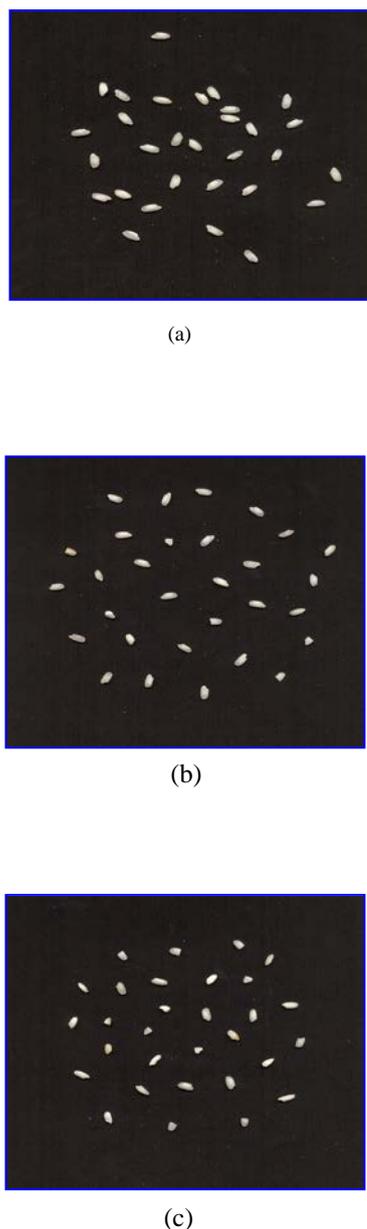


Figure 2. (a) Class A (b) Class B (c) Class C

Paw-San is defined as Class-A if the percentage of broken kernel is between 0 to 5% as Class-B if the percentage of broken kernel is above 20%. This information about rice broken and classify can be found in rice quality standards in 300 tons texture industry, MEC (Myanmar Economic Corporation).

### III. PROPOSED CLASSIFICATION ALGORITHM

There are three varieties of Paw-San which were taken up for grading and classification. The block diagram of image processing algorithm is shown in Figure 3 which consists of some basic steps. At first, rice seeds are randomly placed on black-sheet background for image acquisition. Image is acquired and stored for further analysis. Before the image segmentation, the image is required for pre-processing. After preprocessing, the image is segmented into foreground and background. But it contains some noise in the background. Thus, the noise removal is performed. Then, specified features of the

objects are extracted and classified the rice classes by using KNN (K-nearest neighbor) classifier.

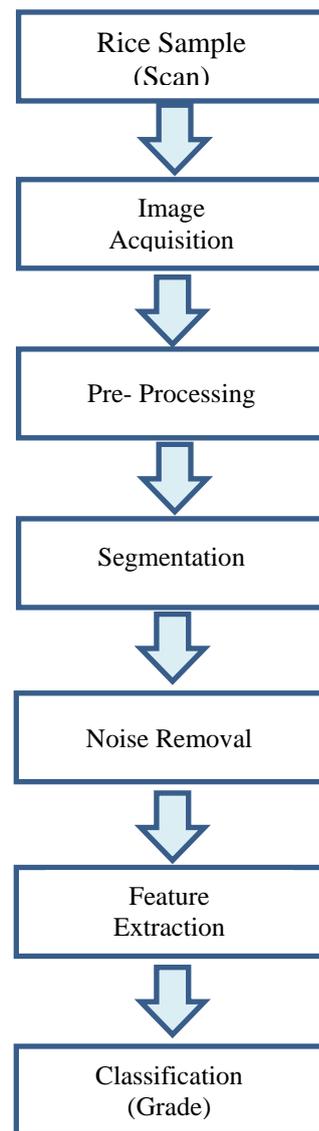


Figure 3. Block diagram of Classification and Grading Techniques

There are three varieties of Paw-San which were taken up for grading and classification. The block diagram of image processing algorithm is shown in Figure 3 which consists of some basic steps. At first, rice seeds are randomly placed on black-sheet background for image acquisition. Image is acquired and stored for further analysis. Before the image segmentation, the image is required for pre-processing. After preprocessing, the image is segmented into foreground and background. But it contains some noise in the background. Thus, the noise removal is performed. Then, specified features of the objects are extracted and classified the rice classes by using KNN (K-nearest neighbor) classifier.

#### A. Scanning and image acquisition

Images of the rice kernels are collected by a flatbed scanner (FBS) for classification and grading of rice which has the resolution of 200 dpi with USB interface to a PC.

A dull black sheet used to reduce the effects of reflection. Image is captured and stored in JPG format automatically. The images acquired are 1997 x 1504 pixels in size.

**B. Image pre-processing**

The acquired image was transferred from RGB to Gray scale image. It was a little large. The image as required is resized and cropped the image.

**C. Image Segmentation**

The color base segmentation and threshold base segmentation are available for image segmentation. In this research, since the images have two simple colors, threshold base segmentation is used. There are two threshold-base segmentation methods; global and local threshold methods. Global thresholding method is used in this work. The required threshold value is calculated by Otsu method of global thresholding. The optimum gray threshold value of this segmentation process is 0.4471.

$$I_{bw} = \begin{cases} 1, & T \geq 0.4471 \\ 0, & \text{Otherwise} \end{cases} \quad (1)$$

**D. Noise Removal**

During segmentation, the image is changed into black and white. The other researcher used the segmentation methods of containing objects in image processing usually include erosion, dilation, based on morphology and watershed transformation method [10]. In this paper, when getting black and white image, it can be seen white spot (noise) in background. It is necessary to remove noise for computation. So, bwareaopen (one of the morphological operation method) function in MATLAB is used as noise removal tool to get smooth image. The object which has less than 10 pixels is considered as noise and must be removed.

**E. Feature Extraction**

It is necessary to calculate each of the object grain to get area by the use of feature in classification. There is the percentage of broken rice such as 5% for Class A, above 10% for Class B, and above 20% for Class C. The object that is larger than the total amount of pixel over 35 must be put into normal rice. The amount of pixel value under 35 is assumed as broken rice. After assuming, the number of normal rice and broken rice must be calculated to get broken kernel.

**F. Object Classification**

In this research, KNN (K Nearest Neighbor) classifier is used to classify the class of rice. KNN is the one of the classification methods based on Euclidean distance. Euclidean distance is finding the nearest distance between the train data and the input data. Although KNN has the first nearest value, the second nearest value and the third nearest value, it used the first nearest value is assume k=1. In this research, minimum Euclidean distance value is chosen.

Euclidean distance method,

$$F = [F_1 F_2 F_3 F_4 \dots F_n] \quad (2)$$

$$D = \|F\| = \sqrt{F_1^2 + F_2^2 + F_3^2 + \dots + F_n^2} \quad (3)$$

Above these equation, F means features vectors and D is Euclidean distance.

**IV. RESULTS AND DISCUSSION**

The good results obtain after testing more than 100 times. To get grade A, 30 times true result from making 30 times. To get grade B, 28 times true result from making 30 times. To get grade C, 25times true result can show from making 30 times. Other differences were also examined repeatedly. To get the result of each grade, testing is done more than 30 times. For each test, different number of rice grain is used. Examining the first time for Paw-San rice, firstly, 10 grains are scanned and then gradually increased into 329 grains. When testing, the right number of rice could also be classified by broken rice. The results of testing maximum 329 seeds are shown in following step by step figures from 4 to 6.

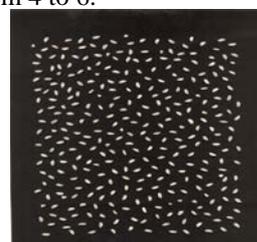


Figure 4. Original RGB image of Paw-San rice

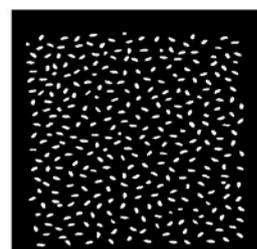


Figure 5. BW image of Paw-San rice

Figure 5 describes the foreground extraction of original frame by Otsu's method. The thresholding value is 0.4471 to segment the object.

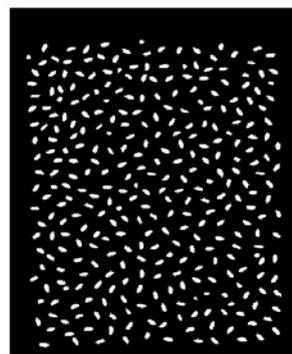


Figure 6. Result of Noise Removal from BW image

Figure 6 is resulted using a smoothing filter that included operations which can enhance and smooth images, and remove noise from an image. Most of these

operations compute results based on the function `bwareaopen`. The operation is known as area opening. By comparing Figure 5 and Figure 6, better result can be seen that in figure 6 as there is almost no noise.

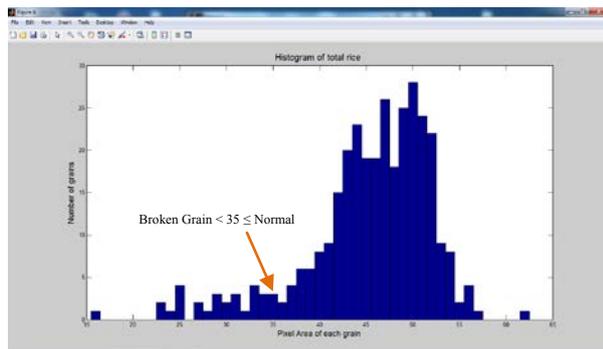


Figure 7. The histogram of number of broken kernel

In histogram of Figure.7, the area value of rice is on the horizontal axis and the numbers of rice grains is on the vertical axis. If the area value is less than 35, it is assumed that the rice is broken. If the total area of the object is more than 35, it is considered as normal (unbroken) rice grains.

```
n =
    329

Broken_rice =
    8.2067

Class =
    'Grade-B'

>>
```

Train data is applying to KNN classifier, `n` means number of grain to be scanned. The result shows the percentage of broken rice whose values assigned with 0 to 5% for Class-A, smaller than 10% for Class-B and greater than 20% for Class-C. Due to the output of broken percentage is obtained 8.2067%, it is defined Class-B.

## V. CONCLUSION

In this paper, an image processing algorithm is proposed for rice grading and its performance is tested with three grades (Class A, Class B, Class C) of Paw-San rice. For each grade of rice, at least 30 classification tests are conducted. When testing Paw-San rice into three classes, the accuracy for Class A is (100%), for Class B (93%) and for Class C is (83%). Therefore, it is enough to test the classification and grading of rice quality. Also the classification of rice can be improved by using more distinct features. The results confirm that the feature extraction and classification of rice kernel based on image processing for Myanmar Rice.

## ACKNOWLEDGMENT

Firstly, the author would like to acknowledge Dr. Thein Gi, Rector of Technological University (Thanlyin), for her

kind permission to carry out this research work. The authors would like to thank many colleagues from digital image processing research group of Department of Electronic Engineering Technological University (Thanlyin). The author particularly wishes to acknowledge all the teachers from Department of Electronic Engineering Technological University (Thanlyin), for their support, encouragement and invaluable guidance in preparation of this research. The authors would like to express their thanks to all preparation period of this paper.

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# Impact of Money Supply on Some Macroeconomic Variables on the Nigerian Economy

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DOI: 10.29322/IJSRP.8.8.2018.p8079

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8079>

## Abstract

The link between aggregate money supply, inflation and economic growth has raised a lot of scholarly debate in the field of economics and finance. The study sets to investigate the impact of money supply on macroeconomic variables in Nigeria from 1985 to 2016. The specific objectives of the paper were to ascertain the impact of narrow money supply, broad money supply, inflation rate, and exchange rate on real gross domestic product on one hand, and narrow money supply, broad money supply and exchange rate on consumer price index in Nigeria. The ex post facto research design and descriptive statistics were used to observe the variables in retrospect. To achieve the objectives of the study, two models were built to mimic the trend. To avoid spurious results, the Augmented Dickey Fuller test was used to solidify the data, which integrated at first difference I(1). The ordinary least square technique was employed to determine the magnitude and direction of the variables in the models. It emerged that narrow money supply has a positive and significant impact on inflation and real gross domestic product; conversely, broad money supply does not have any significant impact on inflation and real gross domestic product. Empirical evidence further showed that exchange rate has an insignificant impact on inflation and real gross domestic product. Inflation rate on the other hand, has an inverse and statistically insignificant impact on real gross domestic product in Nigeria. The results suggest that economic growth and inflation is a function of money supply (narrow money supply) and exchange rate in Nigeria. The paper recommends that efforts should be put in place to better the exchange rate between the naira and other currencies. This will help avoid the imported inflationary pressure on goods and services in the country.

**Key word:** Money supply, inflation, real gross domestic product, narrow money supply, exchange rate

## 1. Introduction

The nexus between aggregate money supply, inflation and economic growth has raised a lot of scholarly debate in the field of economics and finance. Money supply is a very sensitive variable - the size and velocity of money supply determines the pace of any economic activity. Apart from being a powerful instrument of monetary policy, its expansion or contraction dictates the growth in investment and output of any economy. It is therefore the usual slogan of the Monetarist school of thought that money matters. They argued that changes in the amount of money in circulation is a major determinant other economic indices. In other words, the changes in the size of money supply have a number of implications on the macroeconomics variables like inflation and economic growth.

Ceteris Paribus, inflation has a linear relationship with money supply and a negative relation with growth in real income or output (Nyong, 2001). In support of this argument, Ogun & Adenikinju (1995) found that the period of oil boom in Nigeria was characterized by rapid monetary growth which coincided with the periods when the country experienced double-digit inflation. The growth in money supply and its economic implications is therefore an issue to be thoroughly investigated. This subject has bordered the minds of Nigerian policy makers for decades. Despite the lacks of consensus among different schools of thought on its effectiveness as an instrument of monetary policy, the Central Bank of Nigeria (CBN) relies on it as its major barometer for shaping economic activities. The design and shift of the monetary measures taken by the central bank in recent times have been either expansionary or contractionary. Expansionary policy tools have been used to increase money supply with the intent of increasing output. Contractionary policy tools have been used on the other hand to decrease money supply in the economy in order to discourage consumption thereby curtailing inflation.

Obviously, Nigeria is a third world country that is predominately dependent on crude oil for economic survival. Nigeria's economic aspirations have remained that of changing the structure of production and consumption patterns, diversifying the economic base and reducing dependence on oil, with the aim of putting the economy on the part of sustainable, all-inclusive and non-inflationary growth. The implication of this is that while rapid growth in output, as measured by the real gross domestic product is important, the revolution of the various sectors of the economy is even more critical. This is consistent with the growth targets of most developing countries.

Irrespective of this glowing objective, over the years, the economy of Nigeria has been beleaguered with several challenges. There has been rise in general price levels leading to major economic distortions in the late 1970s, consequent to the civil war, salary increment, and excess government spending (Olorunfemi & Adeleke, 2013). The gradual, but increasing, inflation rate became serious during the 1980s with the adoption of the structural adjustment program aimed inculcating liberal policies in all spheres of the national economy, plus several military interventions in governance - the various military leaders who came into power pursued expansionary policies in economic management. Inflationary pressures during the SAP era of 1986-1990 was due largely to sundry factors, especially the depreciation of the Naira on the foreign exchange market, which increased the Naira prices of imported goods including raw materials and capital goods as well as an unprecedented growth in money supply during the period (Onoh, 1990). The outcome was a huge balance of payment deficit.

In spite of many, and frequently changing policies, Nigeria has not been able to harness her economic potentials for rapid economic growth and development (Ogbole, 2010). Today, monetary and fiscal policies are both commonly accorded prominent roles in the pursuit of macroeconomic stabilization in developing countries, but the relative importance of these policies has been a serious debate between the Keynesians and the monetarists. The monetarists believe that monetary policy exert greater impact on economic activity while the Keynesian believe that fiscal policy rather than the monetary policy exert greater influence on economic activity. Despite their demonstrated efficacy in other economies as policies that exert influence on economic activities, both policies have not been adequately used in Nigeria (Ajisafe & Folorunsho, 2002).

This notwithstanding, the Central Bank of Nigeria (CBN) has continued to play the traditional role of regulating the stock of money in such a way as to promote the social welfare of Nigerians (Cochrane, 1998). Over the past two or more decades, the primary objective of many developed and developing countries (including Nigeria) have been the maintenance of price stability that supports sustainable economic growth and employment growth. As in most countries worldwide, the Central Bank of Nigeria (CBN) relies on a money demand function in the design and implementation of its monetary policy. The money demand function is used both as a means of identifying medium term growth targets for money supply and as a way of manipulating not only the interest rate and reserve money for the purpose of controlling the total liquidity in the economy but also for managing prices of commodities in the economy (Owoye & Onafowora, 2004).

Unquestionably, one of the macroeconomic goals which the government strives to achieve is the maintenance of stable domestic price level. To achieve this, monetary policy is used to regulate the value, supply and cost of money in an economy, in consonance with the expected level of economic activity (Baghedo & Ebibai, 2014). This goal is pursued in order to avoid the cost of inflation or deflation and the uncertainty that follows when there is price instability (Salam, Salam, & Feridun, 2006). Thus, this macroeconomic goal is aimed at ensuring price stability basically to avoid excess increase and excess decrease in prices of commodities. (Imoughele, 2014), this invariably leads to the attainment of internal and external balance, and the promotion of long run economic growth. This study therefore seeks to ascertain the impact of money supply on inflation and economic growth in Nigeria.

## 1.2 Objectives of the Paper

The broad objective of this paper is to scrutinize the impact of money supply on inflation and economic growth in Nigeria. The specific objectives of this paper are;

- (1) To investigate the impact of narrow money supply on inflation and real gross domestic product in Nigeria.
- (2) To determine the impact of broad money supply on inflation and real gross domestic product in Nigeria.
- (3) To determine the impact of exchange rate on inflation and real gross domestic product in Nigeria.
- (4) To ascertain the impact of inflation on real gross domestic product in Nigeria.

## 2. Empirical Literature Review

Several studies have been carried out to ascertain the impact of money supply on economic growth and inflation in developing and developed countries with varying results and conclusions. For instance, Mamo (2012) in a cross country study employed fixed effect panel model and Panel Granger causality to test the effect and causal relationship between inflation and economic growth. The study used strongly balanced panel data which contained 13 SSA countries covering 1969-2009. The estimation results showed that inflation was negatively and significantly related to economic growth. It means that inflation has an adverse effect on economic growth. The Panel Granger causality test showed that inflation Granger causes economic growth for all countries in the sample, while economic growth Granger causes inflation for two countries. Similarly, Chaturvedi, Kumar, & Dholakia (2009) equally used a simultaneous equation model for a panel of 140 countries over the 1970-2005 periods to show that there exists a bilateral causal relationship between the growth and inflation as predicted by recent theories. Most importantly, the results indicated that inflation is harmful to growth whereas the effect from growth to inflation is beneficial. Doroshenko (2001) also considered the relationship between money supply and inflation. The findings confirmed a long-run relationship between money growth and inflation.

A recurring debate in the country specific literature on the effectiveness of monetary policy to stabilize the Nigerian economy in terms of price stability and subsequently stimulating economic growth and stability of money demand function that need not to be ignored in a study of this nature about Nigeria is the "TATTOO DEBATE" put forward by Tomori (1972) which found income,

interest rate and real income to be the major determinants of demand for money in Nigeria. Owing to perceived shortcomings of Tomori's work, Ajayi (1974), Teriba (1974), Ojo (1974) and Odama (1974) questioned that postulation and came up with their own positions. Consequently the debate centred around the significance of income in money demand function for Nigeria, the stability of the function, and the choice of appropriate definition of money in Nigeria.

On the issue of income, in line with Tomori (1972) assertion, Teriba (1974) and almost all the other scholars agreed that income is the most significant determinant of money demand in Nigeria. On interest rate, Teriba (1974) contrasted Tomori (1972) view by arguing that long term interest rate is significant (unstable demand for money) but short term rates are insignificant (stable demand for money function). Those who however, argued that the rate of interest is not significant have two reasons for their argument (Mai-Lafia, 1995). Firstly, the interest rates have remained relatively stable in developing countries so that there is too little variation to allow conventional estimators to capture the effect of interest rates in the demand for money function. Secondly, that owing to the underdeveloped nature of the financial structure of less developed countries, the substitution between money and real assets may be quantitatively more important than that between money and financial assets. Owoye & Onafowora (2007) found income elasticity of 2.067 for Nigeria and interest elasticity of 0.306. On the appropriate definition of money demand in Nigeria, Tomori concludes that  $M_1$  performs better than  $M_2$ . In contrast, Ajayi (1974) asserts that  $M_2$  performs better than  $M_1$ . In an attempt to mediate between Tomori (1972) & Ajayi (1974), Gwosh (1981) contends that both  $M_1$  and  $M_2$  can be used as the definition of money in Nigeria. As lively as the debate was, the issue still remains inconclusive. Several studies have been conducted around the globe on the subject matter.

Following this debate, Nwaobi (2002) made efforts to examine the stability of the Nigeria's money demand function and found it to be stable. Nwaobi (2002) then suggests that monetary policy could be effective and that income is an appropriate determinant in the estimation of money demand in Nigeria. Anoruo (2002) explores the stability of  $M_2$  money demand function in Nigeria during the Structural Adjustment Programme (SAP) period. He observed that  $M_2$  money demand function in Nigeria is stable for the study period. Again, like Nwaobi (2002), he asserts – using  $M_2$  money demand function, that it is a viable monetary policy tool that could be used to stimulate economic activity in Nigeria.

Recently, Gatawa, Akinola, Muftau, & Olarinde (2017) empirically examined the impact of money supply, inflation, and interest rate on economic growth in Nigeria using time series data from 1973-2013. VAR model and Granger Causality test within error correction framework were used. The results of the VEC model provided evidence in support of a positive impact of broad money supply while inflation and interest rate exhibits a negative impact on growth most especially in the long run. The short run parsimonious results revealed that with the exception of inflation, broad money supply and interest rate were negatively related to economic growth. For the test of causality, it was revealed that none of the explanatory variables granger causes economic growth, implying that money supply, inflation and interest rate have not influenced growth.

Chinuba, Akhor, & Akwaden (2015) used time series data to study the impact of money supply on economic growth covering 1981-2008 with simple OLS on the Nigeria economy, the results showed that money supply exerted a considerable positive impact on economic growth. An investigation into the long-run and short-run impact of money supply on economic growth of Nigeria for the period 1986-2006 was carried out by Omotor, (2010) using VAR Model, the results provide evidence in support of the long run positive impact of money supply on growth in income but has no impact in the short-run.

Similarly, Aziakpono (2003) presented and tested a model on money supply and economic growth to determine either or both anticipated and unanticipated money affects real output and growth in Nigeria. The evidence revealed that while anticipated money supply affects real output and growth in Nigeria, the unanticipated money supply did not. Omoke & Ugwuanyi (2010) tested the relationship between money, inflation and output by employing co-integration and Granger-causality test analysis. The findings revealed no existence of a co-integrating vector in the series used. Money supply was seen to Granger cause both output and inflation. The result suggest that monetary stability can contribute towards price stability in Nigerian economy since the variation in price level is mainly caused by money supply and also conclude that inflation in Nigeria is to a large extent a monetary phenomenon.  $M_2$  appeared to have a strong causal effect on the real output as well as prices.

Abbas & Husian (2006) examines the casual relationship between money and income and money and prices in Pakistan. The co-integration analysis indicates, in general, the long run relationship among money, income and prices. The error correction and Granger causality framework suggest a one-way causation from income to money in the long run implying that probably real factors rather than money supply have played a major role in increasing Pakistan's national income, regarding the causal relationship between money and prices, the causality frame work provides the evidence of bi-variate causality indicating that monetary expansion increases and is also increased by inflation in Pakistan. However, money supply seems to be the leader in this case.

Akujuobi (2010) studied monetary policy and Nigeria's economic development using multiple regression analysis, namely; gross domestic product (dependent variable) and independent variables: Cash Reserve Ratio (CRR), Liquidity Ratio (LQR), interest rate, Minimum Rediscount Rate (MRR) and the treasury bill rate and found out that apart from cash reserve ratio, others impacted much on the economic development of the nation.

Similarly, Chimobi & Uche (2010) examined the relationship between money, inflation and output in Nigeria. The study adopted co-integration and granger causality test analysis. The co-integrating result of the study showed that the variables used in the model exhibited no long run relationship among each other. Nevertheless, money supply was seen to granger cause both output and inflation. The result of the study suggested that monetary stability can contribute towards price stability in the Nigerian economy since the variation in price level is mainly caused by money supply and concluded that inflation in Nigeria is to an extent a monetary phenomenon.

Usman & Adejare (2014) empirically examined the effect of money supply, foreign exchange on Nigeria economy with secondary data covering the period of 1988 to 2010. Multiple regressions were employed to analyze the variables; gross domestic product (GDP), Narrow Money, Broad money, exchange rate and interest rate. The results found that all the variables have significant effects on the economic growth with the adjusted  $R^2$  showing that about 97.3% variation in the GDP from 1988 to 2010 is due to NARM.

Similarly, Aminu & Amono, (2012) conducted an empirical investigation into the effect of inflation on the growth and development of Nigeria economy. The work employed Cobb Douglas Production function with ordinary least square method and concluded that inflation possess a positive impact on economic growth. Osuala, Osuala, & Onyeike (2013) carried out an empirical study on the impact of inflation on economic growth over a period of thirty-one years. The VAR results revealed a statistically significant positive impact of inflation on economic growth in Nigeria while the causality test showed that there is no causality in between the two variables. In the same vein, Taiwo (2011) investigated the impact of inflation and investment on economic growth in Nigeria with the use of ordinary least square (OLS) method and annual secondary data from 1981 to 2006, the investigation based on inflation-GDP revealed that inflation has negative and insignificant impact on economic growth, meaning that as inflation increases economic growth falls.

Ifionu & Akinpelumi (2015) examined the effect and implication of selected macroeconomic variables on money supply ( $M_2$ ), using derived secondary data gotten from the Central Bank Statistical Bulletin (2013). Coupled with the application of econometric technique such as; O.L.S., causality test and Co-integration of time series data to estimate the long and short run relationship and causality of employed variables. The results revealed that all variables were stationary at various lags and there exists a long run relationship between variables employed and it was discovered that apart from inflation had an inverse significance with money supply ( $M_2$ ) and exchange Rate (EXR), all other variables such as gross domestic Product (GDP) were found to have a positive impact on money supply.

Malik (2006) studied the effects of monetary policy actions on inflation using Near-VAR approach. His results showed that effect of monetary policy transmits into inflation with a lag of half year and then take another year to reach the peak. This study suggested the identification of variables that are most important in explaining inflation in Pakistan by considering monetary policy actions, supply side factors and foreign inflation.

Kenneth, Yuni, & Ihugba (2016) investigated the relationship between inflation and economic growth in Nigeria using a two stage least square estimation to examine the simultaneous models of the study. The study showed that inflation is beneficial to growth though not significantly while growth is significantly beneficial to inflation; given the positive relationship between inflation and growth and the negative relationship between growth and inflation. The results further showed that money supply and trade openness are significant determinants of real GDP for all three estimation techniques under consideration. While, real GDP, money supply and interest rate are significant determinants of inflation.

Furthermore, Femi (2014) the study examined the effect of economic variables such as inflation, income; interest rates, price level and exchange rate have on demand for money, by applying regression analysis with an Error Correction Model (ECM) on various economic variables, covering a period of thirty-three years (1970-2003). The study revealed that inflation was not affected by trend but by Nigerian government policies and that inflation does not exert any significant influence on demand for money. Olorunfemi & Adeleke (2013) studied the impact of money supply and inflation rate in Nigeria using secondary data that ranged between 1970-2008. The study used Vector Auto Regressive (VAR) model. The results revealed that money supply and exchange rate were stationary at the level while oil revenue and interest rate were stationary at the first difference. Results from the causality test indicate that there exists a unidirectional causality between money supply and inflation rate as well as interest rate and inflation rate. The causality test runs from money supply to inflation, from the interest rate to inflation and from interest rate to money supply.

Adeyeye & Fakiyesi (1980) estimated and tested the hypothesis that the main factor responsible for instability of prices and inflationary tendencies in Nigeria was government expenditure. Working with annual time series data spanning 1960–1977, they tested the hypothesis that the rate of inflation in Nigeria is linearly related to the rate of growth of money stock, government expenditure, especially deficit, and growth of government revenue, especially monetization of foreign exchange from oil export. The result established some significant positive relationships between inflation rate and growth in bank credit, growth of money supply and growth in government expenditure, while the relationship with growth of government revenue was uncertain.

Using quarterly data, Osakwe (1983) attempted to verify the amount of government expenditure that affected money supply in the ten-year period 1970–1980. Significant statistical evidence obtained from the analysis showed strong relationships between

increases in net current expenditure and growth in money supply, on the one hand, and growth in money supply and inflation, on the other hand. Further increases in money wage rate and money supply (with a lag in effect) were identified as the two most important factors that influenced the movement of prices during the period.

Baghelo & Ebibai (2014) empirically examined the impact of monetary policy on selected macroeconomics variables such as gross domestic product, inflation, and balance of payment in Nigeria from (1980-2011) using ordinary least square (OLS) regression analysis. The error correction method is used to ascertain if there is a static long run equilibrium relationship among the explanatory variables and subsequently derive an adequate dynamic model of the short run relationship. The study showed that the provision of investment friendly environment in the Nigerian economy will increase the growth rate of GDP.

Nwaobi (2002) used data from 1960 through 1995 and the Johansen co-integration framework found that money demand, real GDP, inflation and interest rate are co integrated in Nigeria. He also found stable money demand in the period under study. Fatukasi (2004) investigated the determinants of inflation in Nigeria between 1981 and 2003. The study made use of non-linear multiple regression models. He posited that the causes of inflation in Nigeria are multi-dimensional and dynamic, requiring full knowledge at any point in time to be able to proffer solutions to the inflationary trends in the country. Also, Omoke (2010) tested the causal long-term relationship between budget deficit, money growth and inflation in Nigeria. Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) test were carried out to test the stationarity of the variables used. The result of the study pointed to a close long-term relationship between inflation and money supply.

In another country specific study, Olusanya (2009) analyzed the main sources of fluctuations in inflation in Nigeria. Using the framework of error correction mechanism (ECM) it was found that the lagged CPI, expected inflation, petroleum prices and real exchange rate significantly propagate the dynamics of inflationary process in Nigeria. Bakare (2011) conducted a study on the determinants of money supply growth and its implications on inflation in Nigeria. The study employed quasi-experimental research design approach. The results showed that credit expansion to the private sector determines money supply growth and inflation in Nigeria. He therefore concluded that changes in money supply are concomitant to inflation in Nigeria.

Anyanwu & Kalu (2015) examined the correlation that exists between money supply and economic growth using time series data for 18 years (1994-2012) on money supply, CLBA and output. The findings showed that change in money supply (M2) has significant effect on variables such as CBLA and output in Nigerian economy within the period under review. It also showed that there is a significant strong multiple correlation among Real GDP, money supply and commercial banks' loans and advances ( $R=95.1\%$ ). The coefficient of Determination ( $R^2$ ) reveals that 90.5% of variations in RGDP were explained by the selected explanatory variables.

Inam (2014) studied the role of money supply on economic growth in Nigeria between 1985-2012 using augmented Cobb-Douglas production function and relying on co-integration/Error - Correction methodology. The results showed that money supply have a linear and statistically significant impact on economic growth. Babatunde & Shuaibu (2011) examined the existence of a significant long run relationship between money supply, capital stock, inflation and economic growth between 1975 and 2008 using error correction mechanism. The empirical estimates revealed a positive and significant relationship between money supply and capital stock while a negative relationship was found between inflation and growth.

Abdulazeez (2016) using time-series data covering 1990 to 2010, investigated the impact of monetary policy on economic growth in Nigeria. With the aid of multiple regressions analysis technique on money supply, interest rate, and financial deepening on gross domestic product, the study found that all the variables have marginal impact on the economic growth of Nigeria.

### 3. Methodology

#### 3.1 Research Design

The Ex-Post Facto research design was adopted to examine the impact of money supply on some macroeconomic variables in Nigeria. This design was adopted to enable the researcher to use time series data to explain the impact of narrow and broad money supply, inflation rate, and exchange rate on real gross domestic product on one hand, and narrow and broad money supply and exchange rate on consumer price index in Nigeria in retrospect.

In addition to this design, the author used descriptive statistics and empirical analytical methods like Augmented Dickey-Fuller (ADF) test to solidify the data, Johansen co-integration test to determine the long run relationship in the variables, and multiple regressions to determine the impact of the variables on the explanatory variables in the study.

#### 3.2 Nature and Source of Data

The nature of the data used in this paper is called time series data. The time series data gave us the needed information about the numerical values of the individual variables of the study from period to period for the estimation of the models.

The data for the paper was obtained from secondary sources, the Central of Nigeria Statistical Bulletin of 2016 and journals. Specifically, the researcher obtained data for real gross domestic product, inflation rate, narrow and broad money supply, and exchange rates from 1985 – 2016.

### 3.3 Model Specification

The study imitated finance literature and adopted the Multiple Regression using the Ordinary Least Squares like Usman & Adejare (2014), Baghelo & Ebibai (2014), Ifionu & Akinpelumi (2015) to examine the impact of narrow and broad money supply, inflation rate, and exchange rate on real gross domestic product on one hand, and narrow and broad money supply and exchange rate on consumer price index in Nigeria in retrospect in the other hand. The Ordinary Least Squares (OLS) technique is used because it is the most unbiased estimator, consistency, minimum variance and efficiency.

Consequently, the study assumed that real gross domestic product is a function of narrow and broad money supply, inflation rate, and exchange rate, and that consumer price index is a function of narrow and broad money supply and exchange rate in Nigeria. Thus, the mathematical and econometric model follows the augmented technique used by McCallum (1991) and Kohn (1999).

The functional models are stated as follows;

$$RGDP = f(M_1, M_2, INFR, EXR) \quad 1$$

$$INFR = f(M_1, M_2, INFR, EXR) \quad 2$$

This is expressed econometrically as follows;

$$RGDPGR = \beta_0 + \beta_1 M_1 + \beta_2 M_2 + \beta_3 INFR + \beta_4 EXR + u \quad 3$$

$$INFR = \beta_0 + \beta_1 M_1 + \beta_2 M_2 + \beta_3 EXR + u \quad 4$$

Where;

RGDP = Growth rate of real Gross Domestic Product

INFR = Inflation rate

M<sub>1</sub> = Narrow money supply

M<sub>2</sub> = Broad money supply

EXR = Exchange Rate

u = Stochastic term

β<sub>1</sub> to β<sub>4</sub> = Parameter estimates

#### A priori Expectations

β<sub>1</sub> > 0, β<sub>2</sub> > 0, β<sub>3</sub> > 0, β<sub>4</sub> > 0.

The implication of this is that all the coefficients of the explanatory variables are expected to have a linear impact on the dependent variables.

#### Operational Description of the Variables

1. **Narrow Money Supply (M<sub>1</sub>)** - Currency outside bank plus demand deposits of commercial banks.
2. **Broad Money Supply (M<sub>2</sub>)** - M<sub>1</sub> plus quasi money. Quasi-money is defined as the sum of savings and time deposits with commercial banks.
3. **Inflation** – general increase in prices of goods and services over a period of time in Nigeria.
4. **Gross Domestic Product** - the total market value of all final goods and services produced in Nigeria annually.
5. **Exchange Rate** - the value of the naira against other currencies.

#### 4. Results and Discussions

### 4.1 Descriptive Statistics

The following report the mean, median, and standard deviation of the variables of the study

Table 4.1: Descriptive Statistics for RGDP, M<sub>1</sub>, M<sub>2</sub>, INFR, and EXR

	RGDP	M <sub>1</sub>	M <sub>2</sub>	INFR	EXR
Mean	4.943667	24.73533	25.89433	20.49333	76.61592
Median	5.100000	20.22000	22.62000	12.10000	94.07500
Maximum	11.36000	62.24000	57.78000	76.80000	158.6200
Minimum	-0.690000	-5.230000	1.320000	0.200000	0.999600
Std. Dev.	3.060835	18.51544	15.34671	20.00498	62.04927
Skewness	0.196472	0.406838	0.426843	1.502732	0.010971
Kurtosis	2.624988	2.251950	2.275053	4.026276	1.220870
Jarque-Bera	0.368799	1.527061	1.567908	12.60757	3.957230
Probability	0.831604	0.466018	0.456597	0.001829	0.138261

Source: Author's Computation using E-view 9.1

Note: RGDP = real gross domestic product, M<sub>1</sub> = narrow money supply, M<sub>2</sub> = broad money supply, INFR = inflation rate, EXR = exchange rate

From the descriptive statistics results, the mean real gross domestic product growth rate over the period of the study is 4.94, while M<sub>1</sub> (narrow money), M<sub>2</sub> (broad money), INFR (inflation rate) and EXR (exchange rate) are: 24.73, 25.89, 20.49, and 76.61592 respectively. The standard deviation of real gross domestic product growth rate, M<sub>1</sub>, M<sub>2</sub>, inflation rate and exchange rate reveals that the values in the data set are close to the mean. Thus reflects a small amount of variation of the data of the variables. All the variables positively skewed as indicated by the positive skewness coefficients.

### 4.2 Augmented Dickey Fuller (ADF) Unit Root Test

The ADF unit root test in this study was employed to solidify the numeric values of the variables. This helped us ensure that the regression outputs were not spurious. The results of the unit root test at level and first difference are presented in table 4.2.

Table 4.2: Unit Root Test for RGDP, M<sub>1</sub>, M<sub>2</sub>, INFR, and EXR

Variable	Level	1 <sup>st</sup> Difference	Order of integration
RGDP	1.3774	1.9889	I(1)
M <sub>1</sub>	-1.5581	-2.9116	I(1)
M <sub>2</sub>	-1.0345	-2.2293	I(1)
INFR	-0.2942	-2.6030	I(1)
EXR	-1.9395	-2.8639	I(1)
<b>Critical Value @ 5%</b>	<b>-1.9583</b>	<b>-1.9592</b>	

Source: Author's Computation using E-views

Table 4.2 show the summary of the unit root test of the variables used for the study. The results shows that all the variables used in the model are all integrated at first difference, symbolized by I(1), all at 5 percent significance level.

### 4.3 OLS Results for Models I & II

The Ordinary Least Square (OLS) is used in this study to estimate and determine the impact of the explanatory variables on the dependent variables of the study. The results are presented in tables 4.3 and 4.4 respectively.

Table 4.3: Regression Outputs for Model I

Dependent Variable: RGDP  
Method: Least Squares  
Sample: 1985 2016  
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.378644	1.485134	3.621656	0.0013

M <sub>1</sub>	0.158868	0.074099	2.143991	0.0419
M <sub>2</sub>	-0.162466	0.082949	-1.958629	0.0614
EXR	0.023757	0.099586	2.385576	0.1637
INFR	-0.059128	0.033224	-1.779659	0.0873
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R-squared	0.509574	Mean dependent var	4.943667	
Adjusted R-squared	0.491106	S.D. dependent var	3.060835	
S.E. of regression	0.836677	Akaike info criterion	5.074155	
Sum squared resid	201.1684	Schwarz criterion	5.307688	
Log likelihood	-71.11233	Hannan-Quinn criter.	5.148864	
F-statistic	5.191085	Durbin-Watson stat	1.648027	
Prob(F-statistic)	0.009167			

Source: Author's Computation using E-view

The results showed that narrow money supply (M<sub>1</sub>) possess a positive and significant impact on RGDP. Broad money supply (M<sub>2</sub>) possesses a negative and insignificant impact on RGDP growth rate. Exchange rate has a linear and insignificant impact on RGDP growth rate; while for inflation rate (INFR), the results predict a nonlinear and insignificant impact on RGDP growth rate in Nigeria.

Further results show that the coefficient of determination (R<sup>2</sup>) explained approximately 51% of the variation/changes in the dependent variable (RGDP growth rate). The test of the aggregate significance of the model also unveils that that the model is statistically significant because the F-statistics (5.191085) is greater than the F-prob(0.009167) which is statistically zero. The Durbin Watson statistic of 1.648027 is greater than the R<sup>2</sup> output of 0.509574. This shows the absence of first order autocorrelation. The Akaike info criterion of 5.07 indicates that the model is correctly specified. The standard error of regression reveals that in about two-third of the time the independent variables explained the dependent variable by exactly 84 percent.

**Table 4.4: Regression Outputs for Model II**

Dependent Variable: INFR  
Method: Least Squares  
Sample: 1985 2016  
Included observations: 30

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.988841	0.399780	12.47895	0.0000
M <sub>1</sub>	0.158364	0.056476	2.804075	0.0187
M <sub>2</sub>	0.106232	0.109901	0.966615	0.1024
EXR	0.650081	0.140658	4.061743	0.9520
<hr/>				
R-squared	0.689006	Mean dependent var	6.380007	
Adjusted R-squared	0.681310	S.D. dependent var	0.336225	
S.E. of regression	0.045966	Akaike info criterion	-3.020716	
Sum squared resid	0.021129	Schwarz criterion	-2.624995	
Log likelihood	35.18644	Hannam-Quinn criter.	8.508300	
F-statistic	2.103845	Durbin-Watson stat	1.648007	
Prob(F-statistic)	0.009167			

Source: Author's Computation using E-view

The results showed that narrow money supply (M<sub>1</sub>) has a linear and significant impact on inflation rate (INFR). This means that every 1 percent increase in narrow money supply led to about 0.16 percent increase in the rate of inflation. Similarly, broad money supply (M<sub>2</sub>) also has a positive and statistically insignificant impact on inflation rate. Also, exchange rate has a linear and statistically insignificant impact on inflation in Nigeria.

The results further revealed that 68 percent of the variation/change in the dependent variable, inflation rate was explained by the explanatory variables in the model. The results also predict that the overall model is statistically significant because the F-statistic is greater than the F-prob (i.e. 2.103845 > 0.009167). Finally, the Durbin-Watson statistic value of 1.648007 is greater than the R<sup>2</sup> value of 0.689006; this suggests the absence of first order autocorrelation.

## 5. Summary of Findings, Conclusion, and Recommendations

## 5.1 Summary of Findings

This paper examined the impact of money supply on economic growth and inflation in the Nigerian economy from 1985 to 2016. Consequently, the study uncovered the following;

1. Narrow money supply ( $M_1$ ) has a positive significant impact on inflation and real gross domestic product in Nigeria.
2. Broad money supply ( $M_2$ ) does not have any significant impact on inflation and real gross domestic product in Nigeria.
3. Exchange rate has a significant impact on inflation and real gross domestic product in Nigeria.
4. Inflation rate does not have any linear significant impact on real gross domestic product in Nigeria.

## 5.2 Conclusion

The paper evaluated the impact of money supply on varied macroeconomic variables in the Nigerian economy from 1985 to 2016. To achieve the objectives of the study, the ex post facto research design and descriptive statistics was used to observe the variables in retrospect. The Augmented Dickey Fuller test was used to solidify the data and the ordinary least square technique was employed to determine the magnitude and direction of the variables in the models. The empirical results showed that narrow money supply and exchange rate has a significant impact on economic growth and inflation whereas, this is not the case for broad money supply and the rate of inflation on economic growth in Nigeria. Ceteris Paribus, the results suggest that economic growth and inflation is a function of money supply (narrow money supply) and exchange rate in Nigeria.

## 5.3 Recommendations

The following recommendations were made;

1. Accelerate efforts should be put in place to better the exchange rate between the naira and other currencies. This will help avoid the imported inflationary pressure on goods and services in the country.
2. Concerted effort should be made to ensure that efforts aimed at ensuring price stability do not stifle aggregate demand and hence economic growth.
3. Measure should be put in place to improve domestic production. This will reduce demand pull inflation and enhance economic growth.

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# Measurement of Natural Radioactivity in Soil Samples From Ladoke Akintola University of Technology, Ogbomosho South-West, Nigeria.

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DOI: 10.29322/IJSRP.8.8.2018.p8080

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8080>

**Abstract-** *Studies on the gamma radiation level and the radionuclide distribution in the soil of Ladoke Akintola University of Technology (LAUTECH), Ogbomosho, Oyo state were carried out. This study is to provide a baseline data on the radiation level as well as the distribution of some naturally occurring radionuclides present in the University that was established in 1990 with population of about thirty thousands. The analysis was carried out through the use of a well calibrated NaI(Tl) detector system. The range of activity concentration of (<sup>40</sup>K, <sup>234</sup>U and <sup>232</sup>Th) were found to be (50.23±1.41 to 183.55±1.42, 9.81±3.11 to 22.70±3.15 and 9.07±0.95 to 34.42±0.78) Bq/kg respectively. The mean absorbed dose rate and annual effectively dose equivalent (AEDE) were calculated and found as presented: 23.06μSvy<sup>-1</sup> and 23.16μSvy<sup>-1</sup> respectively. The values obtained were below the safety limit of 1mSv/y as recommended by the International Commission on Radiological Protection.*

**Index Terms:** LAUTECH, Natural Radioactivity, Nigeria, Soil

## 1 INTRODUCTION

The global interest in the study and survey of naturally occurring radiation and environmental radioactivity had been essentially based on the importance of using the results from such studies for the assessment of public radiation exposure rates and the performance of epidemiological studies, as well as reference radiometric data relevant in studying the possible changes in environmental radioactivity due to

nuclear, industrial and other human technology-related activities (UNSCEAR, 2000).

It has been established that out of the total radiation dose that the world population receives, about 96.1% is from natural sources and the remainder is from human –made sources (Chougankar *et al.*, 2003). The natural environmental radioactivity in a location and its associated external exposure due to gamma

radiation depends primarily on its geological and geographical conditions (Akinloye et al., 2012; Eke et al., 2015). It is related to the composition of each lithologically separated area and the content of the rock from which the soil originates (Whicker, 1983; Wollenberg and Smith, 1990). Therefore, specific concentration levels of terrestrial radiation differ in the soil of each region of the world (Akhtar *et al.*, 2004; Tufail *et al.*, 2007; Shiva Prasad *et al.*, 2008).

In Nigeria, half of the land area of 923 768 km<sup>2</sup> is underlain by crystalline rocks or basement complex and the remaining half by sedimentary rocks. The basement complex is of Precambrian age and composed primarily of metamorphic and igneous rocks such as granites, gneisses and migmatites (Rahaman, 1988). The study of the distribution of radionuclides in the human environment allows the understanding of the radiological implications of these elements due to the gamma- ray exposure of the body and irradiation of lung tissues from inhalation radon and its daughters. Hence, this study is necessitated by the fact that no previous work has been conducted to provide a database on the distribution of radionuclides and their concentrations within Ladoke Akintola University of Technology Oyo State.

The University was established by former old Oyo state government in 1990 located in Ogbomoso, South-Western, Nigeria. Since radiation cannot be felt by the human sense organs, it is important that the total emitting-NORMs in the mentioned institution of over thirty thousand population be determined in order to safeguard the live of people and ensure radiation-pollution free environment. This study is to estimate

the activity concentration of radionuclides, absorbed gamma dose rates and annual effective dose rates in the soil samples from LAUTECH for her record data in case of any changes in future.

## 2. MATERIALS AND METHODS

### 2.1 Sample Collection, Preparation and Analysis.

Seventy soil samples were collected at different locations within the premises of Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria as presented in (Fig.1)

The samples were air-dried, crushed and homogenized. The homogenized samples were packed and hermetically sealed in plastic container with the aid of (PVC) tape to prevent the escape of airborne <sup>222</sup>Rn and <sup>220</sup>Rn from the samples. All the samples were weighed and stored for Twenty-eight days prior to measurement in order to attain radioactive secular equilibrium between radon and its decay products.

After the secular equilibrium period was attained, samples were then analyzed for 36000 s using a well calibrated gamma spectrometer using NaI(Tl) scintillation detector at radiation laboratory, Ladoke Akintola University of Technology, Ogbomoso, Nigeria. The scintillation detector, is a 3x3 inch NaI(Tl), a product of Princeton Gamma Tech. USA, placed in a lead shield to reduce the effect of background radiation. Energy and efficiency calibrations of the detector were carried out using a standard source traceable to Analytical Quality Control Services (AQCS), USA, which contains ten

radionuclides of gamma emitters with energies ranging from 59.54 to 1836 keV.

The activity concentration of  $^{238}\text{U}$  was determined from the 63.3 keV peak of  $^{234}\text{Th}$ ,  $^{226}\text{Ra}$  was determined from the average activity concentration of 295.3 keV of  $^{214}\text{Pb}$  and 1764.5 keV of  $^{214}\text{Bi}$ . The activity concentration of  $^{232}\text{Th}$  was determined from the average concentration of  $^{212}\text{Pb}$  (238.6 keV),  $^{228}\text{Ac}$  (911.1 keV) and  $^{208}\text{Tl}$  (2614.7 keV), and that of  $^{40}\text{K}$  (1460.0 keV). The activity concentration of  $^{235}\text{U}$  was determined from the 185.7 keV gamma lines, which were corrected by removing the contribution from the 186.2 keV of  $^{226}\text{Ra}$  using the following Equation 1:

$$A(^{238}\text{U}) = \frac{N_{186} - A(^{226}\text{Ra}) \cdot f_E(^{226}\text{Ra}) \cdot n_{186} \cdot M \cdot T_c}{n_{186} \cdot f_E(^{235}\text{U}) \cdot M \cdot T_c} \quad (1)$$

Where  $N_{186}$  is the total counts for the 186 keV doublets.  $A(^{235}\text{U})$  and  $A(^{226}\text{Ra})$  are the activity concentrations of  $^{235}\text{U}$  and  $^{226}\text{Ra}$  respectively,  $n_{186}$  is the detection efficiency of the 186 keV line,  $f_E(^{235}\text{U})$  and  $f_E(^{226}\text{Ra})$  are the emission probabilities of the 185.7 keV gamma lines of  $^{235}\text{U}$  and  $^{226}\text{Ra}$  respectively.  $T_c$  is the counting time and  $M$  is the mass of the sample.

The Minimum Detectable Activity (MDA) for each radionuclide  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$  was calculated using the following Equation 2:

$$\text{MDA} = \frac{1.645 \cdot \sqrt{N_B}}{f_E \cdot n(E) \cdot t_c \cdot M} \quad (2)$$

Where, 1.645 is the statistical coverage factor at 95% confidence level,  $N_B$  is the background counts at the region of interest,  $t_c$  is the counting time,  $f_E$  is the gamma emission probability,  $n(E)$  is the photopeak efficiency and  $M$  is the mass of the sample. The MDA

for each of the radionuclide were calculated as 0.12 Bq/kg for  $^{226}\text{Ra}$ , 0.11 Bq/kg for  $^{232}\text{Th}$  and 0.9 Bq/kg for  $^{40}\text{K}$  respectively.

## 2.2 Calculation of the Absorb Dose Rate and Annual Effective Dose

The absorbed rate at 1 m above the ground (in  $\text{nGyh}^{-1}$ ) due to U-Th series and  $^{40}\text{K}$  was calculated using the following Equation 3:

$$D(\text{nGy}) = \sum_{i=1}^n A_i \cdot \text{DCF} \quad (3)$$

Where DCF are the dose coefficient in  $\text{nGyh}^{-1}$  per Bq/kg taken from UNSCEAR (2000) report (UNSCEAR, 2000) and  $A_i$  are the activity concentrations of the radionuclides.

The annual effective dose equivalent,  $H_E$ , from external exposure to gamma rays from the soil samples was calculated from the absorbed dose rate using the Equation 4 (UNSCEAR, 2000):

$$H_E = D(\text{nGyh}^{-1}) \cdot 8760(\text{h}) \cdot 0.2 \cdot 0.7(\text{Sv/Gy}) \quad (4)$$

Where 0.2 is the occupancy factor for the outdoor, 8760 is the total time of the year in hours and 0.7 Sv/Gy is the conversion factor for external gamma irradiation.

## 3 RESULTS AND DISCUSSION

The results obtained for the activity concentrations of radionuclides present in LAUTECH soil samples are presented in Table 1. The results show that three natural radionuclides namely  $^{40}\text{K}$ ,  $^{226}\text{Ra}$  and  $^{232}\text{Th}$  are present in the soil samples analyzed and no traces of artificial radionuclides were not detected. The

activity concentration of these radionuclides ranged from  $50.23 \pm 1.41 \text{ Bqkg}^{-1}$  to  $183.55 \pm 1.42 \text{ Bqkg}^{-1}$  with an average value of  $116.79 \pm 1.40 \text{ Bqkg}^{-1}$  for  $^{40}\text{K}$ ,  $9.81 \pm 3.11 \text{ Bqkg}^{-1}$  to  $22.70 \pm 3.15 \text{ Bqkg}^{-1}$  with an average value of  $12.45 \pm 2.94 \text{ Bqkg}^{-1}$  for  $^{226}\text{Ra}$  and  $9.07 \pm 0.95 \text{ Bqkg}^{-1}$  to  $34.42 \pm 0.75 \text{ Bqkg}^{-1}$  with an average value of  $12.67 \pm 0.79 \text{ Bqkg}^{-1}$  for  $^{232}\text{Th}$  respectively. For  $^{40}\text{K}$  radionuclide, the lowest value was recorded at the University farm while the highest value was recorded at the ceramic studio, this considerable value may be due to the presence of the radioactive minerals and clay soil in the location. For  $^{232}\text{Th}$  radionuclides, the lowest value was recorded at Bee house while the highest value was recorded at mechanical engineering workshop and values could be link to the presence of monazite and other radioactive minerals in the location. For  $^{226}\text{Ra}$ , radionuclide, the lowest values was recorded at LAUTECH Chapel while the highest value was recorded at ceramic studio. The highest activity concentration could be attributed to the geological location. Ra were below detectable limit at three location could be linked to the geological strata of the area since no artificial radioactive material was found in any of the analyzed samples assayed.

The results obtained for the estimated absorbed dose rates and effective dose rates are presented in Table 2. The results show that the absorbed dose rates ranged from 9.97 to  $32.92 \text{ nGyh}^{-1}$  with an average mean of  $23.06 \text{ nGyh}^{-1}$ . This value falls below the recommended mean value of  $51 \text{ nGyh}^{-1}$ . Similarly, the effective dose rate obtained based on the soil samples analyzed ranged from  $12.04 \mu\text{Svy}^{-1}$  to  $40.40 \mu\text{Svy}^{-1}$  with an average value of  $23.16 \mu\text{Svy}^{-1}$ . This value also falls

below the world average values of  $70 \mu\text{Svy}^{-1}$  (UNSCEAR, 2000).

#### 4 CONCLUSION

This study has presented the results of the activity concentrations of terrestrial gamma emitters for soil samples from LAUTECH, Ogbomoso, Nigeria. The obtained values of natural radioactivity of absorbed dose rates due to the activity concentrations of  $^{40}\text{K}$ ,  $^{232}\text{Th}$  and  $^{226}\text{Ra}$  in soil samples have determined and found lower than the world average values. Hence, this implies that the study area is suitable and safe and could not be considered to constitute radiological hazard to the University community.

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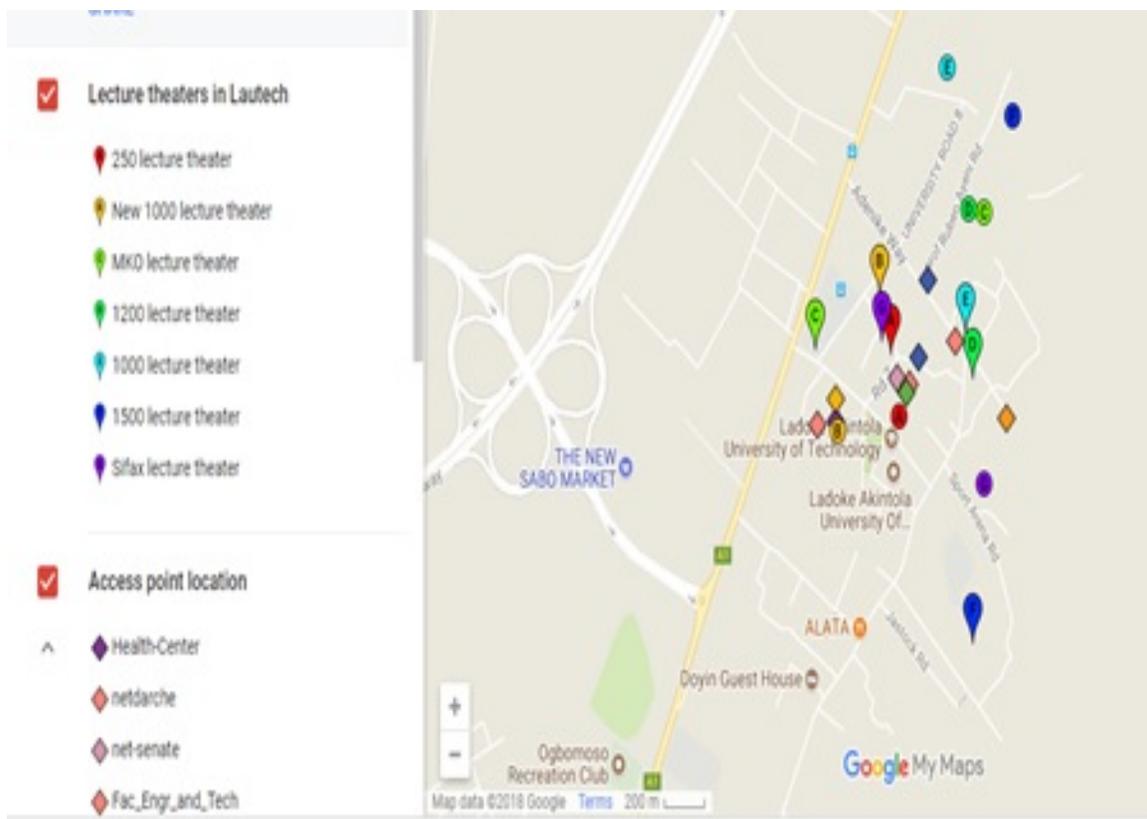


Figure 1: Map of the study area

**Table 1. Activity concentrations of the radionuclides at different locations**

Sample ID	Sample locations	<sup>40</sup> K (Bqkg <sup>-1</sup> )	<sup>226</sup> Ra (Bqkg <sup>-1</sup> )	<sup>232</sup> Th (Bqkg <sup>-1</sup> )
1	Student affairs building	124.23±1.38	11.21±4.85	14.42±0.12
2	Senate building	113.58±1.41	10.01±2.20	11.42±0.77
3	URP studio	140.45±1.37	18.08±3.61	23.51±0.21
4	Ceramic studio	125.96±1.39	22.70±3.15	12.87±0.75
5	New laboratory complex	113.21±1.41	12.92±3.11	13.98±0.77
6	250lecture theatre hall	122.45±1.37	10.37±2.57	11.11±0.76
7	750lecture theatre hall (MKO)	125.44±1.39	12.03±2.47	17.03±0.76
8	1200lecture theatre hall	87.23±1.45	11.81±2.83	12.41±0.83
9	Engineering workshop	122.02±1.07	12.90±2.16	10.86±0.78
10	Post office	183.55±1.42	12.54±2.76	BDL
11	Post graduate school	125.96±1.39	10.66±2.96	BDL
12	High-rise building	125.44±1.39	11.31±2.17	10.06±0.78
13	MEE workshop 1	100.67±1.42	10.14±2.13	11.26±0.76
14	MEE workshop 2	124.25±1.38	11.21±4.85	34.42±0.78
15	Amazing delicacy	140.45±1.37	10.08±3.61	11.51±0.81
16	Health centre	122.04±1.37	20.37±2.57	21.11±0.76
17	New ICT building	125.44±1.39	22.03±2.47	17.03±0.76
18	Old ICT building	87.23±1.45	25.81±2.83	18.41±0.83
19	1200lecture theatre hall	142.02±1.37	12.30±2.76	10.46±0.18
20	1000lecture theatre hall (FAG)	103.55±1.42	12.54±2.76	BDL
21	Lautech bakery	125.96±1.39	12.66±2.96	13.03±0.77
22	Lautech back gate	113.58±1.41	13.01±2.25	11.42±0.17
23	1000 lecture theatre hall (FPAS)	140.45±1.37	10.08±3.61	12.51±0.31
24	The great hall	87.23±1.45	11.81±2.83	12.41±0.83
25	1000lecture theatre hall (SIFAX)	125.96±1.39	10.66±2.96	13.03±0.77
26	Lautech main gate	142.45±1.37	10.37±2.57	11.11±0.76
27	Architecture studio	87.23±1.45	10.81±2.03	9.41±0.83
28	Adejo LT hall	113.23±1.41	12.92±3.10	13.18±0.77
29	Ghana house (FAG)	124.25±1.30	11.21±4.15	13.42±0.78

30	Bee house (FAG)	123.15±1.42	12.54±2.76	9.07±0.95
31	Lautech stadium	100.17±1.42	11.74±2.93	13.86±0.76
32	Feedmill (FAG)	140.45±1.37	11.08±3.61	12.51±0.81
33	Pre degree complex	142.45±1.37	10.37±2.57	11.11±0.76
34	Student union building	125.44±1.39	12.03±2.47	17.03±0.76
35	Poultry research house	141.45±1.37	10.07±2.57	11.21±0.76
36	Open distance learning	140.45±1.37	11.08±3.61	13.51±0.81
37	GTBank building	86.65±1.47	12.85±2.55	16.19±0.77
38	General studies building	125.96±1.39	11.66±2.96	13.03±0.77
39	Anatomy laboratory	142.41±1.37	10.37±2.17	11.11±0.76
40	Firstbank building	87.23±1.45	11.81±2.83	12.41±0.83
41	Lautech farm house	50.23±1.41	9.92±3.11	12.98±0.77
42	Lautech chapel	87.23±1.45	9.81±2.83	10.21±0.83
43	Sport complex	113.23±1.41	12.32±3.11	13.98±0.77
44	Convocation building	125.96±1.3	12.66±2.96	13.03±0.77
45	FAA studio	103.55±1.42	11.54±2.76	12.07±0.95
46	CAD centre	100.67±1.42	12.14±2.93	10.16±0.76
47	Lautech sec. school	147.45±1.37	10.37±2.57	11.11±0.76
48	Cooperative building	134.25±1.38	11.21±4.85	10.42±0.78
49	Security post	150.23±1.41	12.92±3.11	13.98±0.77
50	Skyebank building	125.96±1.39	11.16±2.16	12.03±0.77
51	Acada building	98.75±1.42	11.66±2.97	13.17±0.78
52	X-ray building	73.45±1.47	20.83±2.77	21.57±0.78
53	FPAS building	113.23±1.41	12.92±3.11	13.98±0.77
54	Central mosque	99.27±1.42	11.96±2.82	13.13±0.77
55	URP 500l studio building	150.23±1.41	11.92±3.11	13.98±0.77
56	BIOSSA building	100.67±1.42	12.14±2.93	13.16±0.16
57	Chemistry shed	113.23±1.41	12.92±3.11	13.18±0.17
58	FET building	147.45±1.37	10.37±2.57	11.11±0.76
59	300l physics lab	103.55±1.42	10.54±2.76	11.07±0.95
60	SLT lab	87.23±1.45	12.81±2.83	13.41±0.83
61	Management sci. building	125.96±1.39	10.66±2.96	13.03±0.17
62	PASSA secretariat	134.25±1.38	11.21±4.85	14.42±0.78
63	MTH new building	86.65±1.47	12.85±2.55	13.19±0.77
64	300l chemistry lab	125.96±1.39	12.66±2.96	13.03±0.17
65	Fluid and mechanics lab	98.75±1.42	11.26±2.97	14.13±0.72
66	Alumni park	100.67±1.42	12.74±2.93	12.86±0.76
67	FSE Processing Unit	86.65±1.47	12.85±2.55	13.19±0.77
68	FESSA building	142.25±1.37	10.37±2.57	11.11±0.76
69	Agricultural laboratory	73.45±1.40	12.83±2.77	12.57±0.78
70	Zenith bank building	103.55±1.42	11.54±2.76	13.07±0.95

**Table 2. Absorbed Dose and Effective Dose Rate at different locations**

Sample ID	Sample locations	Absorbed dose rates (nGyh <sup>-1</sup> )	Effective Dose Rates (μSvy <sup>-1</sup> )
1	Student affairs building	19.68±2.21	24.15±2.71
2	Senate building	16.72±1.51	20.52±1.85
3	URP studio	29.32±1.74	35.98±2.14
4	Ceramic studio	23.63±1.90	29.00±2.33
5	New laboratory complex	19.64±1.90	24.10±2.33
6	250lecture theatre hall	17.05±1.66	20.92±2.04
7	750lecture theatre hall (MKO)	21.85±1.62	26.82±1.99
8	1200lecture theatre hall	17.01±1.82	20.88±2.23
9	Post office	17.94±1.49	22.02±1.83
10	Engineering workshop	13.25±1.24	16.26±1.51
11	Post graduate school	9.97±1.32	12.24±1.62
12	High-rise building	16.88±1.50	20.72±1.84
13	MEE workshop 1	16.11±1.47	19.77±1.80
14	MEE workshop 2	32.92±2.65	40.40±3.25
15	Amazing delicacy	17.96±2.14	22.04±2.63
16	Health centre	27.92±1.66	34.26±2.04
17	New ICT building	26.07±1.62	31.98±1.99
18	Old ICT building	26.96±1.82	33.09±2.23
19	1200lecture theatre hall	18.28±1.36	22.43±1.67
20	1000lecture theatre hall (FAG)	9.81±1.24	12.04±1.52
21	Lautech bakery	19.45±1.83	23.87±2.25
22	Lautech back gate	18.00±1.13	22.09±1.39
23	1000 lecture theatre hall (FPAS)	18.63±1.81	22.86±2.22
24	The great hall	17.01±1.82	20.88±2.23
25	1000lecture theatre hall (SIFAX)	18.59±1.83	22.81±2.25
26	Lautech main gate	17.91±1.66	21.98±2.04
27	Architecture studio	14.60±1.48	17.92±1.82
28	Adeojo LT hall	19.11±1.89	23.45±2.32
29	Ghana house (FAG)	19.01±2.34	23.33±2.87

30	Bee house(FAG)	16.65±1.87	20.43±2.29
31	Lautech stadium	18.50±1.82	22.70±2.23
32	Feedmill(FAG)	19.05±2.14	23.38±2.63
33	Pre degree complex	17.91±1.70	22.05±2.09
34	Student union building	21.80±1.62	26.75±1.99
35	Poultry research house	17.80±1.66	21.84±2.04
36	Open distance learning	19.71±2.14	24.19±2.63
37	GTBank building	19.93±1.66	24.46±2.04
38	General studies building	19.02±1.83	23.34±2.25
39	Anatomy laboratory	17.91±1.42	21.98±1.83
40	Firstbank building	17.01±1.82	20.88±2.23
41	Lautech farm house	14.99±1.90	18.40±2.33
42	Lautech chapel	14.70±1.82	18.04±2.23
43	Sport complex	19.38±1.90	23.78±2.33
44	Convocation building	19.45±1.83	23.87±2.25
45	FAA studio	17.37±1.87	21.32±2.29
46	CAD centre	16.24±1.82	19.93±2.23
47	Lautech sec. school	18.12±1.70	22.24±2.09
48	Cooperative building	17.46±2.65	21.43±3.25
49	Security post	21.23±1.90	26.05±2.23
50	Skyebank building	18.90±1.49	23.19±1.83
51	Acada building	17.94±1.85	22.02±2.27
52	X-ray building	26.33±1.76	32.31±2.16
53	FPAS building	19.64±1.90	24.10±2.33
54	Central mosque	18.07±1.75	22.18±2.15
55	URP 500l studio building	20.81±1.90	25.54±2.33
56	BIOSSA building	18.22±1.42	22.36±1.74
57	Chemistry shed	19.11±1.50	23.45±1.84
58	FET building	18.12±1.66	22.24±2.24
59	300l physics lab	16.31±1.74	20.02±2.14
60	SLT lab	18.10±1.82	22.21±2.23
61	Management sci. building	18.60±1.39	22.83±1.77
62	PASSA secretariat	20.11±2.65	24.68±3.25
63	MTH new building	17.95±1.66	22.03±2.04
64	300l chemistry lab	19.45±1.44	23.87±1.77
65	Fluid and mechanics lab	18.41±1.81	22.59±2.22
66	Alumni park	18.28±1.82	22.43±2.23
67	FSE Processing Unit	17.95±1.66	22.03±2.04
68	FESSA building	17.90±1.66	21.97±2.04
69	Agricultural laboratory	16.96±1.76	20.81±2.16
70	Zenith bank building	18.03±1.87	22.13±2.29



# Determination and Evaluation of Radionuclide Contents in the Soil of Oloru, Kwara State, Nigeria

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DOI: 10.29322/IJSRP.8.8.2018.p8081

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8081>

**Abstract:** The radionuclide contents in soil samples obtained from Oloru, Kwara State have been investigated. The qualitative and quantitative of any radionuclides present in an environment depends on the geological formations such an area. The geological formation of the area considered in this study consists of rocks, hill and steeps, and this may contribute to the presence of radionuclides that may be found in environmental matrices. The gamma spectrometry analysis was conducted using a well shielded and well calibrated NaI(Tl) detector. Three natural radionuclides namely <sup>238</sup>U, <sup>232</sup>Th and <sup>40</sup>K were identified and no artificial radionuclide in the samples assayed. The mean activity concentrations for the samples are  $15.65 \pm 1.94 \text{ Bqkg}^{-1}$  (<sup>238</sup>U),  $4.23 \pm 0.27 \text{ Bqkg}^{-1}$  (<sup>232</sup>Th) and  $1006.29 \pm 53.69 \text{ Bqkg}^{-1}$  (<sup>40</sup>K) respectively. The mean values for <sup>238</sup>U and <sup>232</sup>Th fall below the recommended mean while that of <sup>40</sup>K exceeded the recommended value. The various radiological parameters estimated are all lower than the recommended value. Thus, the community can be considered safe for habitation and the soil can be used for building purposes and other practices without causing any radiological hazard to the occupants. The results obtained may be taken as representing the baseline value of the radionuclide contents in the soil of the area.

**Keywords:** Gamma spectrometry, Kwara State, Oloru, Radionuclide contents, Soil

## 1 INTRODUCTION

The significance of soil to support life by serving as a means of habitation for humans and plant cannot be overemphasized (Akinloye *et al.*, 2012). Radiations present in the environment originates from various sources which are grouped into natural and man-made (NCRP, 1976; UNSCEAR, 2000). Exposure to natural sources of radiation is inevitable and unending process on Earth. Natural radiation originates from cosmic rays that are continuously incident on the Earth's atmosphere, terrestrial radionuclides of primordial origin that spread widely in almost all geological materials found on Earth and internal radiation from radioactive elements found within the body (UNSCEAR, 2000; CNSC, 2012). The medical and industrial applications of radiation contribute majorly to the artificial sources of radiation (UNSCEAR, 2000; IAEA, 2010; CNSC 2012).

Studies have shown that exposures to radiation from natural sources contribute about 85% with the

global average dose of  $2.4 \text{ mSvy}^{-1}$  while that from man-made sources contribute 15% to the population and the global average dose of  $0.4 \text{ mSvy}^{-1}$  (UNSCEAR, 2000; WNA, 2013). Human exposure to natural radiation is a function of his or her location on the Earth's surface. Several radiological studies have been carried out by researchers and the results obtained have helped in assessing the effects associated with exposure to radionuclides. The studies show that, soil not only consists of inorganic and organic materials but also radioactive materials (Isola *et al.*, 2015). The distributions of these radioactive materials originate mainly from the radionuclide decay series of  $^{238}\text{U}$  and  $^{234}\text{Th}$  and the singly occurring  $^{40}\text{K}$  (NCRP, 1976; UNSCEAR, 2000). Man-made radionuclides such as  $^{137}\text{Cs}$  have also been found as result of fallout from weapons testing and some other human activities involving the use of these radionuclides (NCRP, 1976; UNSCEAR, 2000; Akinloye *et al.*, 2012). This knowledge of radionuclides concentrations and the distribution in the environment have provided useful information from environmental radioactivity can be monitor (Prasong and Susaira, 2008).

The implication of these radionuclides is a consequence of gamma ray exposure of the body and irradiation of lung tissue that may occur from the inhalation of radon and its decay progeny (Singh and Mahayan, 2005; Akinloye *et al.*, 2012). In view of this, the study was conducted so as determine the radionuclide contents and evaluate various radiological parameters associated with soil samples in Oloru community. This study was necessitated by the fact no previous research have been conducted on the area. Therefore, this study will provide a baseline radiological data for the study area and will also help in determining the safety of the area for habitation.

## **2 MATERIALS AND METHODS**

### **2.1 Description of the Study area**

Oloru, is located in Moro local government area of Kwara State, Nigeria. It is situated at the west of central region of Nigeria and bounded by latitudes  $8^{\circ}27'$  N and  $8^{\circ}30'$  N and longitudes  $4^{\circ}36'$  E and  $4^{\circ}9'$  E. The geological formation of the study area consists of rocks, hill and steeps, and lie entirely within the basement rocks of Nigeria (Rahama, 1988). These geological formations may contribute to the presence of radionuclides that may be found in study area environmental media.

### **2.2 Sampling and Sample Collection**

The study area was group into five locations so as to have good representative sampling of the

area, keeping in mind the population density, location of residential areas and schools. A total of 25 soil samples were collected across each location. The soil samples were collected by clearing the surface vegetation from each location after which the soil samples were collect at depths ranging from 3 cm to 10 cm. This was done so as to determine the presence of  $^{137}\text{Cs}$  that may be present into player of the soil. Each soil sample was packaged in a black polypropylene nylon after which the samples were taken to the laboratory for furtherpreparation.

The soil samples were oven-dried at  $100^{\circ}\text{C}$  for 2 hrs using an electrically heated temperature controlled oven so as to remove the moisture content present in the soil samples. Thereafter, the samples were then pulverized, sieved through a 2 mm mesh, and packed inside a cylindrical polypropylene container that matches the geometry of the detector and tightly sealed with a polypropylene tap for a period of 28 days which was a sufficient period required to attain a state of secular radioactive equilibrium between radium isotopes and it progenies before the gamma spectrometry analysis.

### **2.3 Sample measurement**

The spectrometry analysis of the samples was carried out at the National Institute of Radiation Protection and Research (NIRPR) situated at the University of Ibadan, Nigeria. The gamma spectrometry system used consist of a Sodium Iodide activated with Thallium [NaI(Tl)] detector, Model 802 (3'' x 3'') with serial number 13000850 couple to an Osprey multichannel analyzer (MCA) manufactured by Canberra. The data acquisition was achieved through a Genie 2k software. The energy and efficiency calibration of detector was carried out using both the point sources and IAEA-385 standard sediment source.

Prior to the sample measurement, an empty container of the same geometry of the detector was counted for 36000 s so as to determine the background gamma ray distribution. The sealed samples after attaining a state of secular equilibrium, the samples were then counted for the same period of time. The gamma energies used for the estimation of radionuclide concentrations were  $^{214}\text{Pb}$  with 352.0 keV,  $^{214}\text{Bi}$  with 609.3 keV for  $^{238}\text{U}$ ,  $^{208}\text{Tl}$  with 583.2 keV and  $^{228}\text{Ac}$  with 911.1 keV for  $^{232}\text{Th}$  and  $^{40}\text{K}$  at 1460.8 keV. The samples activity concentrations  $A$  ( $\text{Bqkg}^{-1}$ ) were determined using Equation1:

$$A = \frac{C_{net}}{P_{\gamma} \times \epsilon \times m \times t} \quad (1)$$

Where  $C_{net}$  is the net peak area,  $P_{\gamma}$  is the absolute gamma ray emission probability,  $\epsilon$  is the full energy

peak efficiency of the detector,  $t$  is the counting time, and  $m$  is sample mass.

## 2.4 Estimation of Radiological Parameters

The contribution of the radionuclides identified in the samples to the absorbed dose rate due to external exposure was evaluated using Equation 2:

$$ADRA \text{ (nGyh}^{-1}\text{)} = C_U A_U + C_{Th} A_{Th} + C_K A_K \quad (2)$$

Where  $C_U = 0.042$ ,  $C_{Th} = 0.043$ , and  $C_K = 0.666$  are the conversion coefficient and  $A_U$ ,  $A_{Th}$  and  $A_K$  are the activity concentrations of  $^{238}\text{U}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$  respectively (UNSCEAR, 2000).

The annual effective dose equivalent due to the radionuclides detected in the soil samples was estimated using Equation 3:

$$AEDE \text{ (}\mu\text{SvGy}^{-1}\text{)} = ADRA \times O_f \times C_c \times T \quad (3)$$

Where ADRA is the absorbed dose rate due to external exposure,  $O_f$  is the outdoor occupancy factor (0.2),  $C_c$  is the dose conversion coefficient ( $0.7 \text{ SvGy}^{-1}$ ) and  $T$  is the time of exposure for a year (8760 h) (UNSCEAR, 2000).

Radium equivalent activity ( $Ra_{eq}$ ) is used to assess the different mixtures of environmental materials and hazards associated with radionuclide contained in the materials. The radium equivalent measured in  $\text{Bqkg}^{-1}$  was calculated using Equation 4. (EC, 1999), where  $A_U$ ,  $A_{Th}$  and  $A_K$  are as already define.

$$Ra_{eq} = A_U + 1.43A_{Th} + 0.077A_K \quad (4)$$

The hazard indices evaluate the potential radiological hazard. It is a safety criterion for materials used for building purposes. External hazard index ( $H_{ex}$ ) was calculated using Equation 5:

$$H_{ex} = \frac{A_U}{370} + \frac{A_{Th}}{259} + \frac{A_K}{4810} \quad (5)$$

The internal hazard index ( $H_{in}$ ) further quantify the exposure to radon and its decay products when samples are used as part of building materials, and this was determined using Equation 6:

$$H_{in} = \frac{A_U}{185} + \frac{A_{Th}}{259} + \frac{A_K}{4810} \quad (6)$$

### 3 RESULTS AND DISCUSSION

Table 1 present the results obtained for radionuclides detected in the samples analyzed and this shows that the radionuclides detected belong to the natural terrestrial radionuclides headed by  $^{238}\text{U}$ ,  $^{232}\text{Th}$  series and the singly-occurring radionuclide  $^{40}\text{K}$ . No artificial radionuclide was detected. The mean values obtained are  $15.65 \pm 1.94 \text{ Bqkg}^{-1}$  for  $^{238}\text{U}$ ,  $4.23 \pm 0.27 \text{ Bqkg}^{-1}$  for  $^{232}\text{Th}$   $1006.29 \pm 53.69 \text{ Bqkg}^{-1}$  for  $^{40}\text{K}$ . The mean values obtained for  $^{238}\text{U}$  and  $^{232}\text{Th}$  in all the samples are below the recommended means of  $35 \text{ Bqkg}^{-1}$  and  $30 \text{ Bqkg}^{-1}$  while that of  $^{40}\text{K}$  exceed the recommended mean of  $400 \text{ Bqkg}^{-1}$  (UNSCEAR, 2000). The result obtained for the activity concentration of  $^{40}\text{K}$  can be attributed to the geographical formation of the study area.

The various radiological parameters estimated for the soil samples are presented in Table 2. The estimated ADRA values range from  $19.97 \pm 3.61 \text{ nGyh}^{-1}$  to  $71.36 \pm 4.26 \text{ nGyh}^{-1}$  and fall within the range of 24 to  $160 \text{ nGyh}^{-1}$  recommended by (UNSCEAR, 2000). The mean value of  $52.02 \pm 3.27 \text{ nGyh}^{-1}$  obtained can be compared with the mean value of  $55 \text{ nGyh}^{-1}$  within the limit of experimental error. Similarly, the estimated AEDE for the radionuclides range from  $24.48 \pm 4.24 \mu\text{Svy}^{-1}$  to  $87.52 \pm 5.22 \mu\text{Svy}^{-1}$  with a mean value of  $63.79 \pm 4.07 \mu\text{Svy}^{-1}$ . The mean value obtained for all the samples is less than  $70 \mu\text{Svy}^{-1}$  recommended (UNSCEAR, 2000). These results are in agreement with the results obtained by Nwankwo and Olubo (2016) and this is due to the fact the geographical formation of Kwara State are the same.

The values obtained for  $Ra_{eq}$  range from  $40.66 \pm 7.03$  to  $136.83 \pm 8.41 \text{ Bqkg}^{-1}$  with a mean value of  $96.63 \pm 6.45 \text{ Bqkg}^{-1}$ . The mean  $Ra_{eq}$  obtained fall below  $370 \text{ Bqkg}^{-1}$  recommended (EC, 1999). The obtained values for  $H_{ex}$  and  $H_{in}$  range from  $0.11 \pm 0.02$  to  $0.37 \pm 0.02 \text{ Bqkg}^{-1}$  with a mean value of  $0.27 \pm 0.02 \text{ Bqkg}^{-1}$  and  $0.15 \pm 0.02$  to  $0.43 \pm 0.03 \text{ Bqkg}^{-1}$  with a mean of  $0.31 \pm 0.02 \text{ Bqkg}^{-1}$  respectively. This shows that the radiation dose expected to be delivered both externally and internally to the occupants where these soil samples are used as part of building material does not exceed  $1 \text{ Bqkg}^{-1}$  as the international value (EC, 1999).

### 4 CONCLUSION

The radiological investigation of soil samples in Oloru community, Kwara State have been carried out using a well calibrated NaI(Tl) detector. The results obtained indicate that primordial radionuclides ( $^{238}\text{U}$ ,  $^{232}\text{Th}$  decay series) and singly occurring radionuclide  $^{40}\text{K}$  were detected in the soil samples.

The study area can be considered safe for habitation as the mean AEDE value is 6.34% of the 1.0 mSvy<sup>-1</sup> recommended as the maximum permissible dose equivalent for the members of the public (ICRP, 1990). This implies that the soil sample obtained from the study area can be used as building material and also for agricultural practices without posing any radiological threat to the public.

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Table 1: Activity concentration of Radionuclides detected in the soil samples analyzed

Sample Code	<sup>238</sup> U	<sup>232</sup> Th	<sup>40</sup> K
S <sub>1</sub>	1.10 ± 0.24	3.04 ± 0.20	847.61 ± 43.99
S <sub>2</sub>	13.23 ± 1.91	3.88 ± 0.24	1210.73 ± 61.49
S <sub>3</sub>	17.67 ± 2.15	4.21 ± 0.26	1351.93 ± 69.22
S <sub>4</sub>	20.07 ± 2.29	3.56 ± 0.22	924.84 ± 47.59
S <sub>5</sub>	19.76 ± 2.47	5.94 ± 0.36	1232.07 ± 63.13
S <sub>6</sub>	13.23 ± 1.61	6.03 ± 0.36	244.21 ± 63.71
S <sub>7</sub>	15.58 ± 2.00	4.63 ± 0.28	927.73 ± 47.72
S <sub>8</sub>	19.96 ± 2.22	4.52 ± 0.27	1260.54 ± 64.27
S <sub>9</sub>	9.47 ± 1.45	1.39 ± 0.09	848.33 ± 43.94
S <sub>10</sub>	14.17 ± 1.89	4.38 ± 0.27	587.03 ± 30.64
S <sub>11</sub>	23.89 ± 2.61	6.51 ± 0.39	1248.40 ± 63.85
S <sub>12</sub>	4.64 ± 0.82	2.94 ± 0.18	878.40 ± 45.40
S <sub>13</sub>	19.20 ± 2.35	4.16 ± 0.25	1241.42 ± 63.46
S <sub>14</sub>	17.81 ± 2.10	5.26 ± 0.31	1342.16 ± 68.54
S <sub>15</sub>	23.56 ± 2.59	4.90 ± 0.29	1380.13 ± 70.23
S <sub>16</sub>	11.64 ± 1.54	4.47 ± 0.27	1380.70 ± 70.48
S <sub>17</sub>	12.70 ± 1.61	5.03 ± 0.30	1162.79 ± 59.40
S <sub>18</sub>	7.81 ± 1.26	2.05 ± 0.13	1131.54 ± 57.89
S <sub>19</sub>	17.72 ± 2.12	3.72 ± 0.23	1045.52 ± 53.69
S <sub>20</sub>	14.65 ± 1.92	4.09 ± 0.25	1198.13 ± 61.42
S <sub>21</sub>	23.85 ± 2.56	4.71 ± 0.28	594.26 ± 30.70
S <sub>22</sub>	23.08 ± 2.71	4.14 ± 0.25	880.88 ± 45.95
S <sub>23</sub>	19.14 ± 2.26	5.97 ± 0.35	761.80 ± 39.36
S <sub>24</sub>	11.69 ± 1.53	5.36 ± 0.32	573.54 ± 30.01
S <sub>25</sub>	19.74 ± 2.21	5.76 ± 0.34	902.47 ± 46.25
<b>Range</b>	<b>1.10 ± 0.24</b> <b>23.89 ± 2.61</b>	<b>1.39 ± 0.09</b> <b>6.51 ± 0.39</b>	<b>244.21 ± 63.71</b> <b>1380.70 ± 70.48</b>
<b>Mean</b>	<b>15.65 ± 1.94</b>	<b>4.23 ± 0.27</b>	<b>1006.29 ± 53.69</b>

Table 2: Estimated Radiological Parameters of the soil samples analyzed

Sample Code	ADRA (nGyh <sup>-1</sup> )	AEDE (μSvGy <sup>-1</sup> )	R <sub>aeq</sub> (Bqkg <sup>-1</sup> )	H <sub>ex</sub> (mSvy <sup>-1</sup> )	H <sub>in</sub> (mSvy <sup>-1</sup> )
S <sub>1</sub>	38.10 ± 2.08	46.72 ± 2.56	70.71 ± 3.91	0.19 ± 0.01	0.19 ± 0.01
S <sub>2</sub>	59.12 ± 3.56	72.51 ± 4.37	112.01 ± 6.99	0.30 ± 0.02	0.34 ± 0.02
S <sub>3</sub>	67.18 ± 4.01	82.39 ± 4.91	127.78 ± 7.85	0.35 ± 0.02	0.39 ± 0.03
S <sub>4</sub>	49.84 ± 3.13	61.13 ± 3.84	96.37 ± 6.27	0.26 ± 0.02	0.32 ± 0.02
S <sub>5</sub>	64.20 ± 3.95	78.73 ± 4.85	123.12 ± 7.85	0.33 ± 0.02	0.39 ± 0.03
S <sub>6</sub>	19.96 ± 3.61	24.48 ± 4.42	40.66 ± 7.03	0.11 ± 0.02	0.15 ± 0.02
S <sub>7</sub>	48.75 ± 3.05	59.78 ± 3.74	93.64 ± 6.07	0.25 ± 0.02	0.30 ± 0.02
S <sub>8</sub>	64.54 ± 3.83	79.15 ± 4.70	123.49 ± 7.55	0.33 ± 0.02	0.39 ± 0.02
S <sub>9</sub>	40.63 ± 2.53	49.83 ± 3.10	76.78 ± 4.96	0.21 ± 0.01	0.23 ± 0.02
S <sub>10</sub>	33.76 ± 2.28	41.29 ± 2.80	65.63 ± 4.64	0.18 ± 0.01	0.22 ± 0.02
S <sub>11</sub>	67.04 ± 4.06	82.22 ± 4.98	129.32 ± 8.06	0.35 ± 0.02	0.41 ± 0.03
S <sub>12</sub>	40.85 ± 2.38	50.09 ± 2.92	76.48 ± 4.57	0.21 ± 0.01	0.22 ± 0.02
S <sub>13</sub>	63.17 ± 3.84	77.47 ± 4.71	120.74 ± 7.59	0.33 ± 0.02	0.38 ± 0.03
S <sub>14</sub>	67.53 ± 3.99	82.82 ± 4.89	128.68 ± 7.82	0.35 ± 0.02	0.40 ± 0.03
S <sub>15</sub>	71.36 ± 4.26	87.52 ± 5.22	136.84 ± 8.41	0.37 ± 0.02	0.43 ± 0.03
S <sub>16</sub>	65.97 ± 3.80	80.91 ± 4.66	124.35 ± 7.35	0.34 ± 0.02	0.37 ± 0.02
S <sub>17</sub>	57.65 ± 3.39	70.70 ± 4.15	109.43 ± 6.61	0.21 ± 0.01	0.33 ± 0.02
S <sub>18</sub>	52.25 ± 3.06	64.08 ± 3.75	97.87 ± 5.90	0.26 ± 0.02	0.29 ± 0.02
S <sub>19</sub>	54.01 ± 3.32	66.24 ± 4.07	103.54 ± 6.58	0.35 ± 0.02	0.33 ± 0.02
S <sub>20</sub>	59.34 ± 3.57	72.78 ± 5.85	112.75 ± 7.01	0.31 ± 0.02	0.34 ± 0.02
S <sub>21</sub>	38.35 ± 2.58	47.03 ± 3.16	76.34 ± 5.32	0.21 ± 0.01	0.27 ± 0.02
S <sub>22</sub>	49.70 ± 3.26	60.95 ± 4.13	96.87 ± 6.60	0.26 ± 0.02	0.32 ± 0.03
S <sub>23</sub>	44.20 ± 2.86	54.21 ± 3.51	86.34 ± 5.79	0.23 ± 0.02	0.29 ± 0.02
S <sub>24</sub>	32.69 ± 2.13	40.09 ± 2.61	63.52 ± 4.29	0.17 ± 0.01	0.20 ± 0.02
S <sub>25</sub>	50.23 ± 3.12	61.60 ± 3.82	97.47 ± 6.26	0.26 ± 0.02	0.32 ± 0.02
<b>Range</b>	<b>19.96 ± 3.61</b> <b>71.36 ± 4.26</b>	<b>24.48 ± 4.42</b> <b>87.52 ± 5.22</b>	<b>40.66 ± 7.03</b> <b>136.83 ± 8.41</b>	<b>0.11 ± 0.02</b> <b>0.37 ± 0.02</b>	<b>0.15 ± 0.02</b> <b>0.41 ± 0.03</b>
<b>Mean</b>	<b>52.02 ± 3.27</b>	<b>63.79 ± 4.07</b>	<b>99.63 ± 6.45</b>	<b>0.27 ± 0.02</b>	<b>0.31 ± 0.02</b>

# Assessment on farmers' agricultural practices, uses of organic manure, variety and availability of water in Madaya township, Myanmar

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DOI: 10.29322/IJSRP.8.8.2018.p8082

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8082>

## Abstract

To investigate the farmers' currently used varieties, water management and uses of organic manures, and to evaluate the farmers' perception on climate change, the study was conducted in three village tracts in Madaya township, Mandalay region in January 2017. Purposive random sampling method was used to select 63 respondents from the study area and both qualitative and quantitative data were collected using a structured questionnaire. Most of the farmers (49.2%) in this study are middle aged. The majorities of the farmers are middle-scale farmers (96.8%). The respondents (50.8%) are well-experienced in farming and the most farming experiences are 25-40 years. Almost all of the farmers (92.1%) are male household head. Most farmers in the study area finished their educations in the primary (36.5%) and middle (33.3%) schools. With being of the irrigated village tract, there were found most easy for irrigation (87.3%). Therefore, most farmers practices continuous flooding (44.4%). But some farmers (12.7%) have the difficulties about irrigation because their fields were in tail end of canal (25.4%). The constraints are that the water is not available when necessary (39.7%) and sometimes they experienced the flooding (6.3%). In the study area, there were found scarcity of organic manure for soil amendment in their fields (87.3%). For the farmers' perception on climate change awareness upon the agricultural practices, the farmers noticed the climate change not only on their environment but also on their agricultural practices. However, according to statistical results, they can be supposed that they have no experience about the causes of climate change and agricultural practices are one of the anthropogenic activities for climate change.

**Key words:** rice variety, irrigation water, organic manure, perception on climate change

## Introduction

In 2011-2012, Myanmar's rice area was 7.59 million hectares and total production was 29.01 million metric tons (MOAI 2015). Although one fourth of total area of the country is cultivable land, presently there are only about 20 million acres of net sown area in Myanmar. Most of Agricultural lands are currently cultivated by small scale farmers. The average size of holdings is 5.6 acres and most of the farmers in Myanmar owns lands from 5 acres to 10 acres (MOAI 2004).

In South Asia, 75% of farmers are smallholders (*APAARI and IFPRI 2013*). It is important to acknowledge that increasing smallholder productivity not only improves smallholders' food security but also global food security because they produce such a large share of developing countries' food supplies. Its importance for global food security is expected to rise because of a growing world population (*HLPE 2013*). The massive agricultural research and technology transfer effort of the 1960s and 1970s, often referred to as the 'green revolution', led to dramatic increases in agricultural productivity. Smallholders in developing countries, especially in Asia and Latin America, benefited substantially from these advances in agricultural research as well as from strong extension services (*Ellis 2005*). However, many of these production gains resulted in environmental degradation (*IFAD 2013*). Not only does food production need to increase substantially in order to meet future demand, but with climate change, there is considerable concern that we may even struggle to sustain current food production levels. Therefore, agricultural productivity needs to rise both to meet new demand and to offset expected climate-related yield losses in some regions (*GAFSP 2009*).

As global warming is being felt all over the world, Myanmar also suffers from the adverse effects of climate change such as scarcity of rainfall, irregular rainfall, heat stress, drought, flooding, sea water intrusion, land degradation, desertification, deforestation and other natural disasters (MOAI 2015). By 2030, Myanmar aims, achieve food security and nutrition and climate resiliency, with a globally competitive agriculture sector attaining high productivity through climate-smart good agricultural practices (GAP) resulting in higher standard of living especially in the rural areas. Feeding the country's population in the context of climate change will require gradual and significant expansion of agricultural products. Adopting agricultural practices that are able to withstand changes in climate and contribute to the reduction of GHG emissions require the application of new technologies, modification of existing ones, and revision of relevant laws and policies. Therefore, the development of a Climate smart agriculture (CSA) strategy is indispensable in boosting agriculture and food security in Myanmar (MOAI 2015).

The objective of this study is to investigate the farmers' currently used varieties, water management and uses of organic manures, and to evaluate the farmers' perception on climate change.

## Research Methodology

### Description of study area

Madaya is situated at 22° 13' 0" N and 96° 7' 0" E. The total area is 1098 km<sup>2</sup>. The rural area is 233767 km<sup>2</sup> (90.6 %) and the urban is 24237 km<sup>2</sup> (9.4 %). The population is 258001 and the population density is 235.0 per km<sup>2</sup>. Over hundreds and twenty two thousand (122879=47.6 %) out of total population is male population and 135122 (52.4 %) is female population (Online Wikipedia). There are eighty eight village tracts with total of 285 villages. The allocated land area of Madaya township is shown in Table 1. There are 98669 acres of dry and wet land areas occupying 43502 acres of summer rice areas and 55167 acres of monsoon rice areas. Irrigated areas are 42225 acres and favorable area 1277 acres in summer season. Irrigated areas are 42917 acres, favorable area 10708 acres and rainfed areas are 1542 acres in rainy season. Seven rice varieties (IR 50, 90-day, 110-day, Pyi Taw Yin, Manawthukha, Ayeyarmin and Thuhtaygyi) are cultivated. Out of them IR 50 is cultivated for 3500 acres (6.3 %) of rainy season and 35902 acres (82.5 %) of summer season (DOA Madaya 2016). Irrigation water was mainly from Si Taw Kyi Dam, Madaya. The total serviceable area of Si Taw Kyi Dam is shown in Table 2.

### Data collection

This study was conducted in January 2017. Purposive random sampling technique was used. The highest rice producers according to data from Department of Agriculture (DOA), Madaya were selected for the questionnaire survey. Three village tracts (Tha Min Twin, Si Taing Kan and Kan Lal Khon) were chosen according to their irrigation water availabilities and large rice production of DOA, Madaya also. The sample size from each village tract was 21 respondents and therefore a total of 63 summer and rainy seasons rice producers. Demographic data, socio-economic data, availability of irrigation water, uses of organic manures, rice varieties, constraints of farmers related to them and farmers' awareness to climate change were prepared in the structured questionnaire. Secondary data were recorded from Department of Agriculture, Head office, Madaya township. Data analyses were done by using SPSS (Version 22.0).

## Results and Discussion

### Socio-demographic factors of the respondents in the study area

In this study, the minimum age of respondents is 27 and maximum age is 78. The mean age of the respondents was 51.5 years. The majority (49.2%) of the respondents were between the ages of 45 to 61 years. This was followed by 31.8 % of them whose ages ranged from 27 to 44 years, 19.0% were between the ages of 62-78 years. This implies that majority of the respondents were within the middle ages and hence they could engage actively in rice production and innovative in perception of new technology and methods (Table 3).

The total farm size varied from 4 to 200 ac, with a mean value of 15.4 ac. 61 (96.8%) of the farmers was within 4-69 ac group. But these respondents owned only less than 31 ac, herein 27 respondents owned between 4-10 ac and 32 respondents between 11-19 ac and only two respondents owned 21 ac and 30 ac respectively. Whereas only one respondent (1.6%) owned 200 ac and another one (1.6%) owned 85 ac. According to result, most of the farmers could be characterized as medium scale farmers in the study area (Table 3).

The minimum farming experiences was 9 years and the maximum was 56 years. The average farming experience was 30.6 years. The majorities (50.8%) of respondents were in the range of 25-40 farming experiences. 31.8 % of respondents have the farming experiences from 9-24 years. The rest 11 (17.4 %) of respondents have the farming experience of 41-56 years (Table 3).

Among the respondents, male respondents were 92.1 % and females were 7.9 %. It was observed that large proportions were male household heads and they managed the farming operation (Table 3).

#### Education level

Education is important to accept the new technology and practices and to percept the innovative and the good agricultural practices. Education level can improve the social and living status of population. Educated person can get many experiences and knowledge through books and papers. Therefore literacy is important for national development and well beings. Education can be fulfilled through monastery, primary school (1-5 years), middle school (6-9 years), high school (10-11 years) and university (graduate) (14 years).

Most of respondents who completed primary education were 36.5 % and followed by middle education level group (33.3 %) of the respondents. 8 (12.7 %) out of total respondents finished the high school. In the study area, some (11.1 %) of respondents finished their education in Monastery. Only 6.4 % of the respondents are graduated (Table 4).

#### Availability of Irrigation Water

The study area was in Madaya township and most of farms were irrigated because there was Si Taw Kyi Dam and it can deliver the irrigated water for farming. In the availability of water for irrigation, 55 respondents (87.3 %) out of total 63 gave the answer for easy irrigation whereas only 8 (12.7 %) of respondents said that difficult condition for irrigation. Because farms of some (25.4 %) of respondents was in the tail end of canal. But farms of most (50.8 %) of the respondents are close to canal, in the other hand, in the upstream of canal. Farms of 23.8 % of respondents were in the downstream to canal. Most of the water for farming in the study area came from dam (98.4 %) and only 1.6 % got the water for farming by pumping from stream (Table 5).

For times of irrigation, most (38.1 %) of farmers irrigated 14-25 times per crop season. Similarly 36.5 % respondents preferred to keep the standing water in their fields so they irrigated more than 25 times per crop season. In decision for irrigation, the majorities (49.2 %) of farmers irrigated their crops when the soil dried or run out of water and 44.4 % farmers always keep their fields with standing water whereas only 6.4 % farmers irrigated depending on the plant growth (Table 5).

About the irrigation water for farming in the study area, there were no constraints for 54.0 % respondents. But some farmers (39.7 %) gave the constraint about irrigation water that is they can't get the water when necessary. However, 6.3 % farmers replied that sometimes their fields experience flooding (Table 5).

#### Uses of Organic Manures and Rice Varieties

In the study area, there are three crops seasons in one year (summer rice, rainy rice and winter food legumes). So the soil didn't get the rest besides most of farmers didn't incorporate the stubble in the fields because of time limited condition for stubble decomposition. In recent time, the agriculture led to sustainable. In this aspect, organic manure plays the vital role not only for food safety but also for sustainable management. On the other hand, the manure gives rise to global greenhouse gases emission from agricultural soil. Therefore the farmers were asked for their organic manure uses in their fields for soil amendment. There were 57.1 % of respondents who used manure in their fields. About half of respondents (42.9%) didn't use manure in their fields. For respondents who use manure in their fields, they were asked for types of organic manures. In this study, stubble was one type of organic manure because farmers in this area burned the stubble for limited time of decomposition. Some respondents gave more than one answer. Most (80.6%) of the respondents used cowdung manure for their field amendment. 25% respondents used back the stubble in their fields. Other residues (dried leaves, rubbish, rice hull ash, goat manure) were used only for 19.4% respondents. Again farmers who used cowdung manure were asked the amount of cowdung manure. In this case, this character was categorized two type; one is equal and below of recommended cowdung manure ( $5t\ ha^{-1}$  or  $4\ carts\ ac^{-1}$ ) and the another is greater than the recommended amount ( $>5t\ ha^{-1}$  or  $4\ carts\ ac^{-1}$ ). In total cowdung manure used farmers, 79.3% farmers applied less than  $4\ carts\ ac^{-1}$  and only 20.7% farmers used more than  $4\ carts\ ac^{-1}$  (Table 6).

There were so many constraints for organic manure amendment in the study area. The main constraint was that organic manures were not available enough because this area was reformed to mechanized farming and they didn't give time for the soil amendment. Some farmers (28.6%) didn't apply any manure because of difficult land preparation. Some (15.9%) farmers said that because of high cost of organic manure in their area. 7.9% farmers replied they didn't use manure because they kept the farmyard manure for feed of cattle. Only 3.2% farmers stated soil problem (weeds and disease incidence of organic manure adding) (Table 6).

Rice varieties (Ayeyarmin, IR 50, Manawthukha, Basmati, 90 day variety) were grown in the study area. In summer season, only IR 50 (89.2%) and 90 day variety (10.8%) were grown. In rainy season, Ayeyarmin (51.7%), IR 50 (33.9%), Manawthukha (7.4%), Basmati (1.7%) and 90 day variety (5.3%) were grown in this study area (Table 7).

About the constraint for availabilities of seed, there were no constraints for 47.6% farmers. But some farmers (30.2%) had the constraint for not purities of seed. Other (22.2%) farmers said that they couldn't get the enough seed for their cultivation (Table 7).

#### Farmers' awareness on climate change

The level of awareness was stated as the degree to which the farmers had information on climate change and agricultural practices related to climate change. There was different awareness of people to the adverse impact of climate change among the respondents in the study area. The strongly agree on too high temperature and decrease raining day was described by 52.3% and 41.3%. The highest percentage on dry period is longer, suffered from drought, induced little cool, induced too cool, too little rainfall and too much rainfall was described in the decreasing order (50.8%, 47.6, 47.6, 44.4, 46.0, and 38.1, respectively). The awareness on flood incidence was described as highest percentage of disagree (31.8%) among the respondents in this study area (Table 8).

Agriculture is one of the most vulnerable sectors to the climate change as this primary production activity is highly linked with the natural resources and the environment. The effect of climate change on agriculture is due to three major impacts, namely temperature rise, rainfall variation and carbon fertilization effects (Herath and Dharmakeerthi 2010). The effects of climate change on local environment, socio-economic condition and agricultural production was surveyed in this study. The information of farmers' awareness on effect of climate change on local environment, socio-economic condition and agricultural production was described in Table 4.9. Most of the respondents described the agreement on effect of local environment, socio-economic condition, decrease agricultural production, increase incidence of pest, disease and weeds by 46.0%, 42.9%, 49.2%, 44.4%, 41.3% and 38.1, respectively. Agricultural production disturbed due to climate change was supported by strongly agreement (50.8%) among the respondents (Table 9).

Climate change was caused by natural and anthropogenic activities. Agriculture is one of the anthropogenic activities for releasing greenhouse gases to atmosphere. Therefore, the awareness of respondents on agricultural practices induced climate change was studied. Unfortunately, most of the respondents didn't notice the information about agricultural practices induced climate change although they aware the effect of agricultural practices to climate change by 41.3% in this study area. So undecided answers were recorded on two or three days puddling duration induced methane, continuous flooding induced methane, un-decomposed cowdung induced methane, using urea induced nitrous oxide and

methane, and rice-rice cultivation induced climate change by 85.7%, 84.1%, 76.2%, 65.1% and 47.6%, respectively. But they agreed that burning of rice straw produced carbon dioxide and nitrous oxide by 52.4% and mismanagement of cultural practices induced climate change by 66.7% (Table 10).

Mean awareness score were classified as above 2 and below 2. Mean score above 2 revealed the awareness of respondents on the climate change induce agricultural practices. Most of the scores were observed above 2 in this study (Table 8, 9, 10). These results implied that the respondents aware of the climate change induced agricultural practices.

## Conclusion

The survey was conducted in the four villages within three village tracts. The average population is about 800 in each village. The main economy in these villages is farming. Most of the farmers (49.2%) in this study are middle aged. So they are active to learn and to observe the new methods and technology. This study was conducted depending on the irrigation capacity and large farming area. However, according to the farm size in the survey, the majorities of the farmers are middle-scale farmers and they can't afford the inputs shown on organic manure uses. The respondents (50.8%) are well-experienced in farming and the most farming experiences are 25-40 years because the farming is their professional heritage. It was observed that almost all of the farmers are male household head. However, most farmers in the study area finished their educations in the primary and middle school. With being of the irrigated village tract, there were found most easy for irrigation. Therefore, most farmers practices continuous flooding and they believe the rice plant can give good yield with standing water. But some farmers (12.7%) have the difficulties about irrigation because their fields were in tail end of canal. Their constraints are that the water is not available when necessary and sometimes they experienced the flooding. According to results, it can be suggested to construct the new canal and control the water hole, and to repair and clean the old canal for good water flowing. In the study area, there were found scarcity of organic manure for soil amendment in their fields. Besides, this area was mechanized for farming. As a result, in some farmers there are no cattle and no manure. Furthermost, as mentioned above, these farmers can't afford to put the manure in their fields. Therefore, it can be needed that extension workers should train the farmers in compost making of available materials for their sustainable soil amendment.

For the farmers' perception on climate change awareness upon the agricultural practices, some questionnaires were prepared and asked. The farmers noticed the climate change not only on their environment but also on their agricultural practices. However, according to statistical results, they can be supposed that they have no experience about the causes of climate change and agricultural practices are one of the anthropogenic activities for climate change. Therefore, it can be concluded that there need the agricultural extension services and works in the study area.

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Table 1: Agricultural land allocation in Madaya township

No.	Item	Land area (acre)
1	Agricultural Land	134823
	Lowland	53421
	Upland	32916
	Kai/Kyung	45283
	Horticultural Land	3203
2	Unable to cultivate	102519
3	Fallow land	12
4	Wild land	15021
5	Wood land	38812
	Total	291187

Source: DOA, Madaya, 2016

Table 2: Total serviceable area of Si Taw Kyi dam in Mandalay Region

No.	Township	Acre
1	Madaya	57364
2	Mandalay	165
3	Patheingyi	27097
4	Amarapura	12263
	Total	96889

Sources: ‘Irrigation Department, Madaya Township (2009)

Table 3: Socio-demographic factors of the respondents in the study area

	Items	Frequency	Percentage
Age (yrs)	27-44	20	31.8
	45-61	31	49.2
	62-78	12	19.0
	Mean	51.5	
Farm size (ac)	4-69	61	96.8
	70-134	1	1.6
	135-200	1	1.6
	Mean	15.4	
Farming experiences (yrs.)	9-24	20	31.8
	25-40	32	50.8
	41-56	11	17.4
	Mean	30.6	
Gender (%)	Male	58	92.1
	Female	5	7.9

n=63

Table 4: Education status of respondents in the study area

No.	Education Status	Frequency	Percentage
1	Monastery	7	11.1
2	Primary school	23	36.5
3	Middle school	21	33.3
4	High school	8	12.7
5	Graduate	4	6.4

n=63

Table 5: Availability of Irrigation water of Respondents in the study area

	Items	Frequency	Percentage
Availability of water	Easy	55	87.3
	Difficult	8	12.7
Nearness to water source	Upstream	32	50.8
	Downstream	15	23.8
	Tail end	16	25.4
Water supply	Dam	62	98.4
	Pump	1	1.6
Times of irrigation	2-13	16	25.4
	14-25	24	38.1
	>25 (Continuous)	23	36.5
Decision for irrigation	Soil dry	31	49.2
	Depend on growth	4	6.4
	Continuous	28	44.4
Constraints	Nil	34	54.0
	Not available when necessary	25	39.7
	Flooding	4	6.3

n=63

Table 6: Uses of Organic Manures of Respondents in the study area

	Items	Frequency	Percentage
Use of organic manure	Yes	36	57.1
	No	27	42.9
Types of organic manure	Stubble	9	25
	Cowdung	29	80.6
	Other residue	7	19.4
Amount of cowdung manure	≤ 4 carts/ac	23	79.3
	> 4 carts/ac	6	20.7
Constraints	Not available	55	87.3
	Difficult land preparation	18	28.6
	Feed for cattle	5	7.9
	High cost	10	15.9
	Soil problem	2	3.2

n=63

Note: Total numbers of farmers are more than 63 because one farmer gives more than one answer.

Table 7: Uses of Rice varieties of Respondents in the study area

	Items	Frequency		Percentage	
		Summer season		Rainy season	
Rice varieties	Ayeyarmin	-		51.7 %	
	IR 50	89.2 %		33.9 %	
	Manawthukha	-		7.4 %	
	Basmati	-		1.7 %	
	90 day variety	10.8 %		5.3 %	
Constraints	Nil	30		47.6 %	
	Not pure	19		30.2 %	
	Not enough	14		22.2%	

n=63

Table 8: Farmers' awareness of climate change in the study area

No.	Statement	SD		D		U		A		SA		Mean
		No.	%	Score								
1	Some places had too high temperature	0	0	3	4.8	0	0	27	42.9	33	52.3	4.43
2	Some places had decrease raining day	1	1.6	13	20.6	3	4.8	20	31.7	26	41.3	3.90
3	In some places, dry period is longer	1	1.6	6	9.5	1	1.6	32	50.8	23	36.5	4.11
4	Some places are suffered from drought	0	0	8	12.7	2	3.2	30	47.6	23	36.5	4.08
5	Some places of winter season induced little cool	1	1.6	16	25.4	0	0	30	47.6	16	25.4	3.70
6	Some places of winter season induced too cool	1	1.6	14	22.2	1	1.6	28	44.4	19	30.2	3.79
7	Some places had too little rainfall	1	1.6	13	20.6	2	3.2	29	46.0	18	28.6	3.79
8	Some places had too much rainfall	1	1.6	15	23.8	1	1.6	24	38.1	22	34.9	3.81
9	In some places , flood is in incidence	14	22.2	20	31.8	12	19.0	13	20.6	4	6.4	2.57

SD= Strongly Disagree, D= Disagree, U= Undecided, A= Agree, SA= Strongly Agree

Table 9: Farmers' awareness of climate change on local environment, socio-economic condition and agricultural production

No.	Statement	SD		D		U		A		SA		Mean Score
		No.	%	No.	%	No.	%	No.	%	No.	%	
1	Climate change affects on local environment	2	3.2	8	12.7	2	3.2	29	46.0	22	34.9	3.97
2	Climate change affects on socio-economic condition	1	1.6	8	12.7	2	3.2	27	42.9	25	39.7	4.06
3	Agricultural production was disturbed	0	0	10	15.9	2	3.2	19	30.2	32	50.8	4.16
4	Decrease agricultural production	1	1.6	9	14.3	0	0	31	49.2	22	34.9	4.02
5	Increase incidence of pest	2	3.2	11	17.5	0	0	28	44.4	22	34.9	3.90
6	Increase incidence of disease	1	1.6	14	22.2	1	1.6	26	41.3	21	33.3	3.83
7	Weed infestation	1	1.6	23	36.5	1	1.6	24	38.1	14	22.2	3.43

SD= Strongly Disagree, D= Disagree, U= Undecided, A= Agree, SA= Strongly Agree

Table 10: Farmers' awareness on climate change related to agricultural practices

No.	Statement	SD		D		U		A		SA		Mean Score
		No.	%	No.	%	No.	%	No.	%	No.	%	
1	Climate change is related to agriculture	3	4.8	6	9.5	8	12.7	26	41.3	20	31.7	3.86
2	Two or three days puddling duration induced methane	1	1.6	3	4.8	54	85.7	5	7.9	0	0	3.00
3	Continuous flooding of paddy field induced methane	1	1.6	2	1.6	53	84.1	7	11.1	0	0	3.05
4	Un-decomposed cowdung induced methane	0	0	0	0	48	76.2	13	20.6	2	3.2	3.27
5	Using urea induced nitrous oxide and methane	0	0	1	1.6	41	65.1	18	28.6	3	4.8	3.37
6	Burning of rice straw produced carbon dioxide and nitrous oxide	0	0	1	1.6	26	41.3	33	52.4	3	4.8	3.60
7	Rice-rice cultivation induced climate change	6	9.5	11	17.4	30	47.6	14	22.2	2	3.2	2.92
8	Mismanagement of cultural practices induced climate change	2	3.2	7	11.1	9	14.3	42	66.7	3	4.8	3.58

SD= Strongly Disagree, D= Disagree, U= Undecided, A= Agree, SA= Strongly Agree

# Evaluation of Different Rates of Organic Manure and Water Management Practices on Methane Emission from Rice Production

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DOI: 10.29322/IJSRP.8.8.2018.p8083

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8083>

**Abstract:** To find out the water management and organic manures practices to obtain minimum methane emission, the pot experiments were conducted during the summer and rainy season 2017. Split plot design with three replications was used. Two water management practices and four cowdung manure rates were allocated in main and sub factor arrangement. IR 50 was planted with twenty one seedling age. In summer season, the gas sampling at 8 DAT expressed the second largest amount of methane emission. At 14 DAT, the largest methane emission was found. At later DATs until harvest, the smaller amount of methane emission was recorded. Numerically, the higher methane emission was observed from CF over AWD. The surface water pH was highly statistically correlated with methane emission. In continuous flooding, the highest methane emission was recorded from OM<sub>3</sub> and the lowest emission from OM<sub>0</sub>. In alternate wetting and drying (AWD), the higher methane emissions were recorded from OM<sub>0</sub> and OM<sub>3</sub> and the lowest emission from OM<sub>1</sub>. In rainy season experiment, there was statistically different in methane emission among the water management. CF gave the higher methane emission at every gas sampling over AWD practice. The surface water pH was highly correlated with methane emission. In continuous flooding, the highest methane emission was observed from OM<sub>2</sub> and the lowest emission from OM<sub>0</sub>. In alternate wetting and drying practice, the highest methane emission was recorded from OM<sub>0</sub> and the lowest one from OM<sub>3</sub>.

**Key words:** rice, organic manure, water management, methane emission

## 1. Introduction

Globally rice is a crucial crop: it has a central role in providing food, it has a central role in providing employment, and it has substantial environmental impacts. Globally rice is estimated to be responsible for 19% of anthropogenic methane emissions, second only to ruminants (Chen and Prinn 2006).

Most of the world's rice grows in inundated conditions, and one of the most promising techniques for reducing rice-related emissions is to reduce or interrupt the periods of flooding. The production of rice in flooded paddies produces methane because the water blocks oxygen from penetrating the soil, creating conditions conducive for methane-producing bacteria. Methanogenesis, methane production, is a microbial process strictly limited to anaerobic conditions (Ma et al. 2010).

Methane is produced from the respiration of organic matter in anaerobic conditions. Given the existence of abiotic conditions in a paddy soil, the supply of methanogen substrate – soil organic matter – is the commonest limiting factor for methanogenesis (Yao et al. 1999; Wang et al. 2000). Organic matter typically arise from four sources – three imported or easily controllable sources: animal manure, green manure and crop residues (straw, stubble, roots), and one by-product of rice production – this year's root exudates, sloughed off root cells, root turnover. The addition of 5t rice straw ha<sup>-1</sup> increased CH<sub>4</sub> emissions tenfold compared to the use of urea alone (Neue et al. 1996), and the CH<sub>4</sub> reductions associated with alternate irrigation was lost when rice straw was added compared to continuously flooded paddy, measured per tonne of paddy (Adhya et al. 2000).

Rice farmers tend to keep their fields continuously submerged to control weeds, although long-term experiments suggest that continuous puddling for rice destroys soil physical properties and affects both the puddled rice yield and the following crop negatively (<http://www.fao.org/teca/content/alternatives-rice-puddling-and-transplanting>). Rice environments with an insecure supply of water, namely rainfed rice, have a lower emission potential than irrigated rice.

Alternate Wetting and Drying (AWD) is a water-saving technology that lowland (paddy) rice farmers can apply to reduce their water use in irrigated fields. Hence, the field is alternately flooded and non-flooded. The number of days of non-flooded soil in AWD between irrigations can vary from 1 day to more than 10 days depending on the soil type. Water savings may be up to 15-25 percent with no yield penalty. The AWD promotes good root anchorage, thus reduction in plant lodging problems. The AWD reduces 30-70 per cent of methane emissions depending on the combination of water usage and management of rice stubble (FAO 2013).

Methane emission depends on soil type, weather condition (i.e. temperature, rainfall), varieties, water management, organic amendment and cultural practices. Nowadays human beings noticed well about the climate change and are alert in GHG emission mechanisms. A little has been known the methane emission from paddy fields in the country. This study was, therefore, carried out to investigate the methane emission from paddy field. The pot experiments were conducted in summer and rainy season 2017 with the following objectives: to evaluate the performance of rice plant as affected by different rate of organic manure and water management practice and to find out the suitable organic manure rate and water management practice on methane emission.

## 2. Materials and Methods

The pot experiment was conducted at farmer's field in Si Taing Kan village tract during the summer and rainy seasons. The pots were arranged in split plot design with three replications. The water management (continuous flooding (CF) and alternate wetting and drying (AWD)) was arranged as main plot factor. Different rates of organic manure were assigned as subplot factor. In this study, cowdung manure was applied as organic manure.

Soil was collected from paddy field to use as experimental pot soil. The soil and cowdung manure were analyzed at Water Science Section, Water Utilization and Agricultural Engineering Division, Department of Agricultural Research (DAR). The results of properties of soil and cowdung manure are shown in Appendix I. The meteorological data for the study period (February to October) are shown in Appendix II.

### 2.1 Treatment application

The calculated cowdung manure according to treatments ( $OM_0$  = no cowdung,  $OM_1$  = half of recommended cowdung ( $2.5 \text{ tons ha}^{-1}$ ),  $OM_2$  = recommended cowdung ( $5 \text{ tons ha}^{-1}$ ) and  $OM_3$  = one and half of recommended cowdung ( $7.5 \text{ tons ha}^{-1}$ ) were put at seven days before transplanting. The recommended cowdung manure is  $5 \text{ t ha}^{-1}$  ( $4 \text{ cart load ac}^{-1}$ ). Each pot received the recommended fertilizer at the rates of  $86.8 \text{ kg N ha}^{-1}$ ,  $30.2 \text{ kg P}_2\text{O}_5 \text{ ha}^{-1}$ ,  $18.9 \text{ kg K}_2\text{O ha}^{-1}$ . Urea, T-super and Potash were used as nutrient element sources. Urea was applied as three equal splits at active tillering, panicle initiation and heading growth stages. T-super was applied only as basal at one day before transplanting and potash fertilizer was used for two equal splits at basal and panicle initiation.

Field water tubes were installed in the AWD pots at a depth of 15 cm below the soil surface in between the seedlings and base just after transplanting. For AWD pots, whenever there was no water in the field tube, irrigation water was applied until 5 cm depth above the soil surface. The irrigation interval ranged from 4 to 9 days and the amount ranged from 7 to 13 liters depending on the different rates of cowdung manure in AWD pots. Withdrawal of water was started one week before the harvest period in all water treated pots.

## 2.2 Data Collection

### Soil parameters

Surface water pH was recorded by using pH meter (HI8314, Hanna, Japan). Redox potential was taken by ORP meter (HI8314 Hanna, Japan) with probes. Soil temperature was collected with waterproof digital thermometer (CT-300WP, Tokyo, Japan). These parameters were recorded along with gas sampling time. Soil (15 g) was taken from soil surface of each pot for soil pH analysis. Soil pH was analyzed at Department of Agriculture, Madaya using pH meter in 25:1 ratio of deionized water and soil.

### Gas sampling and calculation

Just after transplanting, the base was put to the gas sample plant to avoid the disturbance of the environmental conditions around the rice plants during chamber deployment. The base was equipped with a water seal to ensure gas-tight closure. The base remained embedded in the soil throughout the rice growing period. The two-binded chamber of total capacity of 77 L (93 cm height) was used for collecting gas sample. The mouth of closed chamber had diameter of 41 cm. Therefore the diameter of chamber base is wide to 40 cm with 3 cm wide-water seal. The chamber was painted with white color to prevent the absorption of temperature. To thoroughly mix the gases in the chamber, the chamber was equipped with a small fan of 12 volt DC connected with three 9-volts dry cells. For CH<sub>4</sub> calculation, temperature was recorded with a digital thermometer (TT-508 Tanita, Tokyo, Japan). For compensation of air pressures between increased temperature and gas sampling, an air buffer bag (1-L Tedlar bag) was attached to chamber. The silicon rubber tube together with the soft vinyl tube (In dia 3mm x out dia 5 mm) attached with double three-way stop corks was inserted air tight to a hole on chamber. The gas sample was taken with airtight 50 ml syringe by inserting it to the three way stop cock. The 50 ml syringe was stroke 5 times for air cleaning before collecting of gas sample. The air inside the chamber was thoroughly mixed by flushing the syringe three times before collection of the gas samples. The gas sample was drawn to the 50 ml volume of syringe through the three way cock from chamber and then transferred to 15 ml vacuum glass vial which were evacuated after adjusting the pressure to the 40 ml volume of syringe.

CH<sub>4</sub> concentration was analyzed with a gas chromatograph (GC 2014, Shimadzu Corporation, Kyoto, Japan) equipped with a flame ionization detector (FID). The amount of CH<sub>4</sub> flux was calculated by using the following equation;

$$Q = (V/A) \times (\Delta c/\Delta t) \times (M/22.4) \times (273/K)$$

Where, Q = the flux of CH<sub>4</sub> gas (mg m<sup>-2</sup> min<sup>-1</sup>)

V = the volume of chamber (m<sup>3</sup>)

A = the base area of chamber (m<sup>2</sup>)

( $\Delta c/\Delta t$ ) = the increase or decrease rate gas concentration (mg m<sup>-3</sup>) per unit time  
(min)

M = the molar weight of the gas,

K = Kelvin temperature of air temperature inside the chamber

Total emissions were calculated by multiplying the daily gas flux at each measurement for the time interval and summing up the values for the growing period.

## 2.3 Statistical analysis

The data were analyzed by using Statistix (version 8.0). Mean comparisons were done by Least Significant Difference (LSD) at 5% level.

## 3. Results and Discussion

### Soil parameters during the summer season, 2017

**Soil temperature:** Different levels of organic manure application gave different mean values of soil temperature (Figure 3.1). In continuous flooding, the start-up high temperature was found at 8 DAT due to the stimulation of organic manure in the soil. The

high soil temperature was given by OM<sub>0</sub> and the low soil temperature from OM<sub>2</sub>. It sharply decreased to minimum value throughout the growing season at 14 DAT. This might be due to soil physicochemical changes affected by weather. Khalil et al. (1998) reported that during the growing season, the temperature changes was driven by diurnal cycles of sunlight and cycles of soil temperature are sometimes observed as weather systems come and go. The high soil temperature was recorded from OM<sub>0</sub>. Then the soil temperature slowly increased until 34 DAT. At that time, the high soil temperature was found in OM<sub>1</sub> and the low soil temperature from OM<sub>3</sub>. This could be due to the decomposition of organic matter. Again at 44 DAT, the soil temperature slightly decreased (about 25 °C), which coincided with panicle initiation stage. From that stage, the soil temperature is gradually increased until 64 DAT and then, decreased again at 74 DAT. From that, the soil temperature increased until harvest because of substrate decomposition.

In AWD, the same trend of soil temperature was recorded. However, the peak soil temperature values were changed depending on growth stages. At 8 DAT, OM<sub>3</sub> gave high soil temperature, OM<sub>1</sub> at 14 DAT, OM<sub>2</sub> at later sampling dates.

The mean effects of soil temperature of different cowdung manure rates under both water regimes were not much different. This result supported the finding of Haque et al. (2016) who stated that the soil temperature was slightly lower when the paddy was flooded than when it was midseason draining. Xu and Hosen (2010) stated that the soil temperature was affected by activity of methanogenic bacteria, the decomposition rate of soil organic matter.

**Soil redox potential:** The different trends of soil redox potential (Eh) of variation was observed in Figure 3.2. In continuous flooding, the soil redox potential was observed between -350 mV and -100 mV. The low redox potential values were recorded from OM<sub>1</sub> at 8 and 14 DAT, OM<sub>3</sub> at 24 DAT, and OM<sub>1</sub> at 34 DAT. During the later growth stage, the redox potential was relatively stable because of microbial process of organic substrates. But mostly low redox potential was given by OM<sub>3</sub>. Jain et al. (2004) reported that in soil with high amount of organic matter, Eh falls to -50 mV and may then slowly decline over a period of a month.

In alternate wetting and drying, the soil redox potential was in the range of -300 to 0 mV. The different trend of soil redox potential was also found. In the early growth stage (8, 14, 24, and 34 DAT), mostly the low redox potential was recorded from OM<sub>2</sub> but in later growth stage, the high fluctuation was found. At 54 DAT, the low value was resulted from OM<sub>2</sub>. OM<sub>1</sub> gave low redox potential at 64 and 84 DAT, OM<sub>3</sub> at 74 and 94 DAT. This is due to the microbial process of organic matter. Ascar et al. (2008) stated that some of abiotic environmental factors such as Eh are strongly influenced by biotic environmental factors.

The mean effects of soil redox potential to different cowdung manure rates were different in both water regimes. After flooding the rice field, the soil Eh values decreased sharply in both continuous flooding and alternate wetting and drying practice within 2 weeks of rice transplanting (Haque et al. 2016). The cowdung manure affected the soil redox potential especially in the continuous flooding. The higher cowdung manure caused the higher reduction condition in the soil. According to the report of Nieder and Benbi (2008), application of organic matter will decrease Eh depending on the degree of humification.

**Surface water pH:** Different mean values of surface water pH were resulted from different levels of organic manure application (Figure 3.3). The values of surface water pH were decreased at 14 DAT and thereafter increasing trends were observed upto 44 DAT. At each DAT, different level of organic manure application showed different values of surface water pH. It was observed that mean values of surface water pH were higher in the early growth stages (from 8 to 64 DAT) as compared to those in the later growth stages (from 74 to 94 DAT) under continuous flooding. This may be due to the microbial breakdown of organic substrates in the early stages and depletion of them in the later growth stages. Gambrell (1994) and Guo et al. (1997) have reported on the influence of soil microbial activities on pH. Zoltan (2008) stated that solute macro- and microelement content may influence on spatial and seasonal variations of surface pH.

Like under continuous flooding, similar trend was observed under AWD. At each DAT, different values of surface water pH were resulted from different levels of organic manure application.

In comparison of both CF and AWD, the pH values under CF were generally higher than those under AWD during 24 – 44 DAT. This period ranged in panicle initiation stage. This increased pH value in CF may be due to the rapid decomposition process by active microbes in the favor of organic substrates in that stage. It was obvious that the range of surface water pH under CF was more wider than that under AWD because some of abiotic environmental factors was strongly influenced by biotic environmental factors, which are also influenced by cultural practice such as water management (Ascar et al. 2008). Oo et al. (2015) found high standing water pH in submerged rice soil. Zoltan (2008) reported that difference in water regime is one of the most important abiotic factors for pH variations.

**Soil pH:** Different mean values of soil pH were observed in different levels of organic manure application (Figure 3.4). The values of soil pH were decreased to 44 DAT and thereafter sharply increasing trends were observed upto 94 DAT except at 84 DAT which showed rapidly decreased. At each DAT, different level of organic manure application showed different values of soil pH. It was observed that mean values of soil pH were lower in the early growth stages (from 14 to 44 DAT) as compared to those in the later growth stages (from 54 to 94 DAT) under continuous flooding. In the early stage of irrigation, neutralized soil condition was resulted because of active microbial process with trapped oxygen.

Like under continuous flooding, similar trend was observed under AWD. Mean values of soil pH were different in different levels of organic manure at each growth stage.

In comparison of both CF and AWD, it was noticed that the soil pH values under CF were generally slightly lower than those under AWD throughout the growing season. The AWD showed slightly alkaline condition. Some microorganisms such as methanotrophs developed in the presence of oxygen and organic substrates, and kept the soil under slightly alkaline condition. Mer and Roger (2001) reported that methanotrophs are ubiquitous in ricefield soils, where their densities were not strongly affected by oxidation status of soil.

#### **Methane emission during the summer season, 2017**

The different amounts of methane emission were observed in the present study (Figure 3.5). In continuous flooding, at 8 DAT, the high methane emission was found, and then it was dramatically increased to highest emission at 14 DAT. This was due to the intrinsic methane production potential of soil and rapid decomposition of cowdung manure. Zou et al. (2005) mentioned that when the field was waterlogged, CH<sub>4</sub> emissions ascended steadily until the peak fluxes were attained approximately 25 days after rice transplanting. Rennenberg et al. (1992) reported that the first emission maxima, observed shortly after flooding, could be attributed to the degradation of organic matter present in the soil. In the present study, small amount of emission was observed in later growth stages to harvest. This might be due to impeding of methanogenic activity and limited carbon source for methanogens. In general, the high methane emission was recorded from OM<sub>3</sub> at all DAT, and the low methane emission was mostly resulted from OM<sub>0</sub>. Khosa et al. (2010) stated that application of organic materials to rice fields significantly increased the rate of methane emission as compared to control plots receiving only inorganic fertilizer as the addition of organic matter selectively enhanced the growth of particular methanogenic populations by providing them carbon source.

In AWD, the same trend of methane emission was observed. The most high methane emission was resulted from OM<sub>2</sub> and low methane emission from OM<sub>1</sub>. The mean values of methane emission in different cowdung manure rates were not different in both water regimes. The methane emission ranged from 0.22 to 511.93 mg CH<sub>4</sub> m<sup>-2</sup> in continuous flooding and 0.03 to 372.25 mg CH<sub>4</sub> m<sup>-2</sup> in AWD. Alternate wetting and drying reduce the amount of time rice fields are flooded and can reduce the production of methane by about 60% or even up to 90% (IRRI, 2009). The total CH<sub>4</sub> emission from intermittently irrigated fields was found to be 22% lower as compared with continuous flooding (Jain et al. 2000). Alternate wetting and drying results in a significant reduction of CH<sub>4</sub> emission, and water drainage and resulting aerobic soil conditions allow the oxidation of CH<sub>4</sub> and avoid CH<sub>4</sub> production (Hussain et al. 2014). Katayanagi et al. (2012) reported that alternate wetting and drying has the potential to reduce CH<sub>4</sub> emission by 73 % compared with traditional flooded rice.

Mean values of cumulative methane emission of rice were different in different levels of organic manure (Table 3.1). Higher cumulative methane emission ( $2645.6 \text{ kg CH}_4 \text{ ha}^{-1}$ ) was found in CF as compared to AWD ( $792.2 \text{ kg CH}_4 \text{ ha}^{-1}$ ). The high organic manure rate gave higher amount of methane emission ( $1968.0 \text{ kg CH}_4 \text{ ha}^{-1}$ ) as compared to others. The mean values of methane emission in different cowdung manure rates were not different in both water regimes (Figure 3.6). However, in concern with water regimes, the higher methane emissions were recorded in CF plots as compared with AWD plots. In CF, the methane emission was found increasing trend depending on the increased cowdung manure rates. Multiple aeration for 2-3 days at 3, 6, and 9 weeks after initial flooding reduced  $\text{CH}_4$  emission by 88% and did not reduce rice yields compared with the normal irrigation (Sass et al. 1992). Wassmann et al. (2000) reported that in alternate wetting and drying, the time intervals between dry and wet conditions appear to be too short to facilitate the shift from aerobic to anaerobic soil conditions resulting in a significant reduction of  $\text{CH}_4$  emission. Water drainage and resulting aerobic soil conditions allow the oxidation of  $\text{CH}_4$  and avoid  $\text{CH}_4$  production. Katayanagi et al. (2012) reported that alternate wetting and drying has the potential to reduce  $\text{CH}_4$  emission by 73% compared with traditional flooded rice. Methane emission from the flooded paddy increases by applying different organic matter sources. Methane production, oxidization and emission from the flooded paddy are highly affected by the added organic matter (Jean and Pierre 2001). Application of organic materials to rice fields significantly increased the rate of methane emissions as compared to control plots receiving only inorganic fertilizer as the addition of organic matter selectively enhanced the growth of particular methanogenic populations by providing them carbon source. The organic materials significantly increased the organic carbon content over the control (Khosa et al. 2010). Schutz et al. (1989), Yagi and Minami (1990), Sass et al. (1991), Cicerone et al. (1992), and Neue et al. (1994) observed that organic amendments to flooded soils increase  $\text{CH}_4$  production and emission by enhancing the reduction of soils and providing carbon sources. Nayak et al. (2013) concluded that livestock manure application in rice increased  $\text{CH}_4$  emission and soil organic C sequestration while considerably decreased  $\text{N}_2\text{O}$  emission.

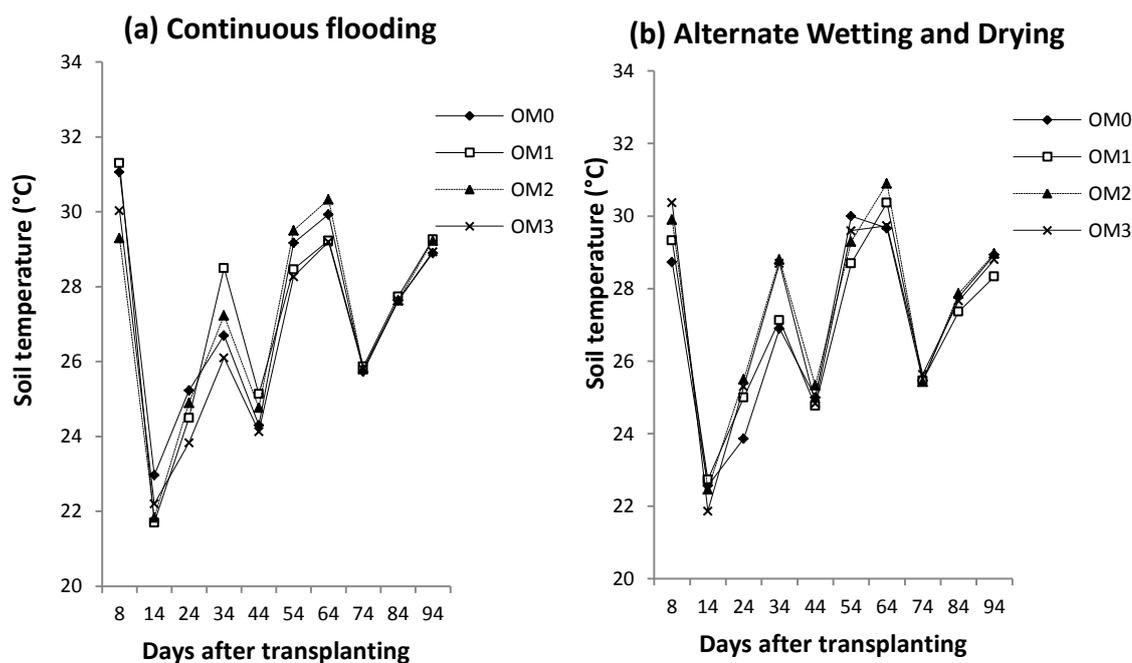


Figure 3.1: Variation in soil temperature (a) continuous flooding and (b) alternate wetting and drying during the summer season, 2017

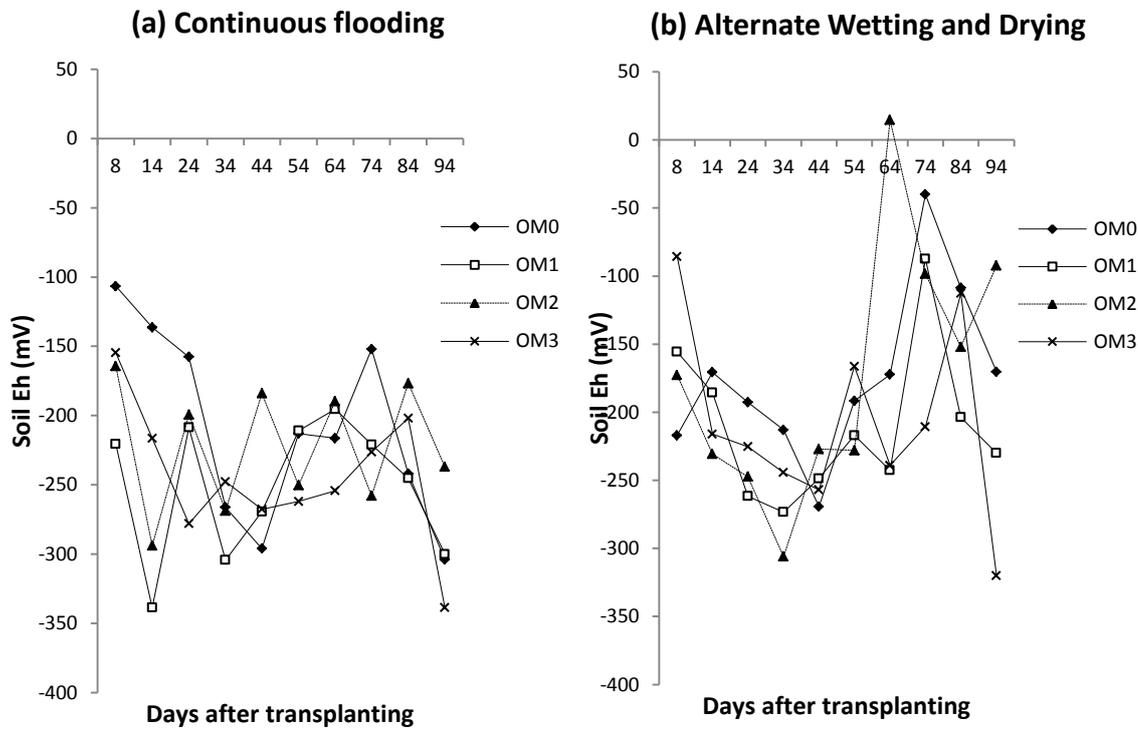


Figure 3.2: Variation in soil redox potential (Eh) (a) continuous flooding and (b) alternate wetting and drying during the summer season, 2017

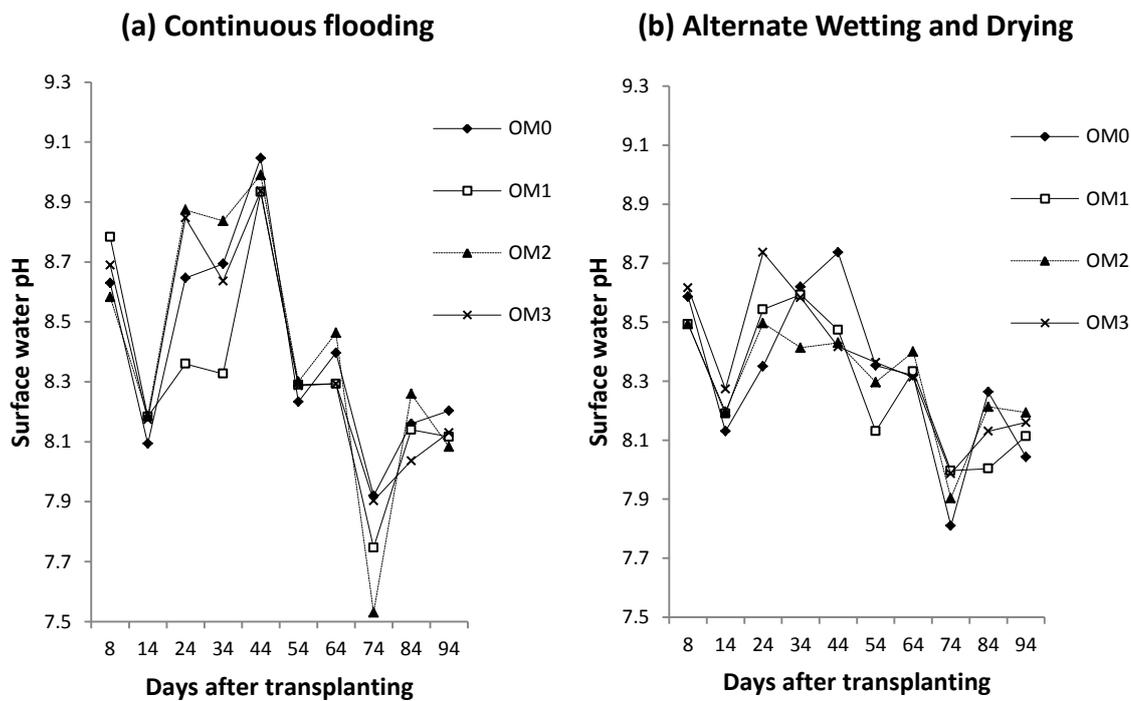


Figure 3.3: Variation in surface water pH (a) continuous flooding and (b) alternate wetting and drying during the summer season, 2017

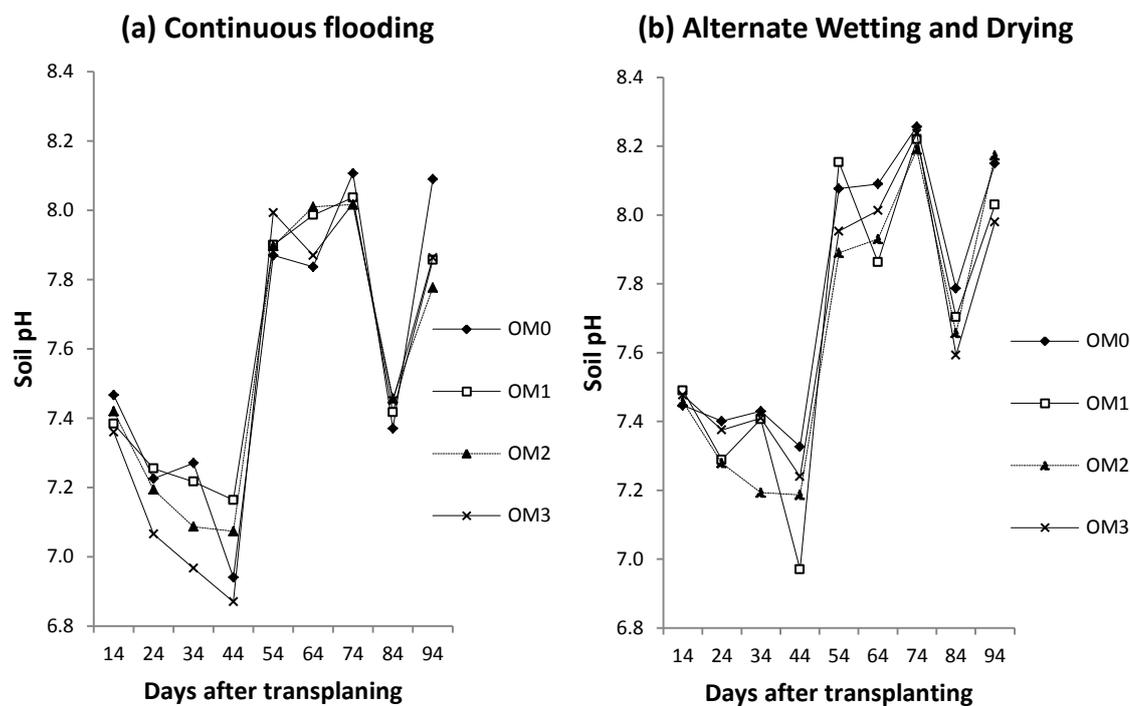


Figure 3.4: Variation in soil pH (a) continuous flooding and (b) alternate wetting and drying during the summer season, 2017

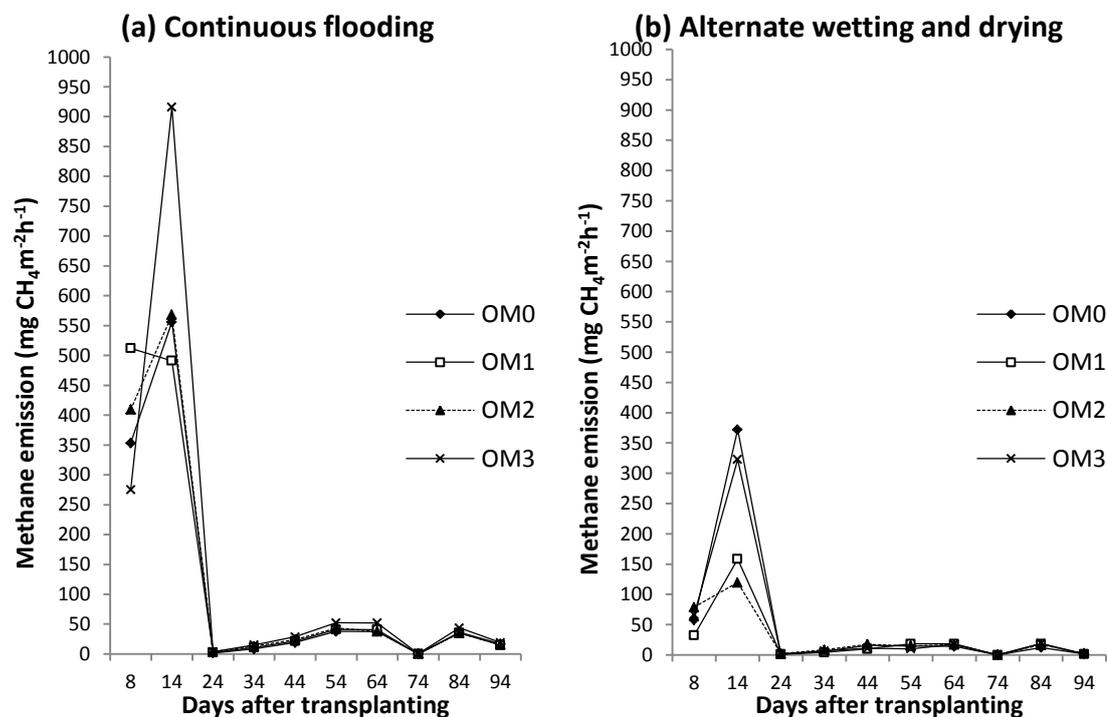
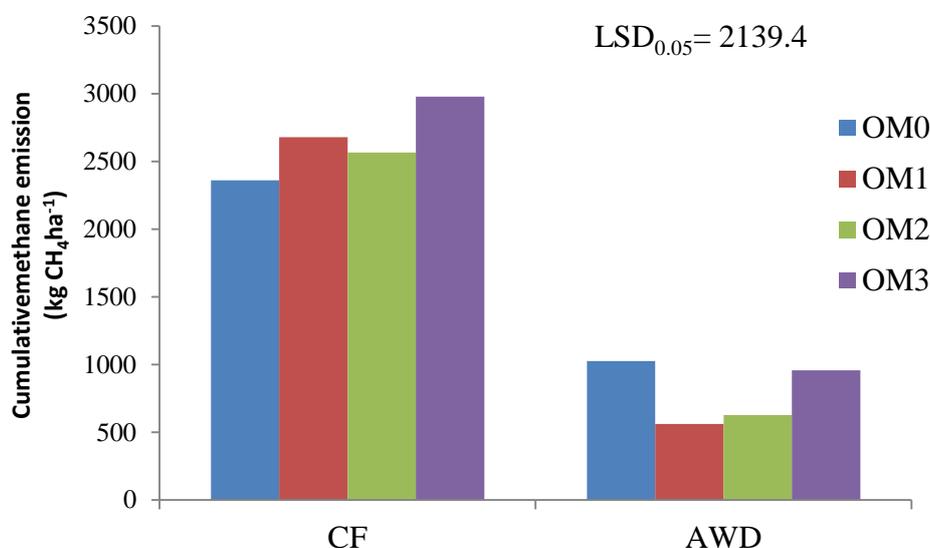


Figure 3.5: Methane emission of rice (a) continuous flooding and (b) alternate wetting and drying during the summer season, 2017

**Table 3.1: Mean effects of water regime and the rate of cowdung manure applied on cumulative methane emission of rice during the summer season, 2017**

Treatment	Cumulative methane emission (kg CH <sub>4</sub> ha <sup>-1</sup> )
Water	
CF	2645.6 a
AWD	792.2 a
LSD <sub>0.05</sub>	1967.1
Manure	
OM <sub>0</sub> (0 t ha <sup>-1</sup> )	1692.7 a
OM <sub>1</sub> (2.5 t ha <sup>-1</sup> )	1619.2 a
OM <sub>2</sub> (5 t ha <sup>-1</sup> )	1595.7 a
OM <sub>3</sub> (7.5 t ha <sup>-1</sup> )	1968.0 a
LSD <sub>0.05</sub>	905.3
Pr>F	
Water	0.0558
Manure	0.7974
Water x Manure	0.7822
CV <sub>a</sub> (%)	65.15
CV <sub>b</sub> (%)	41.87

Means followed by the same letter are not significantly different at 5% LSD.



**Figure 3.6: Mean values of cumulative methane emission of rice as affected by water regime and the rate of cowdung manure applied during the summer season, 2017**

#### Relationship between methane emission and soil parameters during the summer season

Variation in seasonal methane emission from rice paddies are complex and differ among several reported studies. Relationship between methane emission and soil parameters was observed in Table 3.2. From rapidly increase at the beginning of the season, methane emissions show relatively increase in the vegetative phase peaking near panicle differentiation, a period of rapid root development. Emission afterwards is relatively constant during the reproductive stage, and decrease during the late grain filling because of root degradation. In this study, the methane emission was significantly not correlated with soil temperature, soil redox potential and soil pH. A correlation with soil temperature has been reported in some studies (Schutz et al. 1989), but not in others (Cicerone et al. 1983; Neue and Sass 1994). However, it was significantly correlated with surface water pH (Pr > F 0.01). The surface water pH significantly affected on methane emission (Table 3.2).

**Table 3.2: Relationship between methane emission and soil parameters during the summer season, 2017**

	ST	EH	SWPH	SPH
<b>CH4</b>	0.1297 <sup>ns</sup>	-0.3683 <sup>ns</sup>	0.5755 <sup>**</sup>	-0.0563 <sup>ns</sup>
CH4	– Cumulative methane emission (kg ha <sup>-1</sup> )			
ST	– Average soil temperature (°C)	EH – Average soil redox potential (mV)		
SWPH	– Average surface water pH		SPH – Average soil pH	

**Soil parameters during the rainy season, 2017**

**Soil temperature:** Different mean values of soil temperature were observed in different levels of organic manure application (Figure 3.7). In continuous flooding, the start-up high temperature was found at 7 DAT. The high soil temperature was given by OM<sub>2</sub> and the low soil temperature from OM<sub>1</sub>. It decreased at 15 DAT. The high soil temperature was recorded from OM<sub>2</sub>. Then at 24 DAT, the soil temperature increased and maintained level off until 54 DAT. Again at 64 DAT, it decreased to about 28°C. This coincided with heading stage. From that stage, the soil temperature increased to maximum value at 84 DAT throughout the growing season. At 94 DAT, it again slightly decreased. Most high soil temperature was observed in OM<sub>2</sub> and low soil temperature was resulted from OM<sub>0</sub>.

In AWD, the same trend of soil temperature was recorded. The most high soil temperature was recorded from OM<sub>2</sub> and low soil temperature was resulted from OM<sub>1</sub>.

The mean effects of soil temperature in different cowdung manure rates were not different in both water regimes.

**Soil redox potential:** The complex trend of soil redox potential (Eh) was observed in Figure 3.8. In continuous flooding, the soil redox potential was observed between -378.67 mV and -77.00 mV. The low redox potential values were recorded from OM<sub>0</sub> in the early growth stage and from OM<sub>2</sub> in later growth stage.

In alternate wetting and drying, the soil redox potential was in the range of -366 to 33 mV. The complex trend of soil redox potential was also found. Mostly the low redox potential was recorded from OM<sub>0</sub> and the high soil redox potential values were resulted from OM<sub>3</sub>.

The mean effects of soil redox potential to different cowdung manure rates were not different in both water regimes. However, the high soil redox potential was observed in AWD because of soil aeration. However in this study, the soil redox potential is not an indicator for methane emission and it was not affected by water and cowdung manure rates on methane emission.

**Surface water pH:** Different mean values of surface water pH were resulted from different levels of organic manure application (Figure 3.9). In continuous flooding, the surface water pH ranges were higher in early growth stages than in later growth stages. The high pH was recorded from OM<sub>3</sub> at 7 DAT, OM<sub>2</sub> at 15 DAT, OM<sub>0</sub> at 24, 44, 54 DAT and OM<sub>2</sub> at 34, 64, 94 DAT. The low surface water pH was resulted most from OM<sub>0</sub>.

In AWD, the different trend was found. The high surface water pH was observed in OM<sub>0</sub> at 7, 34, 94 DAT, from OM<sub>1</sub> at 15, 24, 44 DAT and from OM<sub>3</sub> at 54, 64, 74, 84 DAT. The most low surface water pH was resulted from OM<sub>1</sub> and OM<sub>2</sub>.

The surface water pH range was from 7.89 to 9.06 in CF and 8.13 to 9.09 in AWD throughout the growing period. In this study, the surface water pH was affected by water and cowdung manure rates. The mean effects changes were found depending on water regime and cowdung manure rates.

**Soil pH:** Different levels of organic manure application gave different mean values of soil pH (Figure 3.10). In the initial stage, the soil pH was a little bit high and gradually decreased fluctuating in some points until harvest. The soil pH was not affected by water regime. The high soil pH was resulted from OM<sub>0</sub>, OM<sub>2</sub> and OM<sub>3</sub>. The most low soil pH was observed in OM<sub>0</sub>.

In alternate wetting and drying, the same trend of soil pH was observed. Mostly the high soil pH was recorded from OM<sub>0</sub> and the low pH from OM<sub>3</sub>.

In both water regimes, the mean effects of soil pH to different cowdung manure rates were not significantly different. The soil pH ranged from 7.24 to 8.01 in continuous flooding and from 7.18 to 8.02 in AWD. In this study, the soil pH was not affected by water and cowdung manure rates.

#### **Methane emission during the rainy season, 2017**

Different mean values of methane emission of rice were resulted from different levels of organic manure application (Figure 3.11). In continuous flooding, at the start-up gas collection, a little increase of methane was recorded. In the middle growth stage, the highest emission was found and gradually decreased to harvest. The decreased methane emission in the beginning was due to restricted supply of organic substrates for methanogenesis. Two peaks of methane emission was recorded in the middle stage; the first peak at 34 DAT and the second peak at 54 DAT. The first peak was dominantly resulted by decomposition of soil organic matters which provide carbon source for methanogenic activity (Fazli and Man 2014). At the second peak, the carbon source for methanogens were available from the plant related organic matters entering into the soil from rice roots (Khosla et al. 2011). More carbon source was available for methanogenic activity at 54 DAT and thus resulted in higher methane emission than 34 DAT (Neue et al. 1996; Gogoi et al. 2008). Methane emission decreased in the later growth stage because of depletion of organic substrates for methanogen. The most high methane emission was resulted from OM<sub>3</sub> and low methane emission was recorded from OM<sub>1</sub> throughout the growing season.

In AWD, the same trend of methane emission was observed. The maximum methane emissions have been observed at panicle initiation stage. This increase was in consequence of decomposition of root exudates, rice plants' litters (Gogoi et al. 2008) and soil organic matters. The most high methane emission was recorded from OM<sub>0</sub> and low methane emission was resulted from OM<sub>3</sub>. Irrigation could affect methane emission pattern indirectly by influencing the availability of organic matters and influencing microbial process of methane production in the soil (Fazli and Man 2014).

The cumulative methane emission of rice during the growing season was shown in Table 3.3. Significant difference of methane emission was recorded among the water treatments at  $P > F 0.05$ . The higher emission (1597.6 kg CH<sub>4</sub> ha<sup>-1</sup>) was found in CF as compared to AWD (542.7 kg CH<sub>4</sub> ha<sup>-1</sup>). No significant difference among the cowdung manure treatments and no interaction between the factors were also observed. In both water regimes, the mean effect of methane emission to different cowdung manure rates was illustrated in Figure 3.12. In this study, the methane emission was affected by water regime. But the cowdung manure rate did not affect on methane emission. Milkha et al. (2001) pointed out that quality and quantity of organic materials influence CH<sub>4</sub> formation. Small differences in the carbon balance between fields and seasons can result in large differences of CH<sub>4</sub> emissions.

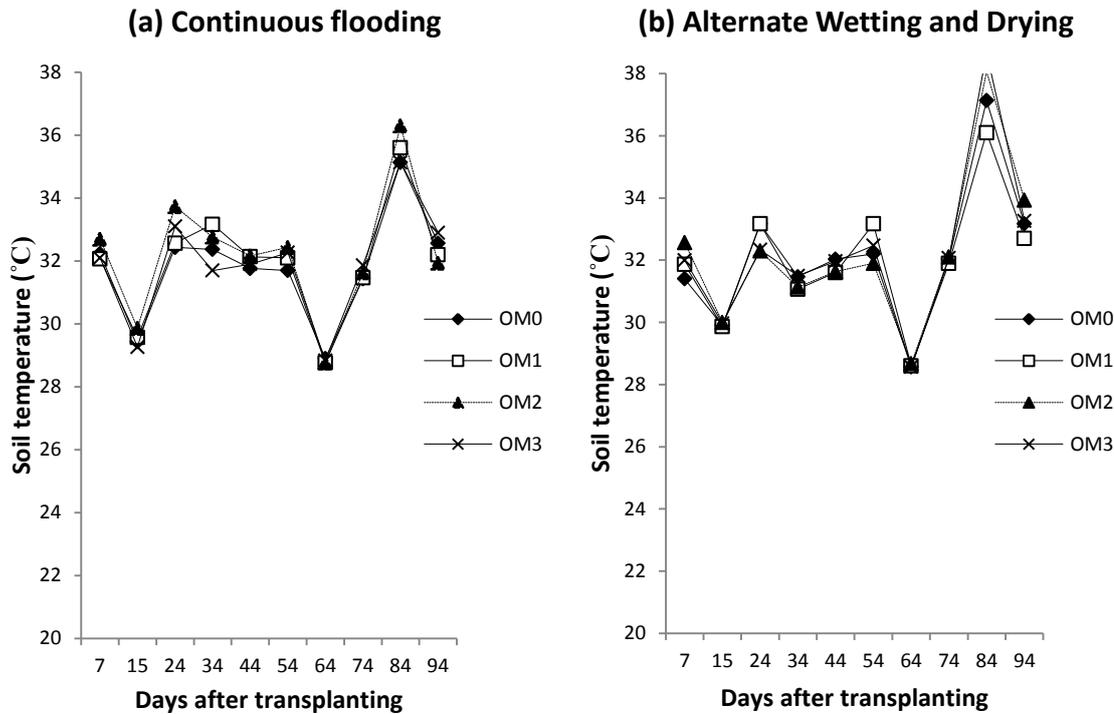


Figure 3.7: Variation in soil temperature (a) continuous flooding and (b) alternate wetting and drying during the rainy season, 2017

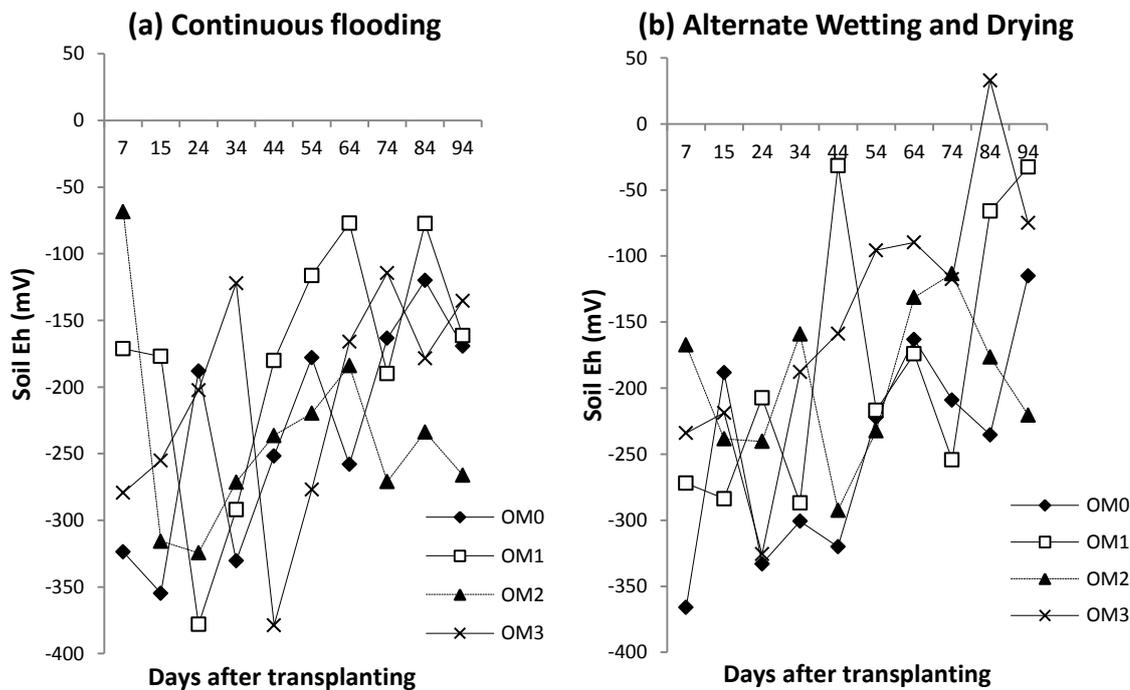


Figure 3.8: Variation in soil redox potential (Eh) (a) continuous flooding and (b) alternate wetting and drying during the rainy season, 2017

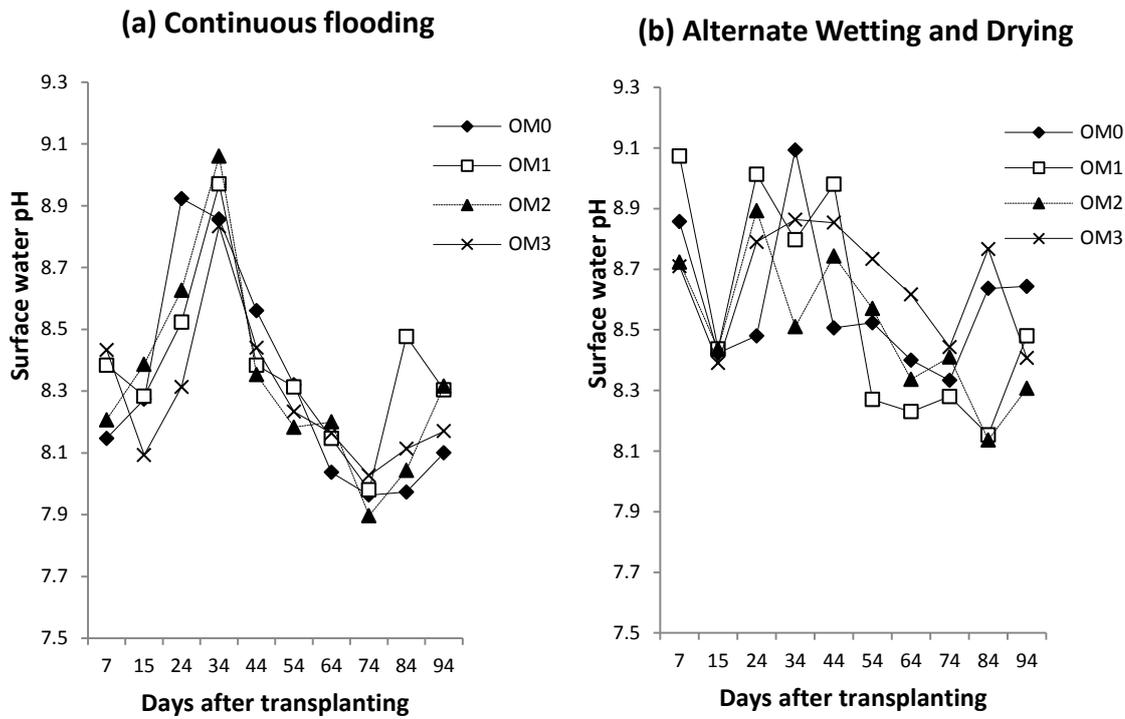


Figure 3.9: Variation in surface water pH (a) continuous flooding and (b) alternate wetting and drying during the rainy season, 2017

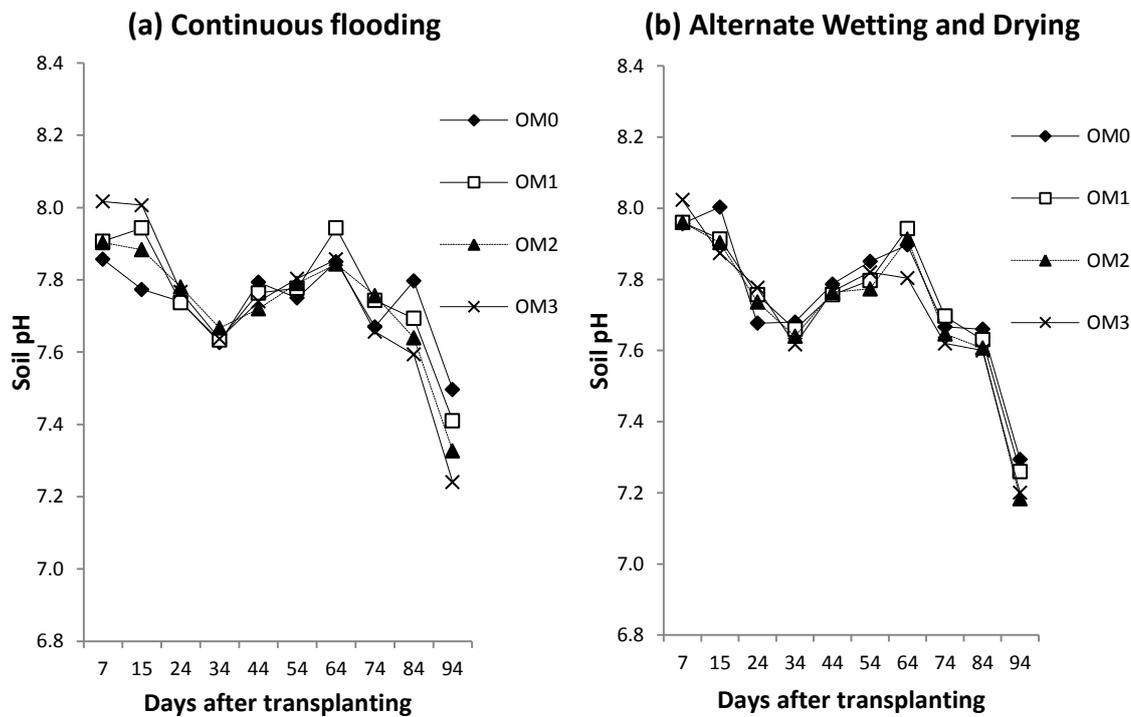


Figure 3.10: Variation in soil pH (a) continuous flooding and (b) alternate wetting and drying during the rainy season, 2017

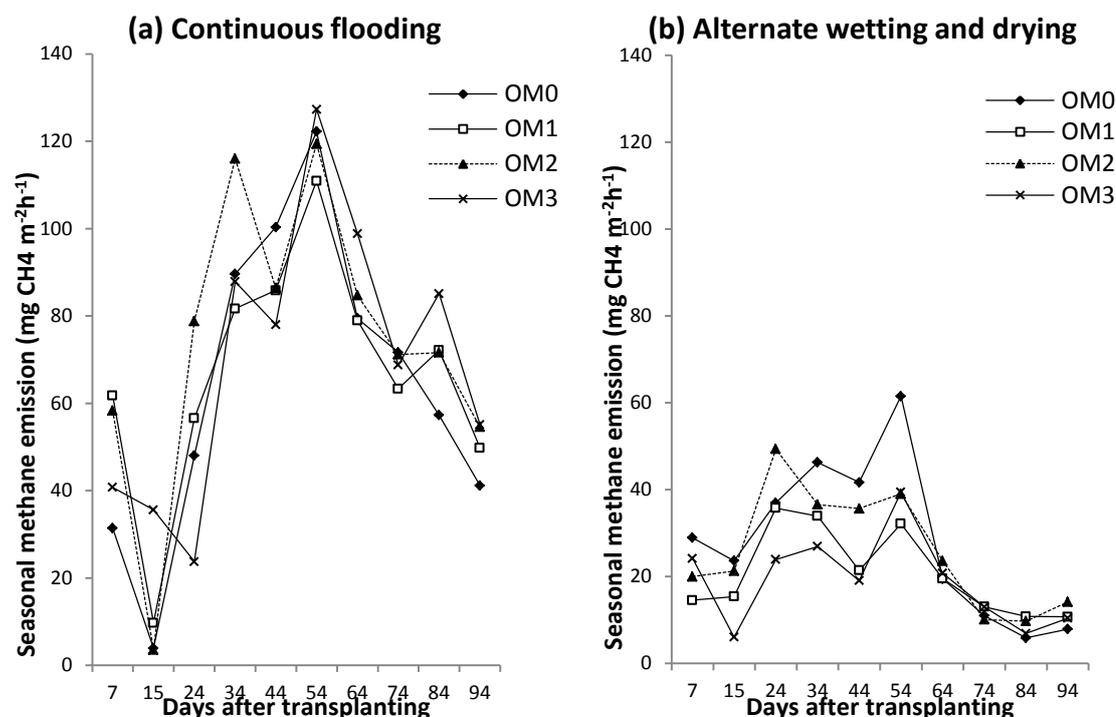
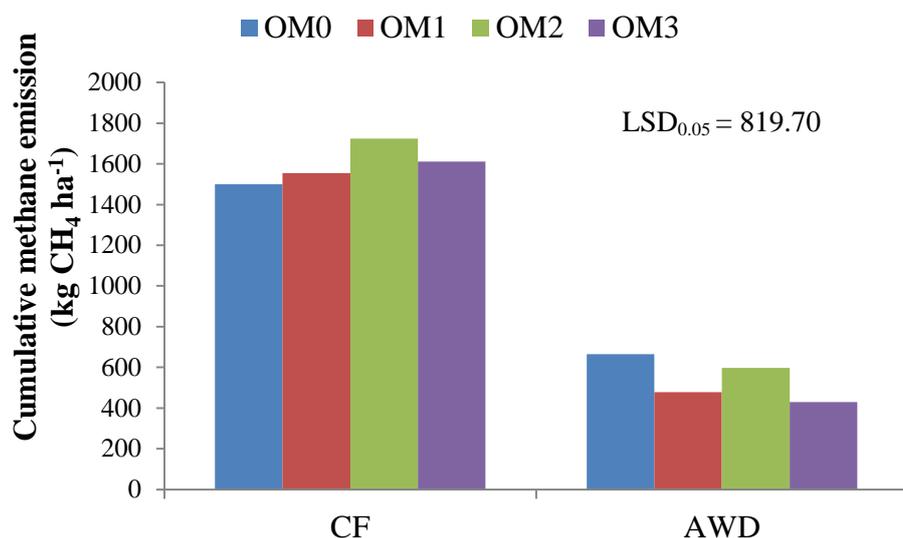


Figure 3.11: Methane variation of rice (a) continuous flooding and (b) alternate wetting and drying during the rainy season, 2017

Table 3.3: Mean effects of water and cowdung manure applied on cumulative methane emission of rice during the rainy season, 2017

Treatment	Cumulative methane emission (kg CH <sub>4</sub> ha <sup>-1</sup> )
Water	
CF	1597.6 a
AWD	542.7 b
LSD <sub>0.05</sub>	737.19
Manure	
OM <sub>0</sub> (0 t ha <sup>-1</sup> )	1082.2 a
OM <sub>1</sub> (2.5 t ha <sup>-1</sup> )	1016.9 a
OM <sub>2</sub> (5 t ha <sup>-1</sup> )	1161.2 a
OM <sub>3</sub> (7.5 t ha <sup>-1</sup> )	1020.3 a
LSD <sub>0.05</sub>	372.11
Pr>F	
Water	0.0254
Manure	0.8147
Water x Manure	0.7545
CV <sub>a</sub> (%)	39.22
CV <sub>b</sub> (%)	27.64

Means followed by the same letter are not significantly different at 5% LSD.



**Figure 3.12: Mean values of cumulative methane emission of rice as affected by water and cowdung manure applied during the rainy season, 2017**

#### Relationship between methane emission and soil parameters during the rainy season

Relationship between methane emission and other parameters was described in Table 3.4. In this pot experiment of rainy season 2017, the methane emission was not significantly correlated with soil parameters (soil temperature, soil redox potential, soil pH) except surface water pH. Methane was significantly negative correlated with surface water pH ( $P < 0.01$ ).

**Table 3.4: Relationship between methane emission and soil parameters during the rainy season, 2017**

	ST	EH	SWPH	SPH
<b>CH<sub>4</sub></b>	-0.2806 <sup>ns</sup>	-0.3343 <sup>ns</sup>	-0.7992**	-0.1044 <sup>ns</sup>

CH<sub>4</sub> – Cumulative methane emission (kg ha<sup>-1</sup>)

ST – Average soil temperature (°C)      EH – Average soil redox potential (mV)

SWPH – Average surface water pH      SPH – Average soil pH

#### 4. Conclusion

According to these pot experiments, the methane emission was significantly correlated with surface water pH and the methane emission was significantly higher in continuous flooding than alternate wetting and drying. The cowdung manure did not significantly affect on yield and methane emission. However, its effect was influenced by water management.

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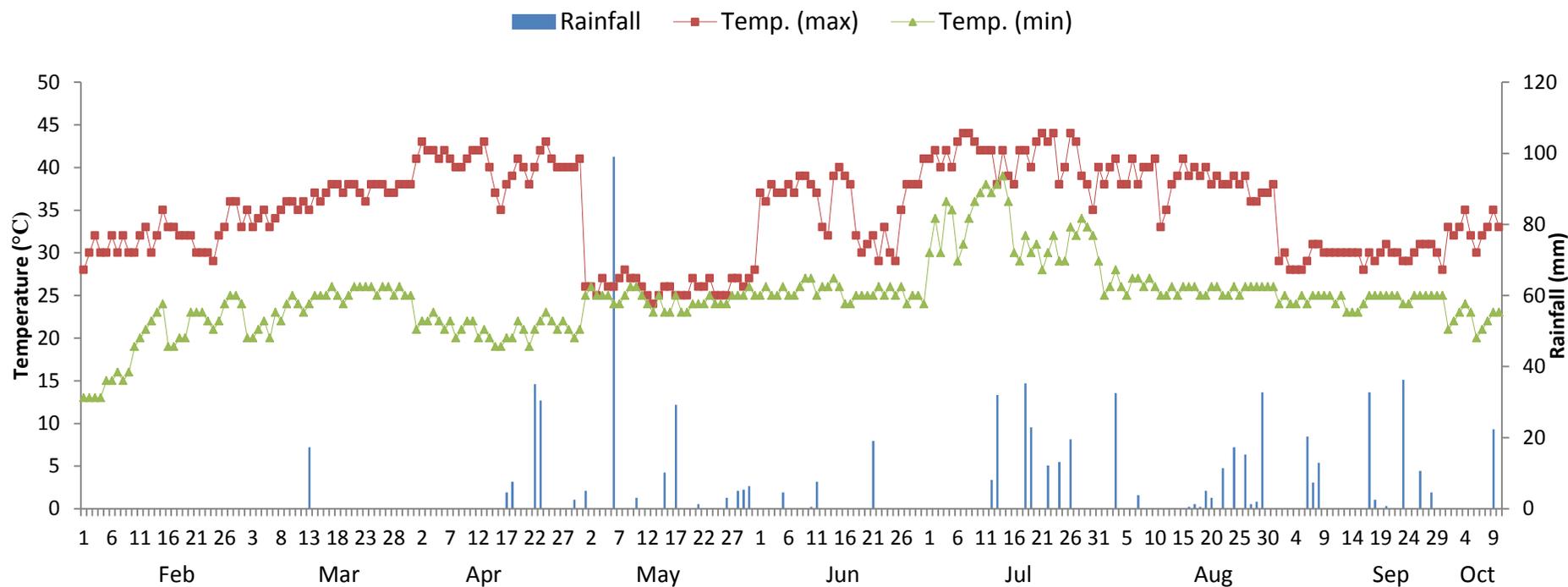
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#### Appendix I. Physiochemical properties of experimental soil and cowdung manure

No.	Analytical Item	Unit	Analytical Result	
1	Soil pH		7.4	Moderately alkaline
2	Available N	mg kg <sup>-1</sup>	50	Low
3	Available P	mg kg <sup>-1</sup>	13	Medium
4	Available K	mg kg <sup>-1</sup>	78	Low
5	Total N	%	0.17	
6	Organic matter	%	1.8	Low
7	CEC	cmol <sub>c</sub> kg <sup>-1</sup>	11	Low
8	Sand	%	87	
9	Silt	%	4	
10	Clay	%	9	
11	Textural class			Loamy sand

No.	Analytical Item	Unit	Analytical Result	
			Summer season	Rainy season
1	Total N	%	1.32	1.2
2	Organic carbon	%	16	23.3

Appendix II. Daily rainfall, maximum and minimum temperatures in Madaya township, Myanmar during the summer and monsoon rice growing seasons, 2017



# A Geometric Approach for Determination of Geoidal Height in Akure Environs, Ondo State, Nigeria.

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DOI: 10.29322/IJSRP.8.8.2018.p8084

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8084>

## Abstract

The study attempts to carry out the determination of geoidal height using a geometric approach. This approach involves the use of GPS/levelling to determine the ellipsoidal and orthometric heights. South DGPS was used in acquiring GPS data, which were processed using South GNSS processor software for deriving ellipsoidal heights, while Leica Jogger modern automatic level instrument was used in acquiring leveling data, which were processed to produce orthometric heights. A total of fifty nine (59) points were occupied for both GPS and levelling observations. The geoidal height was determined by computing the difference between the ellipsoidal and orthometric heights. The geoidal map and the geoidal model (3D) were created using Surfer 11 software. The chart for geoidal, ellipsoidal and orthometric heights show the same pattern, which is an indication that all show a true representation of the terrain. The profile produced for geoidal map and the digital geoidal model follows the same slope, which is an indication that both are natural height systems. The geometric approach was successfully used for geoidal height determination in the study area.

**Keyword:** Geoidal height, GPS, levelling, Orthometric height, Geometric Approach

## I. INTRODUCTION

A precise geoid model constitutes one of the most interesting research subjects of geodesy, particularly since 1980s (Essamet *et al.* 2015). Geoid modelling deals with the determination of geoidal undulations (N) between the geodetic heights (h) obtained from the Global Navigation Satellite Systems (GNSS) techniques and the orthometric heights (H), relative to the Mean Sea Level (MSL). Thus, geoid models are vital for the application of GNSS (particularly the Global Positioning System, GPS) in civil engineering projects (Essam *et al.* 2015).

The geoid is one of the most fundamental concepts in geodesy. It is defined as an equipotential surface of the earth gravity field which is everywhere perpendicular or at right angle to the

direction of gravity at such point of observation which best approximates the mean sea level (MSL) when the mean sea level is undisturbed and extends below the continents. The geoid surface is much smoother than the natural earth surface despite its global undulations (changes) (Aleemet *al.* 2016). In contrast, it is very close to an ellipsoid of revolution, but more irregular, therefore it is approximated by the ellipsoid (Ahmed and Derek, 2011). The geoid height or the geoidal undulation  $N$  is described by the separation of the geoid from the ellipsoid of revolution. However due to the spatial irregularities of the geoid surface, it cannot be described by a simple mathematical function. High-resolution geoid model is valuable to geodesy, surveying, geophysics, and several geosciences, because it represents datum to height differences and gravity potential field. More-over, the geoid is very important for connection between local datum and the global datum, for purposes of positioning, levelling, inertial navigation system and geodynamics (Ahmed and Derek, 2011).

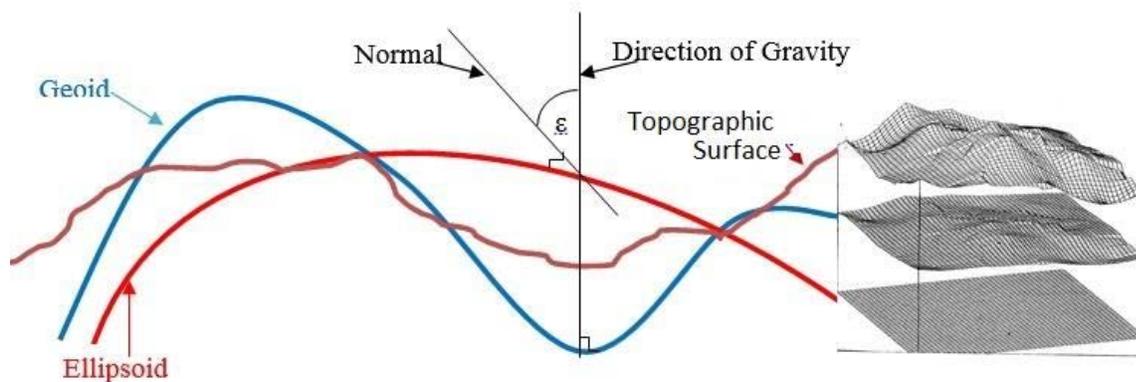


Figure 1: The three geodetic surfaces and their pictorial representation (source: Badejo, *et al.* 2016)

### The Topographical Surface

The topographical surface is generally called the Earth's surface. It is the actual surface of the land and sea. This is the physical surface where all measurements and observations are done. It is an irregular undulating surface, characterised by mountains, valleys, spurs, dunes and other features. Its undulating and irregular nature is caused by uneven distributions of the Earth masses which make it impossible to describe it with any mathematical relation (Vanicek and Krakiwsky, 1986; Uzodinma and Ezenwere, 1993; Vanicek *et al.* 2000; Torge, 2000). Hence, geodetic computation cannot be done on this surface. The surface close to the topographical surface is the geoid.

### Geoid

The term *geoid* comes from the word *geo* which literally means earth-shaped. The geoid is an empirical approximation of the figure of the earth (minus topographic relief). It is defined as the "equipotential surface of the Earth's gravity field which best fits, in the least squares sense, of the mean sea level" (Deakin, 1996; Aleemet *al.* 2016). The geoid can also be defined as the "surface which coincides with that surface to which the oceans would conform over the entire Earth, if free to adjust to the combined effect of the earth's mass attraction (gravitational force)

and the centrifugal force of the Earth's rotation” (Bomford, 1980). Specifically, it is an equipotential surface, meaning that it is a surface on which the gravitational potential energy has the same value everywhere; with respect to gravity. It more or less corresponds to the mean sea level (MSL) over the oceans. It is the surface of an ideal global ocean in the absence of tides and currents, directed and shaped only by gravity. It is a crucial measuring reference for various phenomena such as sea-level change, ocean circulation, and ice dynamics – all affected by climate change (Aleem, 2014). The geoid has a definite physical interpretation, in the sense that it can be fixed by measurements over the ocean with the use of mean sea level. Traditionally, because the sea surface is available worldwide, surveyors, mapmakers and other heights users or professionals have made the task of geoid determination to be simplified by using the average or mean of sea level as the definition of zero elevation. At any point on the geoid, the value of the height is zero, while above is positive and below is negative (Aleem, 2014).

Besides gravimetric approach, precise geoid heights can also be determined geometrically by means of GPS/levelling combination on land area, and altimetric techniques at sea (Banahmed *et al.* 2006). If a relatively large number of well distributed points where ellipsoid and orthometric heights are available, the geometric geoid derived by GPS and levelling can be determined and the correction to be applied to the gravimetric geoid can be modelled and computed. In this way, the possibility exists to develop an empirical surface (corrector surface) which relates a given gravimetric geoid model to the reference system of GPS ellipsoidal heights, and to the vertical datum of one's orthometric height system (Banahmed *et al.* 2006).

### **Relationship between the Orthometric, Ellipsoidal and Geoidal Heights**

The relationship between the three geodetic surfaces (figure 2) can be represented mathematically by:

$$N = h - H \quad (1)$$

$$H = h - N \quad (2)$$

$$h = H + N \quad (3)$$

In equation (1-3), N is the geoidal undulation, H is the orthometric heights, and h is the ellipsoidal height. These equations can be written as:

$$h - H - N = 0 \quad (4)$$

## **II. STUDY AREA**

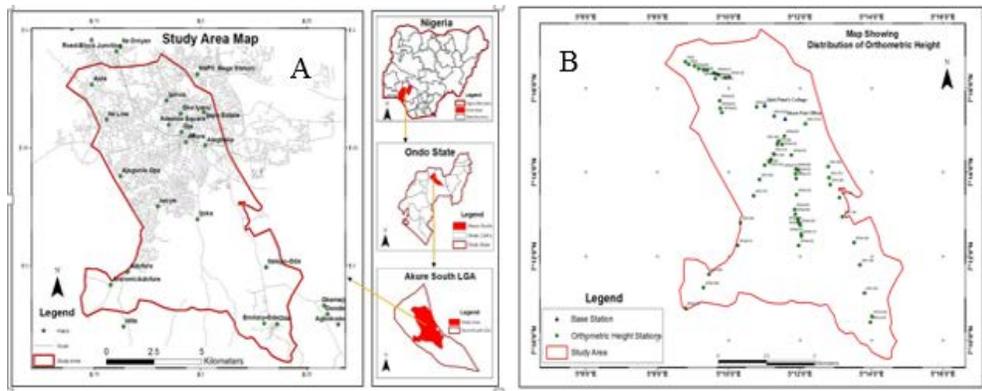


Figure 2(A): Study Area Map (Akure Environs) and (B) Distribution of GPS/Levelling point used for the study

The study area selected for this research is Akure Environs figure 2 (A) of Ondo State in South-Western part of Nigeria. The geographic location is approximately between Latitudes 07° 15'N to 07° 30'N and Longitude 05° 15'E to 05° 25'E.

The topography of the Basement Complex terrain of Akure is generally undulating with a virtually rugged terrain consisting of hills and valleys with field recorded elevation varying between 330m above mean sea level in the southwestern border (Nigeria Army barracks) and 399m in the north eastern border (Shagari Estate) (Michael and Franklin 2017).

### III. METHODOLOGY

In carrying out the determination of geoidal height for Akure environs using geometric approach, methods and mode of operation were carefully chosen, based on some fundamental principles. These procedures include GPS observation and levelling data acquisition. A total of 59 common points were observed for both GPS and levelling. Processing strategy adopted includes, program development to enable the computation of geoidal height and orthometric height alongside deducing levelling data using Microsoft Excel spread sheet and processing of GPS observed data using South GNSS Processor.

#### Data Acquisition

Data acquisition is the process of gathering data or information from the field or from any other sources. The process involved; capturing, collecting, extracting, and surveys etc and then transforming these data into a reality. For the purpose of this study only the primary data was used.

#### Primary data

Primary data are the first hand information observed directly from the field by the researcher, which has not been used for any purpose or been transformed into any format. The primary data used are as:

1. The reduced level (orthometric height) of the stations.
2. The geodetic coordinates of the various control points ( $\phi$ ,  $\lambda$ ,  $h$ )

#### Spirit levelling operation

Spirit levelling is the process of determining the difference in heights between two or more points on the earth surface. It is based on the fact that if a graduated staff can be placed vertically on the two ground points and the instrument, called a level, is set to the middle, and levelled, on bisecting a staff, the instrument will define a horizontal line of sight that will intersect the two staff reading at two different points, which depends on difference in elevation between the two points. For this operation to be performed, a two peg test must be carried out to determine if the quality and accuracy of the instrument really meet the standard for the operation. The collimation error was found to be 0.002mm which indicated that the instrument is in good order and can be used in carrying out observations.

In this study, the operation was carried out in closed loop levelling nets in order to obtain the height differences between the points. The Leica Jogger 20/24/28/32 modern automatic level instrument was set-up at a convenient point and the elevation of the survey control point AKU 001 which is of second order accuracy was observed (back sight reading) with the help of the levelling staff held over the GPS control point and another levelling staff was held over another AKU 002 control point for foresight reading and later closed back on AKU 001 figure 3.

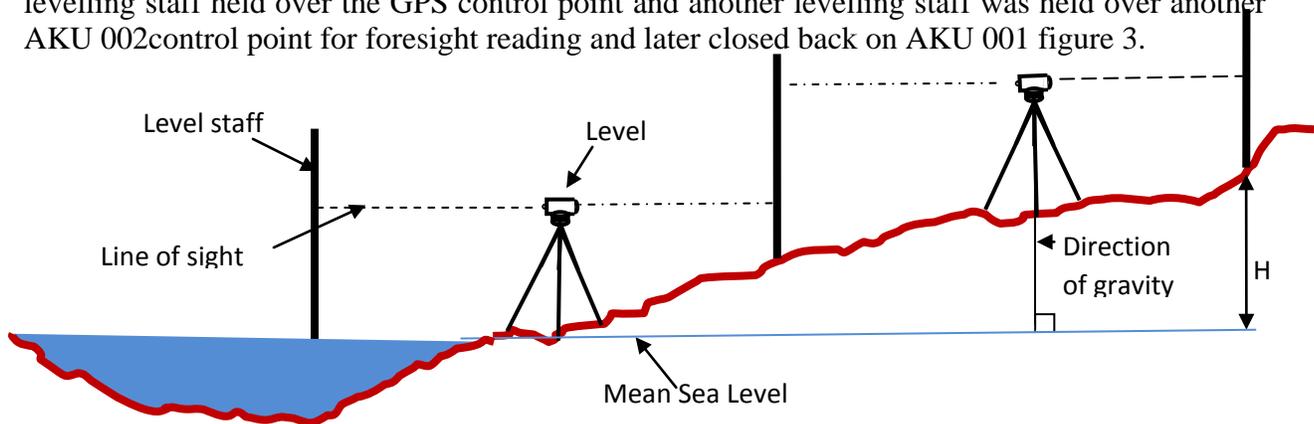


Figure 3: Levelling procedure to determine difference in height. (Source: Badejo, *et al.* 2016)

### GPS Observation

South DGPS was used for acquisition of the 3D coordinates of the existing GPS control points located within the study area. The instrument was mounted on AKU 001 control point as the base station and was levelled. The necessary settings of the parameters needed for the observation were performed (base or rover) such as the ID station, antenna height, epoch for streaming of data, mask angle, mode of observation e.t.c. After the setting operation, GPS was allowed to track not less than 4 satellites for data streaming.

The observations were done in post-processing static mode with the base station at AKU 001 and the rover moving round from pillar-to-pillar after carrying out all the necessary settings. In all the observation (base or rover) the PDOP (Positional Dilution of Precision) was ensured to be consistently less than 2.00. From the GPS observations, ellipsoidal heights were derived.

## IV. RESULT AND DISCUSSION

Table 1: Ellipsoidal, Orthometric and Geoidal Heights

STATIONS	Latitude [Degrees]	Longitude [Degrees]	Ellipsoidal Height (h) [m]	Orthometric Height (H) [m]	Geoidal Heights $N = h - H$ [m]
AKU001	7.2707993	5.1670482	359.9130	346.4700	13.44304
AKU002	7.2707205	5.1651083	358.6052	345.1465	13.45874
AKU003	7.2718627	5.162073	352.0484	338.3880	13.66040
AKU004	7.2725468	5.1597576	350.3126	336.6660	13.64660
AKU005	7.2737013	5.1568474	348.2843	334.6510	13.63330
AKU006	7.2736669	5.1551974	351.0061	337.3650	13.64110
AKU007	7.2743554	5.1527432	356.3205	342.5380	13.78250
AKU008	7.2754062	5.150703	359.4789	345.8310	13.64790
AKU009	7.2759909	5.1481422	359.5066	345.8170	13.68960
AKU010	7.2769842	5.1466017	353.7181	340.1150	13.60310
AKU011	7.2723335	5.1607864	351.9264	338.2150	13.71140
AKU012	7.2702406	5.1606406	347.8124	334.1020	13.71040
AKU013	7.2615421	5.1625064	363.9258	349.7650	14.16080
AKU014	7.258587	5.162796	360.0313	345.8400	14.19130
AKU015	7.256818	5.1636238	353.4029	339.1970	14.20590
<b>MEAN</b>			<b>347.7476</b>	<b>334.3930</b>	<b>13.3885</b>
<b>STDEV</b>			<b>10.95886</b>	<b>10.56190788</b>	<b>0.671478388</b>

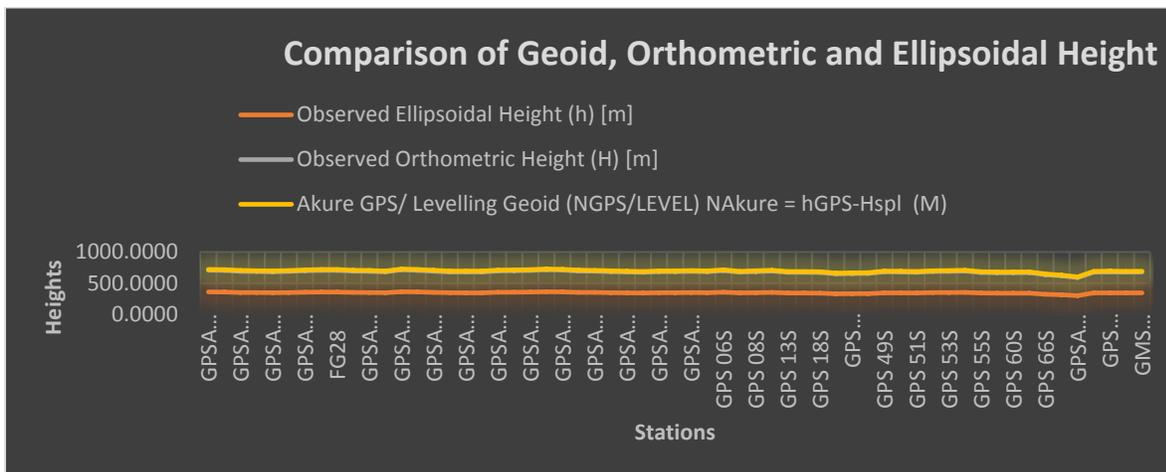


Figure 4: graphical Comparison of Geoidal, Orthometric, and Ellipsoidal heights

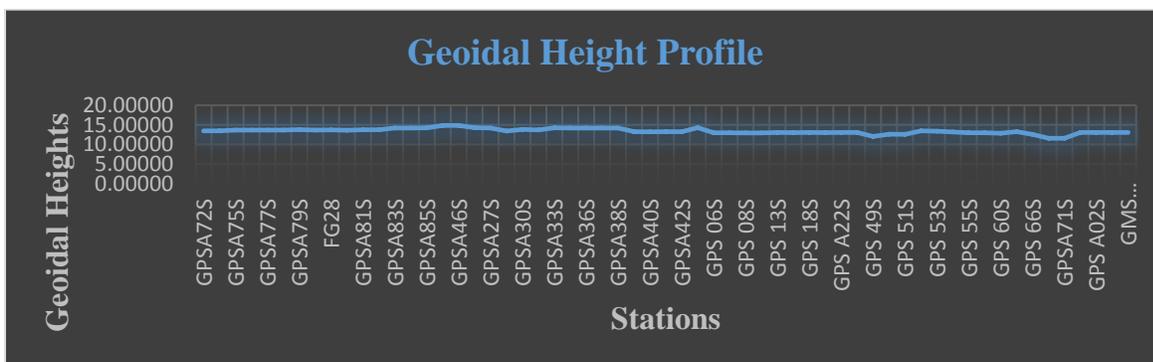


Figure 5: chart showing geoidal height profile

Table 2: Ellipsoidal and orthometric height differences

STATIONS	Ellipsoidal Height (h) [m]	Orthometric Height (H) [m]	$\Delta h$ (m)	$\Delta H$ (m)	$\Delta h - \Delta H$ (m)
AKU001	359.9130	346.4700			
AKU002	358.6052	345.1465	1.3078	1.3235	-0.0157
AKU003	352.0484	338.3880	6.5568	6.7585	-0.2017
AKU004	350.3126	336.6660	1.7358	1.7220	0.0138
AKU005	348.2843	334.6510	2.0283	2.0150	0.0133
AKU006	351.0061	337.3650	-2.7218	-2.7140	-0.0078
AKU007	356.3205	342.5380	-5.3144	-5.1730	-0.1414
AKU008	359.4789	345.8310	-3.1584	-3.2930	0.1346
AKU009	359.5066	345.8170	-0.0277	0.0140	-0.0417
AKU010	353.7181	340.1150	5.7885	5.7020	0.0865
AKU011	351.9264	338.2150	1.7917	1.9000	-0.1083
AKU012	347.8124	334.1020	4.1140	4.1130	0.0010
AKU013	363.9258	349.7650	-16.1134	-15.6630	-0.4504
AKU014	360.0313	345.8400	3.8945	3.9250	-0.0305
AKU015	353.4029	339.1970	6.6284	6.6430	-0.0146

Table 3: Statistical result from change in ellipsoidal and orthometric height

STATIONS	$\Delta h$ (m)	$\Delta H$ (m)	$\Delta h - \Delta H$ (m)	Mean Square Error (MSE) [m] $(\Delta h - \Delta H)^2(m)$
AKU001				
AKU002	1.3078	1.3235	-0.0157	0.000246
AKU003	6.5568	6.7585	-0.2017	0.040665
AKU004	1.7358	1.7220	0.0138	0.000190
AKU005	2.0283	2.0150	0.0133	0.000177
AKU006	-2.7218	-2.7140	-0.0078	0.000061
AKU007	-5.3144	-5.1730	-0.1414	0.019994
AKU008	-3.1584	-3.2930	0.1346	0.018117
AKU009	-0.0277	0.0140	-0.0417	0.001739
AKU010	5.7885	5.7020	0.0865	0.007482
AKU011	1.7917	1.9000	-0.1083	0.011729
AKU012	4.1140	4.1130	0.0010	0.000001
AKU013	-16.1134	-15.6630	-0.4504	0.202860
AKU014	3.8945	3.9250	-0.0305	0.000930
AKU015	6.6284	6.6430	-0.0146	0.000213
<b>MEAN</b>	<b>0.2363</b>	<b>0.2291</b>	<b>0.0071</b>	<b>0.2612</b>
<b>STDEV</b>	<b>8.4658</b>	<b>8.4134</b>	<b>0.5154</b>	<b>0.6779</b>

The change in elevation between each point for both the ellipsoidal and orthometric heights were computed using equation (6)

$$(h_i - h_{i+1}) - (H_i + H_{i+1}) = (N_i - N_{i+1}) \tag{6}$$

- $h_i$  is the ellipsoidal height of station  $i$
- $h_{i+1}$  is the ellipsoidal height of points prior station  $i$
- $H_i$  is the orthometric height of station  $i$
- $H_{i+1}$  is the orthometric height of points prior station  $i$
- $N_i$  is the geoidal undulation of station  $i$
- $N_{i+1}$  is the Geoidal Undulation of points prior station

**Root Mean Square Error:**

The Root Mean Square Error (RMSE) of the orthometric height differences and ellipsoidal height differences were computed by squaring the difference in heights using equation (7)

$$RMSE = \sqrt{\frac{1}{n} \sum_{k=1}^n (\Delta h - \Delta H)^2}, \text{ where,} \tag{7}$$

$n$  is the number of the point used for the accuracy confirmation and  $k$  is the residual sequence.

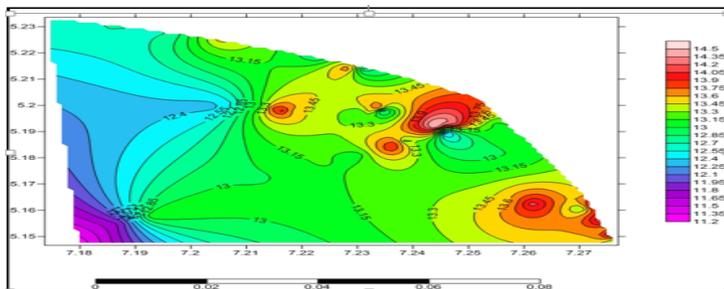


Figure 6: Contour plot of geoidal map of the study area

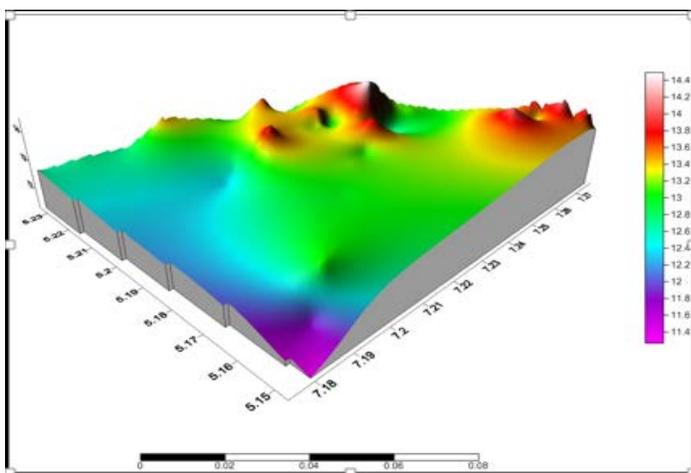


Figure 7: Digital geoidal model of the study area

**V. DISCUSSION OF RESULT**

The geographical coordinate and ellipsoidal heights (h) were obtained from GPS post –processed observation using South GNSS processor software Table 1. The adjusted orthometric heights (H) were extracted from the deduced levelling field book Table 1. The geoidal height was determined from the difference between the ellipsoidal and orthometric height Table 1. Figure 4 is a graphical comparison between the geoidal, orthometric and ellipsoidal heights. Figure 5 is the geoidal height profile to depict the true nature of the terrain. The differences between the ellipsoidal and orthometric height were computed and the result is shown in Table 2. Table 3 shows the statistical result for the changes in elevation between the two height systems. The result produced the standard deviation value as 8.4558 for ellipsoidal heights and 8.4134 for orthometric height respectively while the RMSE value was 0.51107. Figure 6 and 7 are the contour plot of geoidal map and digital geoidal model (3D) plotted using Surfer 11 software adopting kriging gridding method at 0.15m contour interval. The chart comparison for geoidal, ellipsoidal and orthometric height followed the same pattern which is an indication that both are the true representation of the terrain. The geoidal map and the digital geoidal model follows the same slope toward a specific direction which is an indication that both are natural height systems.

## VI. CONCLUSION.

In order to determine the geoidal height of the study area, a geometric method was adopted. The geometric method involves the use of GPS/Levelling data. The data were acquired for orthometric and ellipsoidal heights using South DGPS and Leica Jogger modern automatic level instrument. The difference between ellipsoidal and orthometric height was used for geoidal height determination. The height difference between the ellipsoidal and orthometric heights were computed. The geoidal height computed was used for the production of geoidal map and geoidal model of the study area. The geoidal map and the digital geoidal model show the same slope toward a specific direction, which is an indication that both are natural height systems. The geometric approach was successfully used for geoidal height determination in the study area.

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# Implications of Teacher Resource on Quality Education Provision in Public Primary Schools in Kenya

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DOI: 10.29322/IJSRP.8.8.2018.p8085

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8085>

**Abstract-** The quest to ensure that learners achieve quality education and acquire values and skills that help them play a positive role in their societies is an issue on the policy agenda of Government of Kenya. The purpose of this study was to determine the effect of teacher resource on quality education provision in public primary schools in Masaba South sub-County, Kisii County, Kenya. The objective sought to determine the effect of teacher resource on quality education. The study was guided by Human capital theory. The target population was 82 head teachers and 112 deputy head teachers. Sample size consisted of 68 head teachers and 86 deputy head teachers selected through stratified random sampling technique. Questionnaire, interview schedule, and document analysis were used to collect data. Quantitative analysis was done using descriptive statistics and inferential statistics using regression analysis. Qualitative data was analyzed on the basis of themes and sub-themes. On the concern about effect of teacher resource on quality education provision in primary schools, work load had a highest input of .260 towards teachers as a resource; it was followed by syllabus which had an input of .209 units. Teacher pupil ratio had the lowest input of -.130 units. The content, testing policy, capacity building, and adequacy had inputs of .017 units, .024 units, .079 units, .084 units .088 units respectively. This study was useful to the Ministry of Education to make necessary changes on the effect of teacher resource on quality education provision and make changes to enhance quality education.

**Index Terms-** Teacher Resource, Ministry of Education, Public Primary schools, Quality education and Kenya

## I. INTRODUCTION

Nikel and Lowe (2010) approach on 'fabric' of quality in education proposes seven conceptual dimensions; effectiveness, efficiency, equity, responsiveness, relevance, reflexivity, and sustainability arranged so as to emphasize that the quality of education is much like a 'fabric' that is, it is at its strongest when it is stretched or maintained in tension. The framework emphasizes the need to seek a contextually relevant balance among the seven dimensions, where 'balance' does not imply a simple equalizing across all dimensions, even if that were conceptually possible. The needs and the possibilities for

action within different educational contexts will vary and decisions must be made over what is desirable and feasible within a specific situation.

The UNESCO (2007), Santiago model proposes five dimensions of the quality of education that attempt to capture the perspectives of the various educational stakeholders concerned and the social action that they are engaged in at the local level. In addition to the dimensions of effectiveness, efficiency and equity that characterize an educational system, the model stresses the dimension of relevance which is analyzed at two distinct levels: relevance of the educational system in responding appropriately to collective societal concerns, and relevance to the daily conditions of individual learners, their families and communities. UNICEF (2005) documents that school curriculum have three dimensions; the formal, non-formal and informal which are prerequisites for a holistic approach towards learning and in turn well balanced development of learners. The report indicates that quality education aims at the wholesome development of children. In fact all-round development is the key theme of education. Additionally, when a child comes to school, he/she comes in totality and so education should help him/her to develop total personality. To fulfill these purposes, varieties of educative experiences are to be provided in the school programs which may contribute to a long, happy and normal life of the child. In this regard, educational experiences should not only include formal knowledge to help him to develop intellectually and mentally but also impart lots of other experiences for his social, physical and spiritual development.

A report from Ministry of Education, Kisii County, education board (2014), a conference held by scholars, parents, professionals, political leaders and other players indicated that there is need for research on the cause of dwindling quality education in Kisii County. It further noted that our students are not learning despite the impressive enrolment rates in the County and only further research can help establish the problem. It is against this scenario that the study intended to determine effect of teacher resource on quality education provision in public primary schools in Masaba South sub-County, Kisii County, Kenya.

## Objective of the study

The following was the objective of the study:

To determine effect of teacher resource on quality education provision in public primary schools in Masaba South sub-County, Kisii County, Kenya.

### Research Design

This study adopted a Sequential explanatory design employed within mixed methods approach. Sequential explanatory design is a type in mixed method approach characterized by collection and analysis of quantitative data followed by a collection and analysis of qualitative data. Its purpose is to use qualitative results to assist in explaining and interpreting the findings of quantitative study.

### Study Population

The target population for this study was 82 head teachers, 112 deputy head teachers in public primary schools, from 82 primary school teachers in Masaba South sub county Kisii County of Kenya.

### Sampling Procedures and Sample Size

The researcher used both stratified random sampling technique and simple random sampling. To obtain the desired sample in this study stratified random sampling technique was used in dividing the population into small groups known as strata. The sample size constituted of 68 head teachers, 86 deputy head teachers, from the 68 sampled public primary schools based on Krescie and Morgan's formula.

### Instruments of Data Collection

This research used a questionnaire for the deputy head teachers, document analysis and interview schedule for the head teachers to collect primary data for the study.

### Document Analysis

The researcher examined primary school admission register, board of management minutes, school master timetable, stores records book to check on availability of school facilities. The information obtained was discussed with the head teachers with the aim of collecting data.

### Validity of the Instruments

To ensure validity of the questionnaire, assistance was sought from the expert judgment of researcher's supervisors.

They were also arranged from simple to complex for easy understanding. The researcher also took representative questions from each of the sections of the unit and then evaluated them against the desired outcomes. In addition, a detailed verbal descriptions and clear instructions were provided during the group administration, which the researcher personally conducted.

### Reliability of Instruments

To ensure the reliability of the questionnaire, the split half method was used. This was done by assigning the odd numbered items to one half and the even numbered items to the other of the test.

### Data Analysis

#### Quantitative Data Analysis

The quantitative data was analyzed using both descriptive and inferential statistics. The descriptive statistics was used to describe and summarize the data inform of tables, frequencies and percentages. The inferential statistics was used to help make inferences and draw conclusions. Statistical tests including Pearson correlation which is a measure of the linear correlation between two variables was used.

#### Qualitative Data Analysis

Data from interviews was analyzed by using the thematic frame work and the following steps were considered; the research followed the principles of thematic analysis.

## II. FINDINGS, INTERPRETATION AND DISCUSSION

### Findings on Effect of Teacher Resource on Quality Education Provision in Public Primary Schools.

#### Teacher population

The study sought to explore how the number of current teacher population compares with the expected ideal teacher number in those schools using document analysis. It was established that there was significant difference in current and expected teacher number in public primary schools within Masaba south sub-county. Table 1.0 shows the group statistics on teacher mean number of teachers.

**Table 1.0: Group Statistics on Teacher Mean Number of Teachers.**

	Education Payments	N	Mean	Std. Deviation	Std. Error Mean
Teacher Number	Actual teacher number	66	11.9697	3.33268	.41022
	Expected teacher number	96	15.6515	4.50809	.55491

This teacher mean number of teachers was reflected by the independent-samples t-test results, which was conducted to compare the mean number of current and expected teachers per school within Masaba sub-county. This is shown in table 1.1

**Table 1: Independent Samples Test**

			Levene's Test for Equality of Variances						
			F	Sig.	T	Df	Sig. tailed)	(2-Mean Difference	Std. Error Difference
Teacher Expected Number	Equal variances assumed		1.879	.173	-5.335	130	.000	-3.68182	.69008
	Equal variances not assumed				-5.335	119.707	.000	-3.68182	.69008

Table 1.1 depicts that there was a significant difference between the actual number (M=11.97, SD=3.33) and expected number[M=15.65, SD=4.51; t(120)=-5.34, p<.05], with the actual teacher numbers being significantly lower than the expected number of teachers in the schools within the sub-county as revealed by group statistics. This therefore implied that teacher/pupil ratio was quite disproportionate in disfavor of the current teacher staffing in most of the schools in the sub-county. Teachers' attitudes towards their work and pupils, their classroom management and their interaction with pupils have great impacts on the academic achievement and the retention in school of their pupils. Few classroom observations in schools

indicate that there are cases where teachers' negative attitudes make pupils drop out of school. These pupils are sometimes neglected, abused, mis-handled, and sent out of class during teaching learning periods. This atmosphere is not conducive to learning and makes some children hate school. The need to increase pupils' enrolments has not taken into account their growing up needs in order to retain them in school.

Table 1.2: Shows effect of teacher resource on quality education provision in public primary schools

**Table: 1.2 Effect of Teacher resource on quality education provision in Public Primary Schools (n=86)**

ITEM	1	2	3	4	5	TF	TS	AV	% SCORE
1.The content covered is affected by the numbers	5	5	0	58	20	88	347	3.943182	78.86364
2. The number of lessons per teacher is inadequate.	2	12	0	54	6	74	272	3.675676	73.51351
3. The workload has added since the inception of FPE	1	5	0	62	6	74	303	4.0946	81.8918
4. There is no adequate teacher-student individual attention	5	7	0	51	12	75	283	3.773333	75.46667
5.Teachers attend workshops/seminar rarely	1	30	0	50	5	86	286	3.325581	66.51162
6. teachers do not cover syllabus at the right time	5	4	0	62	11	82	316	3.853659	77.07317

7	There is no	12	5	0	49	10	76	268	3.526316	70.52632
continuouseffect										

Key: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2) and Strongly Disagree (1), P- principals, ST-DH teachers, R – respondents

Table 1.2 depicts that, although (21.1%) of deputy head teachers who took part in the study held the view that the content covered adequate in their schools, a significant proportion [4 (78.9%)] held the belief that the content is generally inadequate. The state of the number of lessons taught adequacy was not any better either; whereas only (26.5%) of the deputy head teachers who were sampled for the study held perception that lessons were adequate in meeting the appropriateness of the teachers in their schools, a significant majority of 4 (73.5%) of the deputy head teachers said that the number of lessons taught are quite inadequate, since they are too many as shown in table 4.9. It also emerged that most of the schools had heavy workload, as confirmed by most 4 (75.5%) of the deputy head teachers whereas a few of the deputy head teachers vehemently agreed with assertion that the workload are heavy as the view was shared by 4(63.1%).

Further findings reveal that there is no adequate teacher-student individual attention. This was attested by many 4 (75.4%) of the deputy head teachers who took part in the study who alluded that pupil teacher ratio has gone high since the inception of FPE. This state was replicated in the other parameters; in capacity building only (33.5%) of the deputy head teachers who participated in the study alluded that teachers attend workshops/seminar but most [4 (66.5%)] of the deputy head teachers insisted that the teachers attend workshops/seminar rarely. Similarly, the state of the syllabus coverage is worse off in most of the primary schools more than three out of every five [4 (77.1%)] of the deputy head teachers who were sampled for the study disagreed with the fact that teachers cover syllabus at the right time. Further, it was revealed from the findings of the study that the testing policy was not characterized by continuous effect in most of the schools in the sub-county; only (29.5%) of the deputy head teachers were satisfied with testing policy as they had it that they had continuous effect. However, nearly three out of every four [4 (70.5%)] deputy head teachers who were asked about the testing said they did not have adequate and continuous effect.

It emerged that many 4 (74.9%) of the deputy head teachers confirmed that structured and inclusive pedagogy has not improved minority (25.1%) had the opinion structured and inclusive pedagogy has improved that while The results and discussions of data collected from in-depth interview schedules with the head teachers on effect of increased enrollment on learning resources in public primary schools was as follows: Lucas and Mbiti (2010) have noted that teacher resource is one of the most important inputs in the education system and therefore their efficient management and utilization is critical to the quality of learning outcomes. Continuous improvements in the quality of educational services should also entail continuous skills upgrading for teachers. The teachers should also be enough, have clear vision, and set achievable goals and

objectives and achieve them. Teachers’ preparation for their lessons and their effect of students has particularly strong associations with student outcomes. A head teacher said;

*“Due to high enrolment and congested classrooms, teachers are unable to teach well and pupils were unable to concentrate hence the content covered in a problem”* (HT3)

A head teacher said

*“FPE has created significant problems like overcrowded classrooms, high pupil -teacher ratio, scarcity of learning materials and overworked teachers”* (HT3)

Another head teacher said;

*“Teachers are conducting classes in a lecture format, which does not hold the attention of young primary students. Less homework is being assigned due to the inability of teachers to mark 100 papers every night.”* (HT6)

This means that quality of education has suffered as teachers have become overburdened and stopped being able to provide students with the attention they need.

Another head teacher said

*“Teachers’ attitudes towards their work and pupils, their classroom management and their interaction with pupils have great impacts on the academic achievement and the retention in school of their pupils”.* (HT4)

One head teacher said;

*“There is sudden increase in enrollment till teachers are nowadays attending up to 100 pupils in a class and syllabus coverage is an issue”*HT6

Another head teacher said;

*“The pupil teacher ratio which has gone up made teachers have extra work which they do not now attend to adequately and even now is a problem”*HT1

A head teacher quoted;

*“Teachers were not ready for such large numbers and we were not take not taken for seminar for orientation.”*HT4

The schools also faced a shortage of desks for the newly enrolled pupils and making slightly well off parents opt to transfer their children from public primary schools to private schools in search of quality education. The MOEST recommends a PTR of 35:1 which would give the teacher adequate time to give personalized attention to each pupil, to supervise class work and mark books and examinations. Moderate numbers would also allow the teacher time to plan lessons and execute their plans more efficiently. Unfortunately, for Kenya the achievement of this standard PTR of 35:1 has been an uphill task all along since independence.

Whatever the case, the PTR in Kenya has shown an upward trend due to somewhat constantly increasing enrolment rate in primary schools as compared to a declining or almost stagnant number of teachers.

**Testing the Hypothesis on Teacher Resource of Study (Zero order correlation matrix)**

In this study teacher resource parameters (content, adequacy, work load, pupil teacher ratio, capacity building, syllabus and testing policy) were converted into continuous ratio scale, with values ranging from 1 to 5. It was therefore suitable to establish the input between the parameters using correlative methods and quality education. Therefore the hypothesis was tested using inferential statistics mainly based on correlation and regression analysis. A bivariate correlation (zero-order

correlation) was used to explore the relationship between the parameters by computing a Pearson Product-Moment Correlation Coefficient. All data was analyzed at a level of confidence of 99.5% (p.v = 0.05). By this testing level, the researcher allowed 5% percent error margin. This meant that the results were 95% true as was found.

Table 1.3: shows the correlation on elements of teacher resource using a zero order correlation matrix.

**Table 2: Correlations on Elements of Teacher Resource (Zero Order Correction Matrix)**

		Content	Adequacy	Work load	Pupil teacher ratio	Capacity building	Syllabus	Testing policy
Content	Pearson Correlation	1						
	Sig. (2-tailed)							
	N	85						
Adequacy	Pearson Correlation	.418**	1					
	Sig. (2-tailed)	.000						
	N	78	78					
Work load	Pearson Correlation	.587**	.831**	1				
	Sig. (2-tailed)	.000	.000					
	N	69	69	69				
Pupil teacher ratio	Pearson Correlation	.497**	.003	-.345**	1			
	Sig. (2-tailed)	.000	.979	.004				
	N	85	78	69	86			
Capacity building	Pearson Correlation	.647**	.330**	.502**	.277*	1		
	Sig. (2-tailed)	.000	.003	.000	.013			
	N	80	78	69	80	80		
Syllabus	Pearson Correlation	.695**	.629**	.749**	.217*	.558**	1	
	Sig. (2-tailed)	.000	.000	.000	.050	.000		
	N	82	78	69	82	80	82	
Testing policy	Pearson Correlation	.509**	.686**	.865**	-.163	.232*	.540**	1
	Sig. (2-tailed)	.000	.000	.000	.151	.039	.000	
	N	79	78	69	79	79	79	79
	Pearson Correlation	.332**	.71**	.931**	-.418**	.332**	.538**	.875**
	Sig. (2-tailed)	.003	.000	.000	.000	.003	.000	.000
	N	77	77	69	77	77	77	77
	Pearson Correlation	.733**	.542**	.637**	.531**	.132	.616**	.630**

\*. Correlation is significant at the 0.05 level (2-tailed).

\*\*. Correlation is significant at the 0.01 level (2-tailed).

From the table of correlations, there was a significant correlation by a correlation of .979 between work load and adequacy followed by a correlation of .931 between syllabus and work load; all at P-value, 0.01. This shows that they had a positive association in the model of Teachers as a Resource. Further; there was also a positive correlation of .875, .865, .749, syllabus and testing policy, syllabus and work load, capacity building and work load respectively. They also showed a positive association of the model teacher resource variable. However, there was no negative association between the parameters In conclusion, a decision was reached on the null hypothesis;

**H<sub>0</sub>2:** There is no significant relationship between teacher resource and quality of education in public primary schools

Given that level of significance was attained in all the variables, the null hypothesis was rejected. Hence, from this analysis a conclusion was reached that; **Ha2** There is a statistically significant relationship between the teacher resource parameters (content, adequacy, work load, pupil teacher ratio, capacity building, syllabus and testing policy) and quality of education. Without proper grounding in the proper teaching methods, teachers will continue to be ill equipped to handle the curricula. It implies at school, there is no emphasis and support to teach literacy skills, especially in the basic years of schooling, thereby resulting to under-teaching at classes 1, 2 and 3.

Primary school teachers face specific challenges in trying to provide quality education. In this case there are no clear set practical guidelines on how to interpret and teach the content in the syllabi, and consolidate and assess the mastery of knowledge and skills learnt at different grade levels. The curriculum has been found lacking in some of the information needed for proper implementation. The concept of mastery of literacy is not clearly articulated beyond the general and specific objectives of the syllabus. There is also an assumption by teachers that all children have gone through pre-school that is erroneous. Many learners, especially those in rural

areas, do not attend pre-school before joining class one. This assumption has created a misconception among teachers that children enter school having acquired reading skills from pre-school. They, therefore, ignore starting with the basic reading skills like the phonics, which is disadvantageous to those who have not acquired such skills.

Table 1.4 shows the model summary for teacher resource variable which was generated by the researcher. It indicates that the coefficient of multiple determination (R squared), a statistical measure of how close the data are fitted to the regression line.

**Table 3: Model Summary for teacher Resource Variable**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.700a	.490	.423	.0000520065

Teacher resource (Constant), content, adequacy, work load, pupil teacher ratio, capacity building, syllabus and testing policy

It was noted that the total R squared value for the model of Teacher Resource Variable was .490 (or 49.0 per cent explained variance). The total R squared value, included the unique variance explained by each variable and also that shared. R squared = 49.0%, this implies that the teacher resource in question accounts for 49.0% variability in quality education and the unexplained variation 51.0% are the teacher resource not considered in the equation that would contribute to the impact of quality education. The independent variables were reasonably strongly correlated; hence there were a lot of shared variance that was statistically removed when they were all included in the model.

Table 1.5 shows coefficients of parameters that will be used in making comparisons on their unique contributions to the school teacher resource variable. Comparing the different parameters of teacher resource, a standardized coefficient was used because the values for each of the different parameters were converted to the same scale so that they could be easily compared. However, in constructing a regression equation, the unstandardized coefficient values listed as B were used. Given that the interest was to compare the contribution of each independent variable the Beta values were considered.

**Table 4: Coefficients of Teachers Resource Variable**

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.017	.000		2.786	.007
1					
Content	.088	.029	.120	3.018	.004
Adequacy	.024	.031	.031	.779	.039
Work load	.260	.035	.380	7.428	.000
Pupil teacher ratio	-.130	.048	-.065	-2.714	.009
Capacity building	.084	.036	.082	2.314	.024
Syllabus	.209	.021	.290	9.865	.000
Testing policy	.079	.058	.079	1.365	.008

Dependent Variable: Teachers Resource

From table 1.5, the largest Beta coefficient was .380 which was for work load implying it made the strongest unique contribution to explaining the dependent variable Teachers as a Resource Variable; the second largest Beta coefficient was .290 which was for syllabus, implying it made the second strongest unique contribution to explaining the dependent variable; this was followed closely by content with a beta coefficient of .120,

implying it made the third strongest unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model was controlled for. The parameter pupil teacher ratio had a lowest Beta value of -0.130 which shows that it had the least contribution to the model. Adequacy, capacity building had beta of .031, .079 and .081,

respectively. All the parameters were significant at P-value <0.05.

### The Regression Model for Teacher Resource

Of all the pre-requisites for effective management of a school, the most vital is the teacher resource. The success of any type of organization, be it social, political religious or economic, depends to a large extent on the human beings that make up the organization. Teachers take decisions, which provide the knowledge, energy and the co-operation through which schools objectives are achieved hence attainment of quality education. A regression model for the relationship between the teacher resource variable and the parameters is shown below.

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \epsilon$$

Where: Y is Teachers resource

- x<sub>1</sub> content
- x<sub>2</sub> adequacy
- x<sub>3</sub> work load
- x<sub>4</sub> pupil teacher ratio
- x<sub>5</sub> capacity building
- x<sub>6</sub> syllabus
- x<sub>7</sub> testing policy

$$= .017x_1 + .088x_2 + .024x_3 + .260x_4 - .130x_5 + .079x_6 + .084x_7 + \epsilon$$

From the regression model, the parameter of work load had a highest input of .260 towards teachers as a resource; it was followed by syllabus which had an input of .209 units. Teacher pupil ratio of had the lowest input of -.130 units. The content, work load, testing policy, capacity building, and adequacy had inputs of .017 units, .024 units, .079 units, .084 units .088 units respectively. Effective teachers are highly committed and care about their pupils and they need supportive working conditions to maintain these positive attitudes. The condition of infrastructure, availability of textbooks and learning materials and class sizes all influence the teacher's experience as an educator. In the schools under study, teachers are de-motivated and less able to address the needs of individual pupils, effectively discipline children or create opportunities for interactive learning. They also give fewer assignments and sometimes conduct classes in lecture format, which does not hold the attention of the young primary school pupils. Meeting quality benchmarks in schooling in the sub-county remains a challenge.

### III. SUMMARY OF FINDINGS

#### Effect of Teacher Resource on Quality Education

From the regression model, the parameter of work load had a highest input of .260 towards teachers as a resource; it was followed by syllabus which had an input of .209 units. Teacher pupil ratio had the lowest input of -.130 units. The content, work load, testing policy, capacity building, and adequacy had inputs of .017 units, .024 units, .079 units, .084 units .088 units respectively.

The descriptive analysis results of the study established from the respondents that significant proportion held the belief that the content covered is generally small. The state of the number of lessons taught adequacy was not any better either besides the appropriateness of the teachers in their schools, a significant majority of the deputy head teachers said that the number of lessons taught is quite inadequate, since they were too many. It also emerged that most of the schools had heavy workload, as confirmed by most of the deputy head teachers. Further findings revealed that there is no adequate teacher-student individual attention as was attested by many of the deputy head teachers who took part in the study who eluded that pupil teacher ratio has gone high since the inception of FPE. In capacity building most of the deputy head teachers insisted that the teachers attend workshops/seminar rarely. Similarly, the state of the syllabus coverage is worse off in most of the primary schools more than three out of every five of the deputy head teachers who were sampled for the study disagreed with the fact that teachers cover syllabus at the right time. Further, it was revealed from the findings of the study that the testing policy was not characterized by continuous effect in most of the schools in the sub-county as agreed by nearly three out of every four of the deputy head teachers who were asked about the testing policy. It emerged that many of the deputy head teachers confirmed that structured and inclusive pedagogy has not improved. Similar findings were revealed from qualitative analysis which had it that; the specific programs being implemented have not been very effective in enhancing quality education. The teachers had become overburdened and stopped providing students with the attention they needed and hence challenging the pedagogy. As a result of substantial rates of drop out and non-completion of primary school many children left school without acquiring the most basic skills.

### IV. CONCLUSION

#### Effect of Teacher Resource on Quality Education Provision in Public Primary Schools

It can be concluded from the correlation regression model of that the parameters of teacher resource affected quality education in order of importance as were factored in the regression model.

The parameter of work load had a highest input towards teacher resource with a Beta coefficient of .380 implying it made the strongest unique contribution to explaining the dependent variable quality education. The second largest Beta coefficient was .290 which was for syllabus, implying it made the second strongest unique contribution to explaining the dependent variable; this was followed closely by content covered with a beta coefficient of .120, implying it made the third strongest unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model was controlled for. The parameter pupil teacher ratio had a lowest Beta value of -0.130 which shows that it had the least contribution to the model. Adequacy, capacity building had beta of .031, .079 and .081, respectively.

The model is 49.0% explained by the parameters on quality education. This means that teacher resource variable had an effect on quality education.

## V. RECOMMENDATIONS

In light of the findings about effect of teacher resource on quality education provision in primary education, the study recommends that:

There is need to improve the quality of education through consolidation of schools rather than spreading resources thinly and encourage participation of private individuals to support education. The MOE should address the teacher resource shortage as well as put in place effective quality assurance mechanisms to enable schools get timely disbursement of funds. The possibility of synchronizing the school calendar with GoK fiscal year should be considered. The MOE should develop and implement comprehensive frameworks for mobilization of adequate funds and implementation of all policies addressing inclusive and equitable basic education. Teachers should be attending workshops/seminar to keep on upgrading them as per changes in the needs of the curriculum. Capacity building of teachers should be regular and structured and inclusive pedagogy should be improved.

### Suggestions for Further Research

A study should be conducted to establish the effect of time resource management on quality education so as to broaden the factors that affect quality.

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# Impact of Demonetisation on India with Reference to Logistics & E-Commerce

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DOI: 10.29322/IJSRP.8.8.2018.p8086

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8086>

**Abstract-** Demonetisation is an act of taking back the status of legal tender from any currency, in India this decision was taken on 8 November 2016 making the economy swing on a roller coaster ride. Main aim for such a strong step is the elimination of black money and funding for terrorism which completely disrupted the social, political, and economic spheres of the world's second largest emerging market. Economy was hit badly. Business on cash basis ruined up and customers suffered. Producers faced a loss whereas e-commerce consider it a short term pain. E-wallets gained up where as small traders loose it all. Economy is now facing the heat of the move but will soon be enjoying its benefits. The main aim of this paper is to highlight the impact of demonetisation on the economy in general and on e-commerce and logistics in particular. The paper considers the affect of this move on the economy and how it has created opportunities for some businesses while making other concerns to loose.

**Index Terms-** E-Commere, Logistics, Start-ups

## I. INTRODUCTION

From a nation of cash preference payments to a cashless economy is a very big jump. The DEMONETISATION policy by the government was a sudden and a prodigious move, which laid its impact on the entire country. The main aim of this surgical strike was to eliminate and capture black money. This move has its positives and negatives as faced by the entire nation. Some businesses got an upswing whereas others clasp a back seat facing temporary losses, rich class experienced tension of their black money and poor strived for their basic needs. This cash crunch affected the operations of all streams to their highest mount. Where the traditional market faced huge losses, for e-commerce it was a mixed reaction; as with no cash in hand and with a withdrawal limit at banks people preferred online shopping making digital payments.

The following literature is reviewed for the paper based on secondary data through internet, newspapers and reports.

## II. DEMONETISATION



Source: indianonlineseller.com

It is term a which means an act of scrapping the old currency notes or taking back their status of legal tender money. In India this decision was taken on November 8, 2016 where by paper currency of ₹ 500 and ₹ 1000 were no longer to be considered as legal tender money. India had been done before also in 1946, when all 1,000 and 10,000 rupee notes were recalled. In 1978, 1,000, 5,000, and 10,000 rupee notes were demonetized. As per the notification, sparing some places of public utilities like petrol pump, railways, airports and government hospitals use of this currency was discontinued. Citizens were allowed to take ₹ 2000 per identity from bank, the limit was later raised to ₹ 2500, withdrawal or ₹ 10000 per cheque per account at once and ₹20000 in a week was allowed Since that day till now the Indian Economy is on a roller coaster ride facing challenges every day in a new way. This move received a mix response, where the government decision received praises as well as criticism from the society. The immediate effect of this appalling move was seen on the very day of its announcement when people rushed up to deposit their money in banks and then later stood in long queues for money exchange and withdrawal in order to minimise the aftermaths of this cash crunch.

The positives and negatives of Demonetisation are listed as such.

## III. PROS

- This move will help in eliminating black money from the economy.

- It was an effort to stop funding for terrorism.
- To reduce corruption, use of drugs and smuggling.
- The move could boost government revenue.
- It can help to move economic activities from informal sector to formal sector. According to the Ambit capital Report, the share of informal sector can reduce from 40 percent to 20 percent.
- E-Commerce and digital payments will take a head.
- It will benefit the economy in the long run.
- Income tax rates may come down.
- Rate of interests on loan will fall encouraging money supply.
- Rate of real estates and gold prices will fall.
- Currency will become stronger
- Industries will become more productive.

#### IV. CONS

- The move has caused great inconvenience to the common people.
- Consumption and trade are the first to suffer.
- Consumption expenditure and thus GDP will be affected as people have no cash in hand.
- Bonds prices can increase in the near future.

The further impacts of Demonetisation on the economy are shown in the next sections. This paper will be addressing the collision of the same on e-commerce, new start-ups and logistics.

#### V. OBJECTIVE OF THE STUDY

- The main objective of this study is to understand demonetisation and its impact on the economy in reference to e-commerce and logistics in particular.
- To study various challenges faced by e-commerce and logistics.

#### VI. RESEARCH METHODOLOGY

This paper is fully done by secondary data, collected from sources like Research agencies, websites and news papers.

#### VII. IMPACT ON E-COMMERCE



Source: [economictimes.indiatimes.com](http://economictimes.indiatimes.com)

The term is used to convey trading and business operations conducted via internet. Today's e-commerce is a fully developed field introducing new and creative ways for satisfying customers. Customers' ease, trust and satisfaction for e-commerce has also increased over the years. This fact is evident from the study conducted by "India Goes Digital", The Indian E-commerce market of the value 28500 crores in 2011 of which online travel constitutes about 87%. As per Internet and Mobile Association of India, e-commerce sector will be earning ₹ 211,005 crores till December 2016 of which 61% is due to travel.

The impact on demonetisation can be seen clearly on the market, the sudden changed purchasing behaviour of the consumer is the ultimate proof as in the hour of emergency with no cash spare with them, the last resort for the consumers was e-commerce only.

Undoubtedly the e-commerce companies also felt the heat of this move but the pain was short termed. As when the majority population turned up to be cashless, they turned up. For e-commerce, where demand for luxurious and technical goods saw an abnormal fall, there demand for that of grocery and essential commodities welcomed a surge of sales. With shortage of goods in the traditional market people preference for e-commerce gained up but the fact can not be denied that the rural area people are still not that efficient in making digital payments and prefer the traditional market over e-commerce so from that part the sales from e-commerce got affected a lot.

The main source of earning for any e-commerce site whether Amazon, Flipkart or Snapdeal is cash on delivery and when the crowd went cashless so suffered the e-commerce companies. Cash on delivery orders were badly hit as per the research done by Forrester Research, "The cash on delivery option will witness a significant fall and thus it will force customers to make online payments atleast in the first 1-2 months". According to PayU India CEO, Amrith Rau, "This move will also have an effect on Gross Merchandise Volume as not every COD order will move to digital payments". E-commerce companies have to increase the discounting rates to drive sales.

At last demonetisation proved to be a good move for e-commerce as according to Snapdeal's co-founder and CEO Kunal Bahl, "CoD returns are a big pain point from economics' and logistics' perspective...this will significantly get mitigated going forward as more and more payments move to digital,"

#### VIII. IMPACT ON LOGISTICS

#### IX.

Impact Of Demonetisation On Auto Companies FY17 Earnings Per Share Estimates			
	Previous	Current	% Revision
Bajaj Auto	144.25	141.9	-1.63
Eicher Motors	643	625	-2.80
Hero MotoCorp	183	180	-1.64
Mahindra & Mahindra	72.5	72.5	0
Maruti Suzuki	229	231	0.87
Tata Motors	46.9	38.3	-18.34
	1318.65	1288.7	-2.27

Source: bloombergquint.com

Logistics serves as the backbone of an economy. It facilitates the movement of good from one place to another. Logistics is as important to business as is government to a nation. As the entire nation tasted the taste of this cash crunch so as its producers. When the producers fall short of cash with lower prices of their commodities and less profits making them fail to produce any further commodity creating a shortage of goods in the market. Their comes the role of logistics of transferring commodities from the place of extra to the place of shortage specially for essential commodities.

As described earlier, the more number of people turning towards e-commerce want things to be delivered to them at the earliest which was made possible with the help of logistics therefore to some extent the importance of logistics has increased with demonetisation but the logistic companies have suffered also as when the cash on delivery is totally eroded, logistics companies faced a dip in their profit volumes.

According to Blue Dart Express, the Indian logistics and courier company owned by DHL Group has suffered a loss, Charles Brewer, CEO said, "There is a short term pain(in terms of profitability). The volumes are lower. E-tailers are not sending some of these cash on delivery shipments,"

We are not able to take any new consignments or orders considering we have no cash to give to our drivers. Some of our drivers are stuck following the announcement as there are no new denomination notes available for immediate usage," said Gurvinder Singh, vice-president, Bombay Goods Transport Association.

The working president of All India Transporters Welfare Association said, " there re about 85 lakh trucks engaged in the transportation of goods in the country and the operations of almost all of them are fast coming to a halt" as the transporters have run out of cash and are no longer able to provide it to their drivers.

#### IMPACT ON E-COMMERCE START-UPS



Source: indianexpress.com

Technology has driven our lives to a modernised world. All the changes are coming fast due to creativity and new ideas. This innovation is brought by the start-ups. Start-ups are nothing but a new innovation done to make our lives better than before and to satisfy the ultimate customers. New companies that were set up to deal in real estate suffered losses because of decrease in price of properties. Start-ups with the business of consumer electronics and luxury also had to taste the salt of losses where as newly developed those who were dealing in durables, gold and jewellery, e-wallets were the ultimate beneficiary as on the very day of announcement and even after that those having black money invested in gold leading to sudden hike in gold prices and online jewellery sites do accept digital payments making them survive in this cashless era but later on common man withdraw his savings from gold only those for marriage and important purposes paid for it as the crowd having bare money to spend on neccesities, gold became a far cry.

## X. TRANSPORT START-UPS

Neither the online transport nor the public transport bled with demonitisation, as this move has affected the entire economy but many sectors were there who got scratched a little and online transport and public utility vehicles are one of them.



Source: mid-day.com

It goes without saying that with the ban of ₹ 500 and ₹1000 notes e-wallets are the highest beneficiary. It is the happiest sector after the government's move to ban currency. Ever since this decision was announced Paytm's user base rose to 160 million. Paytm founder-CEO Vijay shekhar sharma said, "I don't need to sleep, this is a dream that I am living while trying to solve the pain of the people". "Paytm is registering over 7 million transactions worth Rs 120 crore in a day as millions of consumers and merchants across the country try mobile payments on the Paytm payment platform for the first time," said Sudhanshu Gupta, Vice President, Paytm. From a vegetable vendor to paying for a school fee Paytm is everywhere and with this decision of the government e-wallets like Paytm, Mobikwik, Freecharge gained a lot. According to an analyst from AppAnnie, about 46.62 percent Indians open for wallet recharge and payment. To attract more consumers these wallets have launched their apps in local languages which really results in adding more number of consumers than never before.

For e-wallets demonitisation proved to be a big hit, they are adding more number of consumers and are making good profits.

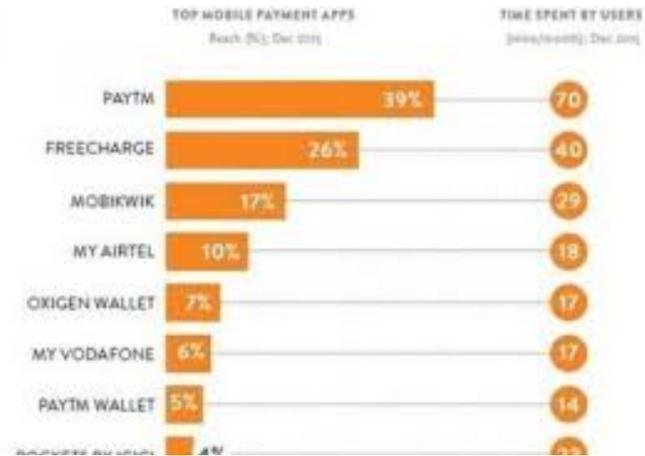
## XII. ONLINE FOOD DELIVERY BUSINESS

Food start-ups like foodPanda, Wow Momo, Café Coffee Day etc allow their customers to pay via e-wallets or through debit card, credit card or any other mode of digital payment. With demonitisation this business has not been affected much as unless like traditional market they can not only deal in cash. Their revenue had probably remained the same.

Other sector of the society which suffered is the AAM JANTA sector, this was the most affected. People were standing in long queues struggling to get their currency changed.

Online transport facility like that of OLA and UBER was not that affected by demonitisation as they accept online payments and many users in India pay from their smart phones through e-wallets and other measures.

## XI. E-WALLETS



source: insidein.com

Traditional market faced a huge loss because of this cash crunch every transaction in the traditional market came to a standstill. Every business from a kirana shop to airlines, there is not a single business except e-wallets which had enjoyed any relief. Some praised this action whereas for some it was a disastrous decision which let the whole economy bite its nails.

## XIII. IMPACT ON ECONOMY AS A WHOLE

As discussed above business being the core component of an economy got badly hit. The worst sufferers are those dealing on cash basis. The country gave a mixed response for common people it is difficult to adjust in a short span of time but they will enjoy the benefits as for a common man investment in gold and real estates are the popular options the rates of which will come down. Society will become more equitable. Inflation will come down. Drop down in prices of properties and gems and jewellery will lead to decrease in profits from the producer. "The unbanked and informal economy is hard hit," explained Monishankar Prasad, the New Delhi-based author and editor for Alochonaa, an Australian current events publication. "The poor do not have the access to structural and cultural resources to adapt to shock doctrine economics. The poor were taken totally off guard and the banking infrastructure in the hinterland is rather limited. The tech class has poor exposure to critical social theory in order to understand the impact on the ground. There is an empathy deficit."

## XIV. CONCLUSION

This paper aimed at finding the various ill and positive effects of demonitisation on economy and business. The sufferers of this move are common man, small and medium sized businesses, terrorists, Country's GDP, banks, e-commerce,

logistics and so on the list is long. The beneficiary of this move can only be concluded as E-Wallets, although the study is still on but the following paper has made an effort to highlight some of the after effects of demonetisation on e-commerce and logistics. Everything has its positive and negatives so as demonetisation. Some praised the move whereas some criticised it. Demonetisation at one side laid one business to rise and on the other hand has made the economy and its people go through the pain. Demonetisation is a good move and will lead to betterment of the economy in the long run, no doubt but many businesses have to shut down their work or production. A short term pain can be handled for a long term benefit. When it comes to common man people with large amount of black money got restless with this move and used unscrupulous means to hide and convert it, whereas a taxpayer has to stand in long queues to withdraw his own hard earned money. Small and medium sized business dealing on cash basis were totally thrashed seeing a collapse in demand. Banks had hard time while dealing with customers. The economy gross domestic product is expected to decline but will gain up again in the long run. It can be concluded that where demonetisation proved to be a blessing for e-wallets, solution for other e-commerce business will also come soon as majority economy was hit badly so way out from this problem need to be taken care of.

#### ACKNOWLEDGMENT

*I would like to express my gratitude to Dr. Gyanesh Kumar Sinha from School of Management, G D Goenka University,*

*Gurgaon for facilitating the necessary informations and facts to make this study a worthy..*

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# The Implementation of Vocabra Games to Teach Vocabulary for High Motivated Students in Elementary School

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DOI: 10.29322/IJSRP.8.8.2018.p8087

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8087>

## Abstract

This study was aimed to investigate the implementation of vocabra games faced by the Elementary Students in one of the schools in Indonesia. The sample in this study was the fifth grade students having high motivation in vocabulary mastery. This research was a qualitative study using purposive sample. In collecting the qualitative data, the researchers did observation, interview and distributed questionnaire. This study revealed some findings related to the students' high motivation in vocabulary mastery. There were some implementation of vocabra games which come from the students' motivation in vocabulary mastery, they were (1) the implementation of using vocabra games; (2) the students' motivation in vocabulary mastery with high motivation; and (3) the aspect of vocabulary as the indicator in mastering vocabulary. Concerning with those statements, the researchers would like to review a various media in vocabulary mastery. That is vocabra games. This media gives positive effect and suitable to the students with high motivation.

**Keywords:** EYL Students, vocabulary, vocabulary mastery, vocabra games, motivation.

## Introduction

The core problem that young learner faced in language is about how to memorise new word. There are a lot of languages in this world and each country has its own language. We know that English language is the universal language which is used to communicate with other nations. That is why it will have a good result to study English from basic level, especially for teaching and learning vocabulary. Although the person is not an English, she or he definitely uses English to communicate with other people in the world. It is unfortunate that the word *language* is often used to cover all forms of communication (Broughton et al., 2003, p. 25). Not only communicating English language, but also becoming as formal and second language in several countries. Even though every language has its own style, in fact it is the same with other language, it is as bridge to communicate for one person to other person. The basic rules of one language are the same as those of all languages (Swarbrick, 2003, p. 9).

In learning English the students are demanded to understand and use the language skill such as listening, speaking, reading and writing. But before the students achieve all of them, they should pass some steps in learning English. In the first step students will study vocabulary because it is the most important component in English.

Vocabulary can be defined, roughly as the words we teach in the foreign language. However a new item of vocabulary may be more than a single word: for example, post office and mother-in-law which are made up of two or three words but express a single idea (Ur, 2009, p. 60).

There are several definitions of vocabulary proposed by some experts. According to Caroline and David (2005, p. 121), vocabulary is the collection of words that an individual knows. Hatch and Brown (1995, p. 1) prove that the term of vocabulary refers to a list or set of words for a particular language or words that individual speakers of language might use. Ur (1996, p. 60) argues that vocabulary is the words we teach in the foreign language. Brown (2001, p. 377) views vocabulary items as a boring list of words that must be defined and memorized by the student, lexical forms are seen in their central role in contextualized, meaningful language. Cerce and Murcia (2001, p. 285) state that vocabulary is central to language acquisition whether the language is first, second or foreign language. Nation (2008, p. 30) states that the learner needs to know of the "words". It means that students need to know the words not only the meaning but also the spelling, pronouncing, and the usage of words.

From the aforementioned definitions, it can be concluded that vocabulary is a set of words or collection of words that must be memorized by a student or an individual speaker in order to construct new sentences or words covering its meaning, pronunciation, spelling, and using word.

In vocabulary mastery, there are several indicators of vocabulary proposed by some experts (table 1):

Table 1: Construct the indicators of vocabulary

No.	Ur (1996, pp. 60-62)	John (2000, p. 16)	Jackson & Amvela (2000, p. 11)	Richards & Schmidt (2002, p. 580)	Construct the Indicators
1.	√	—	—	—	Pronouncing
2.	√	—	—	—	Spelling
3.	√	√	√	√	Meaning
4.	—	—	√	√	Using the word

The indicators in this study that are going to be measured from the aspect of meaning are: giving the meaning of word, stating the meaning of word, and labeling the picture based on the expression given. The indicator from the pronunciation aspect is asking the students to pronounce, while the indicator from the spelling aspect is asking the students to arrange letters into a word from jumble letters. The indicators that are going to be measured from the last aspect is the use of words are: using words to make simple sentences.

In vocabulary mastery, this study used direct instruction. There are several definitions of direct instruction proposed by some expert. Direct Instruction characterized by teacher-centered and teacher-dominated classroom (Peterson, 1999, p. 231). Because direct instruction is widely used by teachers, the predominant use of direct instruction technique needs to be evaluated, and educators need to recognize the limitation of these methods for developing the abilities, processes, and attitudes required for critical thinking, and for interpersonal or group learning. Direct Instruction is specifically designed to promote student learning of procedural knowledge and declarative knowledge that can be taught in step-by-step fashion (Arends, 1998, p. 66). Direct Instruction is one of which there is a predominant focus on learning and in which students are engaged in academic tasks, a large percentage of time and achieve at a high rate of success (Bruce, et al., (2002, p. 338).

Based on explanation above, direct instruction is teacher-centered technique that includes frequent lesson where the teacher presents information and develops concept through demonstration and lecture which are focused on utilizing systematic and explicit instruction by providing feedback and correction of students' mistake to engage them in successful academic task. Moreover, direct instruction is specifically designed to promote student learning of procedural knowledge and declarative knowledge.

There are several teaching steps to teach vocabulary using direct instruction proposed by some experts (table 2).

Table 2: Construct the teaching steps using direct instruction

No.	Ur (1996, pp. 11-12)	Cross (1996, pp. 63-	Marzano (2004, p.	Construct the Teaching step
1.	√	—	√	Explaining
2.	√	√	—	Sound, meaning, and repetition for memorizing and testing
3.	√	√	—	Written form for testing in the word
4.	—	—	√	Discussing, refining, and reflecting.

There are several definitions of vocabra games proposed by some expert.

Rider (2003) says that Abra Vocabra Game is real-world words, words that anyone is likely to read in a newspaper, hear on the news, read in a magazine. In fact, just seeing and hearing the words outside the classroom reinforces for students the idea that the words are useful and important ones to know.

Hadfield (1999) summarizes that Abra Vocabra Game is memorizing, personalizing, and communicating vocabulary games which become a set of new words to integrate them into our existing word store easily based on in a daily activity.

Samston (2001) says that Abra Vocabra Game is helping students improve their vocabulary as a relatively easy project for the classroom and one that reaps results almost immediately where this teaching media powerfully makes the students easy, interesting, practical and enjoyable in vocabulary mastery.

Extracting from the definitions above, it can be concluded that Abra Vocabra Game or Vocabra Game is the process of memorizing, personalizing, and communicating vocabulary games which become a set of new words to integrate them into our existing word store by real-world words, words that anyone is likely to read in a newspaper, hear on the news, read in a magazine.

There are several definitions of motivation proposed by some expert.

Harmer (2002, p. 51) states that motivation is essential to success in most fields of learning because a learner wants to do something to succeed at it.

Whittaker (1970, p. 142) states that motivation is a broad term used in psychology to cover the internal conditions or states that activate or energize person and that lead to goal directed behavior.

Sorrentiono and Liggins (1990, p. 4) explain that motivation is a process pushing someone to act as his desire.

According to Brown (2007, p. 168) motivation is from behavioral, cognitive and behaviorist perspective. Behavioral views motivation as the anticipation of reward and it is driven to acquire the positive reinforcement. By the previous reward, the action will be repeated accordingly. In this case, motivation occurs because the mercy of the external forces such as parents, teachers, peers, educational requirement, job specification, and so forth.

Beck (1990, p. 28) defines that motivation is a psychological aspect dealing with behavior differences among individual from time to time. It is a process to push someone to act based on a certain objective.

Schunk in Driscoll (1994, p. 292) states "Motivation refers to the process where goal-directed behavior is instigated and sustained."

Weiner in Driscoll (1994, p. 292) also states "Motivation is often inferred from learning, and learning that is usually an indicator of motivation for the educational psychologist".

Essentially, motivation is a process to encourage a person to reach a goal. Motivation, like intelligence, cannot be directly observed. Motivation can only be inferred by noting a person's behavior, a type of movement as a part of process of taught, passion, desire, emotion, need, interest, curiosity, and psychology aspects.

There are several aspects of motivation proposed by some experts (table 3):

Table 3: the aspects of motivation

No.	Arden in Rohmah (2012, p. 242)	Dornyei (2001, p. 72)	Sadirman (1994, p. 91)	Construct aspects of motivation
1.	—	√	√	Knowing the goal of learning
2.	√	√	√	Having expectation
3.	√	—	√	Having curiosity of something new
4.	—	√	√	Having interest on subject which will be studied
5.	√	—	√	Having self-determination and self-control on subject which will be studied

### Research Elaboration

Another research about using games was also carried out by Aisah (2014) in her research about the use of abra vocabra game in increasing students' vocabulary. She proved that "Abra Vocabra" can increase significantly the students' vocabulary shown by the statistical analysis that the percentage between pre-test and post-test namely 6.89% using experimental research. Thereby, by using "Abra Vocabra" game can increase significantly the students' vocabulary in learning process.

In addition, the other research taking vocabra games as teaching media was also undertaken by Itsnan (2013) whose research focused on vocabra game to enrich or improve students' vocabulary, because this game motivates the students to know more about the new vocabulary. With Vocabra, teams compete against each other to define vocabulary words correctly.

Furthermore, there is a research conducted by Sekarini (2013) In her research she used "Spelling Bee" Game to Improve Seventh Graders' Spelling. She used Spelling Bee game as an alternative in teaching and learning activity since this game effectively improved the students' spelling ability. Spelling Bee game is considered as an appropriate game to increase the students' spelling ability.

Uzun et al. (2013) in the journal about developing and applying a foreign language vocabulary learning and practicing game through the effect of voca word. They summarized that Voca word is the name of this game. It is designed as a board game that is played quite similarly to one of world's famous games, monopoly.

Baierschmidt (2013) in his journal about a principled approach to utilizing digital games in the language learning classroom. In a principled approach, he conducted that using a certain game in digital game is able to make students acquire new words without they feel bored and confused.

From the description above, the researchers took about game as the research elaboration using vocabra games.

### Method

This research is a qualitative study using purposive sampling. It is aimed in the implementation of vocabra game faced by the elementary students in mastering vocabulary. 14 students were involved as a sample in this research. The sample consist of 5 boys and 9 girls at the fifth grade which consider as the class with the high motivated student in mastering vocabulary and the mean score is above the passing grade.

The researchers used performance test, interview, and questionnaire in collecting the data. The performance test is used to know the students' mean score. Interview and questionnaire are used to know the internal and external problems. Furthermore, the researcher analyzed the data based on Creswell theory. The analysis of the data was done in the following steps: collecting the data from fourteen participants, classifying the data by coding to generate the setting and people, selecting/displaying the data to make it easier in analyzing and interpreting the data which is involved interpretation or meaning of the data. In addition, the researcher interpreted by adopting the interactive model by Miles and huberman (2014).

**Result and Discussion**

The study revealed that the students have a high motivation in vocabulary. It was shown by the post-test result which was shown that the mean score of the students is 9.5 from the passing grade 7.5. The fact from the post-test was that the mean score is higher than passing grade. The result of the students' post-test in vocabulary showed that their score is over the minimum score of vocabulary. Based on the data, the highest score was 9.5 and the lowest score was 8.0 and the mean score was 8.89. It is shown from the table 4 above.

Table 4: the students' high motivated score using vocabra games

Number of Respondent	Motivation Questionnaire	Vocabulary Test
1	135	9.5
2	133	8.5
3	132	9
4	131	9.5
5	131	9.5
6	130	9
7	130	9.5
8	129	9.5
9	128	8
10	126	9
11	125	9
12	124	8
13	124	9
14	122	8
Mean score	8.89	

The study resulting in mean score for the students having high motivation in mastering vocabulary in: (1) pronouncing; (2) meaning; (3) spelling; (4) Using words by total score from vocabulary test.

This study revealed some findings related to the students' high motivation in vocabulary mastery. There were some implementation of vocabra games which come from the students' motivation in vocabulary mastery, they were:

1. The implementation of using vocabra games.  
 Vocabra Games trigger to stimulate students more active and to be actively involved during the instructional activities by using a lot of Vocabra Game types, the students will have high interest and full attention when they face with different interesting media. This media has interesting type in vocabulary learning process about new words that they are going to learn, some practices, and scores for each task. It will aim at acquiring practice rather than the other media in learning practice. This means that the activities will focus more on using forms to communicate than on the forms themselves. When students use a language to try to solve the problem or achieve some goal, success will be sufficient reward in itself.
2. The students' motivation in vocabulary mastery with high motivated students using vocabra games.  
 In mastering vocabulary using vocabra games, high-motivated students are those who provide artificial reinforcement, generate full interest and participation, consistent regarding mastery of learning, and also have positive attitudes by time period of learning activities. They have high learning motivation and are usually actively involved, have full attention, and will stay involved for a long period of time. Students who are clearly motivated will have a positive display of emotion, and they are satisfied with their work and show more enjoyment in the activity. So, when high motivated students learn new vocabulary using vocabra games, they will not face difficulties and get bored because they can study vocabulary with the various media from vocabra games.
3. The aspect of vocabulary as the indicator in mastering vocabulary. To develop the students' mastering vocabulary, there are four aspects: (1) pronouncing; (2) meaning; (3) spelling; and (4) using words. To develop those four aspects related to the kinds of vocabra game, the researcher finds:
  - 1) Vocabulary Bee

The students can acquire new word by a vocabulary bee, conducted somewhat like a spelling bee. In a vocabulary bee, the class is divided into two teams. Unlike a spelling bee, however, students aren't eliminated from the game when they miss a word. Because students will probably know most of the words, it's a good idea to add question "levels," to make the game more interesting. Let each student to select one, two or three point question. For one-point question, students simply define the word correctly, and they can earn their team a point. Then ask students to repeat that word for pronunciation and spelling by the teacher. For two-point questions, they must define the word correctly and use it in a sentence. Three point questions require the student to define two words correctly and use both in one sentence that indicates their meaning. To get the students' ability to spell the words correctly, the teacher can give the jumbled letter. It can be the simple media to make the students understand how to spell the letter based on arrangement the letter.

2) Categories

The teacher asks students to work in small groups to categorize the words, to place at least three words in each category after the class has studied four or five word lists. Students should come up with their own categories. There are, of course, no limits to the number and kind of categories students might choose. Just a few examples: "adjectives," "words that begin with t," "words that describe someone who is mad," "words good for describing food," "words that might be used by a doctor," etc.

The teacher is not allowed to try to give the groups any hints. Insist that the students themselves determine the categories, and remind them that there is no one right answer to the exercise. As long as the category has done at least three words and the words must fit the category, the answer is correct. By these three words, the students can study pronunciation and spelling by the teacher's repetition. Then the teacher gives students some simple media such as sentences or pictures to match the three words before, so the students can get the meaning. This exercise really requires creative thinking and a strong understanding of the words. It is an excellent activity for review.

3) Sell It

The teacher divides the class into small groups, and give each group one of the assigned vocabulary words. The teacher ask the group to imagine being an advertisement agency hired to sell the word to the rest of the class. The teacher gives students a short time to come up with an idea. For example the teacher gives three adjective in an advertisement: cheap, satisfied and delicious with three sentences to be matched to each other. The teacher can asks also the students to match the word based on clues for the other topic, it is the same media for sell it that the teacher sells the words to the students and the students will buy those words. So the student can study the meaning. Then the teacher can ask students to repeat those words by teacher's repetition to study pronunciation and spelling. Finally, the teacher can know how far the students understand the meaning words by asking them to use them in a sentence.

4. Dialogue

The teacher asks students to find the meaning in the bracket. The teacher also can ask them to write a short two or three-person dialogue (conversation) using all the words on the vocabulary list. Or ask them to design a short comic strip that includes all the words on the vocabulary list. As a usual simple media, the teacher can serve at least three words with three sentence randomly. Then the teacher asks the students to match them. After they know about the meaning, the teacher asks students to repeat those words to study the pronunciation and spelling. To encourage the students to study vocabulary, the teacher can use jumble words to make the students understand how to use the words to be a correct sentence.

**Conclusion**

In dealing with the aforementioned vocabra games implementation to teach vocabulary for high motivated students in elementary school, the researcher will conduct a further research in enhancing students' vocabulary mastery through vocabra games. This study is expected to give a huge contribution in English language teaching, especially in recognizing the problems faced by the students in mastering vocabulary.

**Appendix**

Data class of students' high motivation using vocabra games:

8 8 8 8.5 9 9 9 9 9 9.5 9.5 9.5 9.5 9.5

1. The highest score is 9.5
2. The lowest score is 8
3. Range is  $9.5 - 8 = 1.5$
4.  $1 + (3.3) \log 14 = 1 = (3.3) (1.14) = 4,762$  (5 is used)
5. The width (interval) =  $1.5 = 0.3$  (0.4 is used)
6. Mean 5

Class limit	Class Boundaries	Mid. Point	Frequency	Fi.Xi
8.0 – 8.3	7.95 – 8.35	8.15	3	24.45

8.4 – 8.7	8.35 – 8.75	8.55	1	8.55
8.8 – 9.1	8.75 – 9.15	8.95	5	44.75
9.2 – 9.5	9.15 – 9.55	9.35	5	46.75
9.6 – 9.9	9.55 – 9.95	9.75	0	0
			14	124.5

$$\text{Mean} = \bar{x} = \frac{\sum f_i x_i}{N} = \frac{124.5}{5} = 8.89$$

### Acknowledgments

This research work is supported by my family to encourage me and give contribution for the ideas and innovations. I would also thank to the anonymous L2 learners for responding to the research. My big thank also delivered to the lecturers of Sebelas Maret University, Indonesia who support and give many contributions to the completion of this research.

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# Effect of Peer Tutoring on Academic Achievement of Low Achievers in Keyboarding In Secondary Schools in Anambra State

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DOI: 10.29322/IJSRP.8.8.2018.p8088

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8088>

**Abstract-** The study determined the effect of peer tutoring on academic achievement of low achievers in keyboarding in secondary schools in Anambra State. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. The study was quasi-experimental research which specifically used the pretest, posttest non-equivalent control group design. The population of the study was 140 low achieving students of junior secondary school two (JSS2) students from 262 public secondary schools in Anambra State and the sample size was 24 low achieving students from Awka education zone. The purposive sampling technique was used to select Awka education zone out of the six education zones in Anambra State. Simple random sampling was used to select two public secondary schools in the area. The experimental group had 13 students (6 males and 7 females) while the control group contained 11 low achieving students (6 males and 5 females). The academic records of the students was used in collecting the information regarding the low achievers. Keyboarding Achievement Test (KAT) developed by the researcher using JSS2 past questions between 2015 to 2017 was used as research instrument. The face and content validity of KAT was established by three experts, one expert in the Measurement and Evaluation unit of Department of Educational Foundations, one from Vocational Education department both in the Faculty of Education, Nnamdi Azikiwe University, Awka and one experienced Business studies teacher from secondary school sampled. KAT was administered to low achieving students in both experimental and control groups. Test-retest method was used to establish the reliability of the instrument and data were analysed with Pearson Product Moment Correlation coefficient which yielded 0.88. Mean was used to answer the research questions while analysis of covariance (ANCOVA) was used to test the hypotheses. The SPSS version 20.0 was used for analysis. Findings revealed that using peer tutoring instructional mode enhances secondary school low achieving students' academic achievement in keyboarding when compared with conventional teaching method. Gender is not a significant factor on the effect of peer tutoring instructional mode on academic achievement of low achieving students taught keyboarding. Based on the findings of the study, the researcher concluded that peer tutoring instructional mode has the capacity of improving low achievers academic achievement in keyboarding. It was therefore recommended among others, that peer tutoring

instructional mode should be formally adopted by business teachers in secondary schools for teaching keyboarding and other skill-based subjects to improve academic achievement of low achieving students.

**Index Terms-** Peer Tutoring, Academic Achievement, Low Achievers And Keyboarding

## I. INTRODUCTION

All over the world, education has been regarded as an indispensable tool for societal development and transformation. It is on this basis that the Federal Republic of Nigeria (2013) stated in her National Policy on Education that education is an instrument par excellence for effecting national development. To achieve the goals of education, Federal government of Nigeria from time to time initiates various policies and programmes. These policies and programmes are achieved through the establishment of schools at various levels of which secondary education is one of them.

Secondary education is a type of education received after primary education and it has its own goals and objectives as stated in the National Policy on Education. It is important to emphasize that the extent to which these goals and objectives are achieved is dependent on the academic achievement of the students. In fact, students' academic achievement plays an important role in identifying graduates who will become great leaders and productive manpower for nations' economic and social development. Undoubtedly, a student's primary objective is his academics especially at secondary school level, because it is the stage of career building. Unfortunately, many students are leaving this stage without essential business skill and knowledge. In order to achieve these required skill and knowledge, there is need for students to offer business studies at secondary school level.

Business Studies is that part of the curriculum that enables the student to make informed decisions in the everyday business of living. It contributes to the student's understanding of the world of business and encourages a positive attitude to enterprise and also develops appropriate skills in that field ( Popham, 2009). The business studies programme builds a strong foundation for those who wish to move on to further study and

training in specialised areas such as management, international business, marketing, accounting, entrepreneurship or information and Communication technology (ICT).

The recent advancement in Information and Communication Technologies (ICT) which is also revolutionizing business as well as the educational institutions across the globe is posing a challenge to teaching and learning thereby affecting students' academic achievement. To enable students and teachers cope with the challenges and dynamics of ICT, computer studies is introduced into secondary school curriculum. It is obvious that students and teachers need adequate skills in keyboarding to enable them get a firm hold on the use of computer.

According to Robinson (2009), keyboarding is a complex skill made up of finely discriminated movement patterns that depend upon interrelated sensory, perceptual, mental, and motor inputs and outputs which must occur close together in time. As a fundamental skill in today's society, keyboarding provides our connection with the rest of the world through electronic communication. Students who become efficient keyboarders compose better, are proud of their work, produce documents with neater appearances, and have better motivation. Most keyboardists today are involved in generative typing which involves composing original thought directly into electronic documents and email.

Unfortunately, limited access to computers in most Nigerian schools prevents classroom teachers from involving much keyboard technology in their students' daily activities. This is as a result of shortage of computers in secondary schools and teachers have no other choice but to concentrate on conventional teaching method. Conventional teaching method, being one of the oldest teaching methods is still the most widely used method of instruction by teachers in almost all discipline at various levels of education. This method do not seems to address students' different needs in the learning process in the teaching of keyboarding in secondary schools. This is so because the conventional teaching method seems to be teacher-centred since the teacher does almost all the talking while the students listen and watch the teacher. Notwithstanding, conventional teaching method has its own merit as a teaching method. Teachers of keyboarding mostly use conventional method of teaching in teaching keyboarding in their schools. It also helps the teacher to cover much especially when large quantity of information needs to be passed on to the students. Unfortunately, this method does not allow students to think creatively, innovatively and critically since they possibly receive what has been taught to them. As a result student academic achievement is hampered.

Academic achievement represents performance outcomes and indicates the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university (Richardson, Michelle, Charles & Rod, 2012). Therefore, academic achievement should be considered to be a multifaceted construct that comprises different domains of learning. Because the field of academic achievement is very wide-ranging and covers a broad variety of educational outcomes, the definition of academic achievement depends on the indicators used to measure it. Among the many criteria that indicate academic achievement, there are very general indicators such as procedural and

declarative knowledge acquired in an educational system, more curricular-based criteria such as grades on an educational achievement test, and cumulative indicators of academic achievement such as educational certificates.

The issue of poor academic achievement at the secondary school level of education in Nigeria has been widely documented. Record from Anambra State Universal Basic Education Board (ASUBEB, 2017) revealed the performance of all the junior secondary school candidates that registered for the Basic Education Certificate Examination (BECE) organized by Examination Development Centre (EDC) between 2015-2017. According to ASUBEB (2015), 42.97% performed well while 50.03% recorded poor performance. In 2016, 49.26% was good performance and 50.74% was recorded as poor performance while in 2017, 47.27% was good performance and 52.72% was recorded as poor performance. This is an indication that the major problem facing the educational system in Nigeria is the abysmal failure of students in public examinations, particularly at the secondary school level of education.

In Nigeria, academic achievement is measured by grades or by scores at the secondary school level. These grades determines whether a student will have the opportunity to continue his or her education (e.g., to move to the next higher class). Therefore, academic achievement defines whether one can take part in higher education, and based on the educational degrees one attains, influences one's vocational career after schooling. Besides the relevance for an individual, academic achievement is of utmost importance for the wealth of a nation and its prosperity, yet some students perform below average and these students are termed low achievers.

Low achievers are those students who perform academically poor as evidenced or shown in their school academic records. This category of students is identified through their record of results with Anambra State Universal Basic Education Board (ASUBEB, 2017) and the testimonies of their teachers. According to Vanauker-Ergle (2012), a low achiever is someone who achieves less than those around him. The author further stated that, children who are low achievers generally have a below average intelligent quotient (less than 100 IQ) and struggle in the classroom to keep up with general academic requirements. These low achieving students may not be part of nation builders because they drop out of school, join bad gang, underemployed, unemployed and also violent offenders. Notwithstanding, certain strategies could be put in place to help low achieving students improve academically. The strategies may include the use of pre-test technique, calling on low achievers regularly to answer questions, using descriptive praise, communicating high expectations, use of peer tutoring and so on. The present study focuses on peer tutoring technique.

According to Outhred and Chester (2010), peer tutoring is an instructional strategy that consists of student partnerships, linking high achieving students with lower achieving students or those with comparable achievement. Peer tutoring may play a special role in children's development in addition to parents and teachers. There are many types of peer tutoring such as cross-age peer tutoring, peer assisted learning strategies (PALS), reciprocal peer tutoring (RPT), same-age peer tutoring, class wide peer tutoring and so on. The present study would focus on class wide peer tutoring. Class wide peer tutoring (CWPT) involves

dividing the entire class into groups of two to five students with differing ability levels. Students then act as tutors, tutees, or both tutors and tutees. Typically, CWPT involves highly structured procedures, direct rehearsal, competitive teams, and posting of scores (Kalkowski, 2011). Some scholars believe that pairing of low and high achieving students are influenced by gender. Kunsch, Jitendra and Sood (2012) opined that the pairing of students should base on sex, male and male, female and female or male and female.

Gender is one variable that could always be a factor in the issue of students' academic achievement. It is a term which describes behaviour and attributes expected of individuals on the basis of being male or female in a given society (Uwameiye & Osunde, 2009). Undoubtedly, the gender of students may have influence on academic achievement of keyboarding irrespective of the fact that the Federal Government of Nigeria (2013) through its National Policy on Education has provided for equal opportunities for all citizens to study all subjects in schools irrespective of their gender. Okeke (2008) noted that there are many challenges posed by gender on academic achievement of students where certain subjects and activities are recognized as masculine and others, feminine. For instance, in a study conducted by Amoor and Umar (2015) on the influence of demographic variables such as gender on business education students' choice of secretarial option in colleges of education revealed that more female students opted for secretarial option than male students. This was found to be based on the notion that secretarial education where keyboarding is housed is meant for female gender. Such challenges call for instructional method that will enhance academic achievement of students irrespective of gender.

In view of the above, there is indeed a need to have a re-examination of the mode of teaching and learning of keyboarding so that students especially the low achievers might apply the knowledge they acquired to real life situations. It is against this background that the researcher seeks to find out the effect of peer tutoring on academic achievement of low achievers in keyboarding in secondary schools in Anambra State.

### Statement of the Problem

The technological innovation in the 21st century has altered the way people do things including education sector. Everything today is technologically driven which create the need for students to be computer literate. Observation has shown that despite the effort of teachers, curriculum planners and government secondary school students still perform poorly in computer keyboarding in public examinations and this has become a source of worry to education stakeholders especially in Anambra State. The issue of poor academic achievement at the secondary level of education has been widely documented. Record from Anambra State Universal Basic Education Board (ASUBEB, 2017) revealed poor academic achievement of students that registered for Basic Education Certificate Examination between 2015-2017. Records from ASUBEB shows that in 2015, 42.97% performed well while 50.03% recorded poor performance. In 2016, 49.26% was good performance and 50.74% was recorded as poor performance while in 2017, 47.27% was good performance and 52.72% was recorded as poor performance.

A number of factors have been identified to be contributory to students' poor academic achievements in keyboarding in schools. In the literature, some of these factors identified were to include students' study habits, school environment, lack of facilities and inappropriate teaching methods. Supporting the above stance, literature attributed poor academic achievement of students to deficiency in teaching methods adopted by the teachers which invariably do not encourage students' active participation in the instructional process.

Conventional teaching method often used in Nigerian secondary schools though help teachers to cover much especially when a teacher needs to pass a lot of information to the students. The advantage on the part of the teacher notwithstanding, it does not give students the opportunity of being actively involved in their own learning. The conventional teaching methods prevalent in Nigerian secondary schools have made the role of the students, most times a passive one. The student is regarded as the recipient of learning while the teacher is the giver. Onukaogu and Arua in Agboh (2015) saw the student in this regard, as one who sits and swallows what the teacher has to give in terms of narration, exposition, instruction, classification, definition, and so on. The resultant effect of this has always been poor academic achievements of students.

Poor academic achievement of secondary school student could be improved through the use of other teaching methods such as peer tutoring. In peer tutoring class, each student gets more attention from the tutor and more time to speak while others listen. This allows the students' take active part in constructing their knowledge. Though, peer tutoring as an instructional mode may be known by teachers and students, its effect in the teaching and learning of keyboarding has not yet been fully researched and established. Therefore, the problem of this study is that students performed poorly in keyboarding hence the need to determine the effect of peer tutoring on academic achievement of low achievers.

### Purpose of the Study

The major purpose of this study was to determine the effect of peer tutoring on academic achievement of low achievers in keyboarding in secondary schools in Anambra State. Specifically, the study sought to determine:

1. Effect of peer tutoring technique and conventional method on achievement of low achievers in keyboarding.
2. Effect of peer tutoring technique on achievement of male and female low achievers in keyboarding.

### Research Questions

The following research questions guided the study:

1. Is there any effect of peer tutoring technique and conventional method on achievement of low achievers in keyboarding?
2. Is there any effect of peer tutoring technique on achievement of male and female low achievers in keyboarding?

### Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. Peer tutoring technique and conventional method had no effect on the achievement of low achievers in keyboarding.
2. Peer tutoring technique had no effect on the achievement of male and female low achievers in keyboarding.

## II. LITERATURE REVIEW

### Peer Tutoring

Peer tutoring is designed to supplement rather than replace a variety of teacher directed activities. In this process, peer tutoring provides low achievers with a high level of active responding (with ongoing guidance and feedback) on a concept that has been introduced, explained and demonstrated by the teacher. The reason behind the idea of peer tutoring is that it is assumed that most pupils working in pairs may learn better in social context.

According to Topping (2011), peer tutoring is the acquisition of knowledge and skills through active helping and supporting among learners of equal status or level. Topping added that peer tutoring involves people from similar social groupings who are not professional teachers helping each other learn while learning themselves. Kourea, Cartledge and Musti-Rao (2013) reported that peer tutoring may consist of students of the same learning level working together or students of varying learning levels working together. This can easily be implemented even in a classroom of diverse learners. The authors further added that by implementing peer tutoring as a teaching strategy, classroom teachers are able to individualize instruction for each of their students, giving all the students in the classroom the opportunity to be actively engaged in learning at the same time.

Nnaka (2014) opined that peer tutoring is an instructional strategy in which students in their groups under the guidance of a teacher work together through a given instructional assignment with brilliant student as a peer tutor, providing assistance and instruction to others. The author added that peer tutoring is fruitful and successful because hierarchical atmosphere in the classroom is removed and cordial, friendly and free atmosphere that facilitates learning is obtained. During peer tutoring, there is no more fear of criticism in the students, blame or punishment from the teacher when they are not coping as the teacher wants. Igbo (2015) saw peer tutoring as a teaching process whereby a student who has proficiency in a skill teaches another student under the teacher's supervision. It is a process of chain teaching whereby the teacher shows a student how to perform a skill and the student in turn trains a second student on the same or similar skill. This means that for effectiveness of the teaching, the teacher plans the peer tutoring.

According to the researcher, peer tutoring is an instructional mode designed to supplement rather than to replace a variety of teacher directed activities. It involves students serving as academic tutors and tutees.

### Academic Achievement

Academic achievement, according to Soohyun (2011) is defined as the level of individuals' education and/or educational outcomes accomplished successfully, as a result of learning at school. It is usually determined by comparing his or her score in

a school test and or a standardized test with the average score of other people of the same age. Loo and Choy (2013) see academic achievement as a multidimensional construct consisting of three dimensions: student's characteristics, teacher competencies and academic dimension. Lopez (2015) in her view stressed that academic achievement refers to a person's strong performance in a given academic arena. A student who earns good grades or awards in exams has achieved in the academic field. Academic achievement may be defined as excellence in all academic disciplines, in class as well as co-curricular activities.

According to Ganail and Ashraf (2013), academic achievement includes excellence in sporting behaviour, confidence, communication skills, punctuality, arts, culture and the like which can be achieved only when an individual is well adjusted. The authors defined academic achievement as knowledge attaining ability or degree of competence in school tasks usually measured by standardized tests and expressed in a grade or units based on pupils' performance.

The researcher opined that academic achievement concerns how students cope with or accomplish different task given to them by their teachers thus the determinants of this dimensions are students' intelligence, personality and the socio-economic status within the academic context.

### Low Achievers

According to Vanauker-Ergle (2012), a low achiever is someone who achieves less than those around him. The author further stated that children who are low achievers generally have a below average (100) IQ and struggle in the classroom to keep up with general academic requirements. Low achievers typically do not qualify for special education services because they do not meet the 70 or below IQ requirement for mentally retarded or the IQ/achievement discrepancy for learning disabled classification. Hensen (2014) in his view stated that low achievers is a term referring to students who are slow learners, disadvantaged, underachieve, and backward in their academic pursuit.

As noted by Shaw (2013), the author stated that low achievers are children who do not perform well in the classroom. Low achievers account for a large numbers of school drop outs, unwed teen mothers, illicit drug users, functionally illiterate persons, incarcerated persons. Others include unemployed, underemployed violent offenders, alcohol abusers, school failures, low scorers on group test and gang and hate group members. According to the researcher, low achievers are students who their parents and teachers have put in maximum effort and all forms of strategies necessary to make them better academically, but all to no avail.

### Keyboarding

Keyboarding is the penmanship of the computer age." (Johnson, Nelson & Townsend, 2008). It has been a separate course which involved learning the meteoric skills of typing as well as formatting skills in writing reports and various forms of correspondence (Rogers, 2010). According to Robinson (2009), Keyboarding is a complex skill made up of finely discriminated movement patterns that depend upon interrelated sensory, perceptual, mental, and motor inputs and outputs which must occur close together in time. Supporters of this thought like Prigge (2011) believed that children should be taught

keyboarding skills before the habitual hunt-and-peck method becomes a difficult habit to overcome.

Braathen (2013) opined that keyboarding is the skills involving typing without hunt-pecking. According to Wolf (2011), the hunt-and-peck method gives students a false sense that they 'know how to keyboard. Nieman (2012) demonstrated that children with keyboarding skills compose faster, produce documents with a neater appearance, have better motivation, and demonstrate improved language arts skills. In other words, she indicated that a digital divide exists between students with keyboarding skills and students without keyboarding skills. To master keyboarding skills proficiently, students' fingers must be able to flow freely. According to Bartholome (2010) asserted that keyboarding is a lifelong skill. it is no longer a routine for transferring ideas from scribble to print. Most keyboardists today are involved in generative typing which involves composing original thought directly into electronic documents and email. According to the researcher, keyboarding is the smooth movement of fingers in the home keys of computers or typewriters without hunt-pecking.

### III. METHOD

The research was carried out using quasi-experimental design of pre-test and posttest non-equivalent control group. The

study was carried out in Anambra State of Nigeria and the population consisted of 140 low achievers of all the Junior Secondary School two (JSS2) studying keyboarding under Information Communication and Technology (ICT) as a compulsory subject in Awka Education Zone in Anambra State and the sample size was 24 low achieving male and female junior secondary schools two (JSS2) students drawn from the two sampled schools out of 18 public secondary schools in Awka Education Zone in Anambra state. The instrument for data collection was Keyboarding Achievement Test (KAT) extracted from JSS2 past questions from 2015-2017. The instrument was validated by three experts and the reliability of the test was calculated using Pearson Product Correlation Coefficient and the result revealed a reliability coefficient of 0.88. Mean and standard deviation were used in analyzing the data and Analysis of Covariance (ANCOVA) was used in testing the hypotheses at 0.05 level of significance.

### IV. RESULTS

**Research Question 1:** Is there any effect of peer tutoring technique and conventional method on achievement of low achievers in keyboarding? The result of the analysis in respect of research question 1 is presented in Table 1.

**Table 1: Effect of Peer tutoring technique and Conventional method on Achievement of Low Achievers in Keyboarding**

Methods	N	Pre-test Mean	Post-test Mean	Mean gain	Decision
Peer Tutoring	13	13.73	41.60	27.87	Effective
Conventional	11	13.57	33.43	19.86	

Data in Table 1 shows that the pre-test and post-test mean scores of low achievers taught keyboarding using peer tutoring are 13.73 and 41.60 while the pre-test and post-test mean scores of students taught with conventional method are 13.57 and 33.43 respectively. The mean gain of experimental group of 27.87 is higher than that of control group (19.86). This show that experimental group perform better than the control group.

**Research Question 2:** Is there any effect of peer tutoring technique on achievement of male and female low achievers in keyboarding? The result of the analysis in respect of research question 2 is presented in Table 2.

**Table 2: Effect of Peer tutoring technique on Achievement of Male and Female Low Achievers in Keyboarding**

Gender	N	Pre-test Mean	Post-test Mean	Mean gain	Decision
Male	6	32.32	55.28	22.01	Positive Effect
Female	7	28.15	54.67	19.01	
Mean gain difference				0.61	

Data in Table 2 shows that the pre-test and post-test mean scores of male low achievers taught keyboarding using peer tutoring are 32.32 and 55.28 while the pre-test and post-test mean scores of female low achieving students are 28.15 and 54.67 respectively. The mean gain of male low achievers is 22.01 higher than that of their female counterpart which is 19.01. This implies that the mean achievement scores of male low achieving students are 0.61 higher than that of females' low achievers.

Hence, peer tutoring enhanced the performance of males more than the female low achievers.

**Hypothesis 1**

Peer tutoring technique and conventional method had no effect on the achievement of low achievers in keyboarding. The statistical test for hypothesis 1 is presented in Tables 3.

**Table 3**

**ANCOVA on effect of Peer tutoring technique and Conventional method on Achievement of Low Achievers in Keyboarding**

Source	Type III Sum of Squares	df	Mean Square	F	p-value	
Corrected Model	392.959 <sup>a</sup>	2	196.479	15.607	.000	
Intercept	647.988	1	647.988	51.471	.000	
Pretest	55.612	1	55.612	4.417	.048	
Group	326.512	1	326.512	25.936	.000	Significant
Error	264.375	21	12.589			
Total	7730.000	24				
Corrected Total	657.333	23				

The result in the Table 4 shows that there is a statistically significant difference on the effect of Peer tutoring technique and Conventional method on Achievement of Low Achievers in Keyboarding. This is because the p-value (.000) is greater than the level of significant (0.05). Based on the above, the null hypothesis is not rejected, implying that there is a statistically significant difference on the effect of Peer tutoring technique and

Conventional method on Achievement of Low Achievers in Keyboarding.

**Hypothesis 2**

Peer tutoring technique had no effect on the achievement of male and female low achievers in keyboarding. The statistical test for hypothesis 2 is presented in Tables 4.

**Table 4**

**ANCOVA on effect of Peer tutoring technique on Achievement of Male and Female Low Achievers in Keyboarding**

Source	Type III Sum of Squares	Df	Mean Square	F	P-value	
Corrected Model	104.045 <sup>a</sup>	2	52.022	3.356	.077	
Intercept	377.270	1	377.270	24.335	.001	
Pretest	95.325	1	95.325	6.149	.033	
Gender	7.339	1	7.339	.473	.507	Not significant
Error	155.032	10	15.503			
Total	5784.000	13				
Corrected Total	259.077	12				

The result in the Table 5 shows that there is no statistically significant difference on effect of Peer tutoring technique on Achievement of Male and Female Low Achievers in Keyboarding. This is because the p-value (.473) is greater than the level of significant (0.05). Based on the above, the null hypothesis is not rejected, implying that there is no statistically significant difference on effect of Peer tutoring technique on

Achievement of Male and Female Low Achievers in Keyboarding.

**V. SUMMARY OF FINDINGS**

From the analysis of data presented, the following findings were made:

1. The mean gain of experimental group is higher than that of control group. This shows that experimental group taught keyboarding with peer tutoring performs better than the control group taught keyboarding with conventional method.
2. The male low achieving students taught keyboarding using peer tutoring had mean scores higher than their female counterparts, which shows that male low achieving students perform better than their female counterparts when taught using peer tutoring.
3. The male low achieving students taught keyboarding using conventional method had mean scores higher than their female counterparts meaning that male low achieving students perform better than their female counterparts when taught using lecture method.
4. There is significant difference on the effect of Peer tutoring technique and Conventional method on Achievement of Low Achievers in Keyboarding.
5. There is no significant difference on the effect of Peer tutoring technique on Achievement of Male and Female Low Achievers in Keyboarding.
6. There is no significant difference on the effect of Conventional method on Achievement of Male and Female Low Achievers in Keyboarding

#### VI. DISCUSSION OF FINDINGS

The findings revealed from Table 1 that low achievers who were taught keyboarding using peer tutoring technique performs better than those taught keyboarding using conventional method. The findings in Table 4 also revealed that academic achievement of low achieving students taught keyboarding using peer tutoring differed significantly from the low achievers taught using conventional method.

The findings of this study agree with Ejiofor (2011) who found out that peer tutoring has a significant effect on academic achievement of students in biology. In support, Okoye (2013) study revealed that students taught home economics using peer tutoring performed better than those taught using conventional teaching method. The relationship between the findings is that the use of peer tutoring technique enhances academic achievement of low achievers in various subjects,

The findings in Table 2 showed that male and female low achieving students taught keyboarding using peer tutoring performs better than those taught keyboarding using conventional method.

These findings are in line with the findings of Ifeakor (2010) which revealed that students taught physics using peer assessment achieved higher than those taught using conventional method and that gender had no statistical effect on the student's achievement in physics. This implies that peer tutoring is effective for both male and female low achieving students in keyboarding and other subjects. Therefore, peer tutoring can be a yardstick to improve low achievers academically.

The findings in Table 3 showed that the male low achieving students taught keyboarding using conventional method had mean scores higher than their female counterparts, meaning that male low achieving students perform better than their female counterparts when taught using conventional

method. The findings in Table 6 also revealed that there is no significant difference on the effect of Conventional method on Achievement of Male and Female Low Achievers in Keyboarding. Hence, such differences in academic achievement with respect to gender are a chance occurrence.

The findings of the literatures reviewed support these findings of the study. For instance, Oludipe (2012) found that gender did not significantly influence students' academic achievement in skill subjects when taught with conventional method. In contrast, Orjikutu (2012) showed that gender difference exist between secondary school students taught skill subjects using conventional teaching method. Efanga (2014) found that significant difference did not exist in academic achievement between male and female students when taught using peer tutoring strategy as oppose to use of conventional teaching method. This implies that conventional method can unevenly influence academic achievement of both male and female low achieving students in keyboarding.

#### VII. CONCLUSION

As a result of the findings of this study, it could be concluded that peer tutoring is an effective instructional strategy capable of enhancing low achieving students' academic achievement in keyboarding. Also, the academic achievement of low achieving students in keyboarding is not influenced by gender when peer tutoring and conventional method are employed in teaching. However, it is necessary for business studies teachers at secondary school level to use peer tutoring as an effective instructional strategy especially in teaching skill-based subjects. This strategy when properly used will continue to improve students' academic achievements and low achievers in particular.

#### VIII. RECOMMENDATIONS

Based on the findings of this study, the researcher makes the following recommendations:

1. Peer tutoring technique should be adopted in secondary schools by business studies teachers for teaching of keyboarding so as to improve academic achievement of low achieving students.
2. Secondary school business studies teachers should ensure constant and effective utilization of peer tutoring for instruction in keyboarding and other skill-based subjects.
3. Secondary school administrators should periodically organize training programmes for teachers on effective utilization of peer tutoring strategy.
4. Enlightenment programme should be carried out by government and secondary school education board to enlighten students on the benefits of peer tutoring and how effectively peer tutoring mode can be in enhancing their academic achievement.

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# The System of Shifting Cultivation Management of Dayak Ngaju Local Community in Central Kalimantan

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DOI: 10.29322/IJSRP.8.8.2018.p8089

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8089>

## Abstract

The aim of this study is to identify the factors causing local communities to actively manage the system of shifting cultivation in Central Kalimantan. The research took place in Mantangai Tengah Village and Mantangai Hilir Village of Mantangai Sub-District, Kapuas Regency, Central Kalimantan Province. The location and sample of the research are determined by using the "purposive sampling" method. The total of respondents is 70 people consisting of 60 farmers and 10 key informants. There are primary and secondary data in this research. The descriptive qualitative method is used for the data analysis. The results showed that the management of shifting cultivation done by the local people has changed that in the early 2000 era, a settled cultivation management was applied. It can be concluded that the factors causing the change are population pressure, village development, and oil palm plantation development. These are the factors which narrow the space of the farming community to do shifting cultivation business. The rotation and fallow systems are no longer done because the fields have been managed throughout the year. However, it is known that the technology is still simple including the system of land preparation and processing using the burn method. Without any fertilization and intensive care, the burn method is considered effective and efficient in land preparation. This is also considered suitable for hetero-culture planting system. To have a settled cultivation system, such suitable technology for managing a dry land is required since the land is generally marginal and have a peat structure. This will possibly decrease the yield if it is practiced continuously.

**Keywords:** Shifting cultivation, Subsistence, Planting System, and Dayak Ngaju

## I. INTRODUCTION

The shifting cultivation system is still a potential source of subsistence food source in Indonesia especially for the people of local dry land and hills including those in Central Kalimantan. Shifting cultivation is the tradition of local communities (indigenous peoples) to get food especially rice in a dry land. It is a form of land use managed by local communities with the system of rotation and fallow (temporary resting of land) which most of them aim to have a subsistence living. This research is based on Scott's subsistence theory (1989) that the management of shifting cultivation system of Dayak Ngaju local communities, particularly farmers, is an attempt to meet the main food needs on a basis for non-profit living and managed throughout the year.

The general concept of shifting cultivation as defined by some experts is a form of land use between the resources of poor people conducted with rotation and fallow system in the same unit of land. This is generally done in dryland zones seasonally. Shifting cultivation is also an agricultural activity in many parts of the tropical agricultural border which is practiced as a subsistence farming way. This practice consists of cutting and burning (Slash and Burn) the natural vegetation at the end of the dry season in which the cultivation begins on the rainy season and the harvest will complete at the end of the rainy season (Hossain 2011; Grogan *et al.*, 2012; Culas 2013; Pectorini *et.al* 2013).

Some studies illustrate the management of shifting cultivation system as a form of traditional activity done by tribal people around the world. It is the most ancient farming system as a survival scenario of past societies. Shifting cultivation has various terms in the world, among others; *Hoe and Burn*, *Slash and Burn*, and *Jhum* cultivation. This cultivation system is a common practice in agriculture and intrigue related to social or humanities institutions. It is a traditional farming practice in most tropical regions of the world and has the potential to provide food for people in tropical regions. In general, shifting cultivation is

accounted for almost 86% of the total cultivation area in Asia making it more suitable to represent the traditional agriculture system in Southeast Asia. (Mero *et. al* 2012; Saha *et. al* 2013; Patel *et. al* 2013; Li *et. al* 2014; Magnuszewski *et. al* 2015).

Although technically and economically the shifting cultivation business is inefficient because it is not productive for financial gain, this is in line with the results of a study showing that shifting cultivation is still a patchwork knowledge related to important elements such as areas and the people involved that have not been well documented. Unsustainable farming systems are associated with social, economic, political and cultural changes that affect the communities. This is also related to the negative impacts on the environment that the socio-cultural factors of the actors need to be taken into consideration, the conversion of forests into grasslands as a result of an increasing process of burning in the last 10 years, as well as a short fallow time which caused the decline of biodiversity conservation (Mertz *et. al* 2009; Robiglio *et. al* 2011; Filho *et. al* 2013; Talaohu, 2013; Vliet *et. al* 2013).

Based on the data from the Central Bureau of Statistics of Central Kalimantan in 2017, the potential area of dry land in Central Kalimantan reaches more than 2 million hectares. The land area that is used as paddy fields by the people in Central Kalimantan is 85,654 hectares in a total production of 177,732 tons with the productivity per hectare of 2 tons. As for an example, Kapuas Regency has 10,494 hectares area of dry land with 3,884 hectares of paddy fields. The total production rate in Kapuas is 10,262 tons with a productivity that reaches 26.42 tons per hectare. By that, the cultivation management is still potential to be the main food source for the local people in Central Kalimantan.

The problem of shifting cultivation has always been linked to global, national, and local issues as the cause of forest and land fires in which the increasingly complex problem is in relation to government policies on banning forest and land fires. This shifting cultivation system is a potential agricultural business as a source of food producers which needs the right solution in the management so that the potential and actual gap can be overcome for local people, especially in Central Kalimantan. This is in line with Carmenta *et al.* (2013) that the problems in slash and burn activity in the shifting cultivation system is the land and forest fire in concern with the involvement of local communities with small-scale enterprises which use fire in the business. Therefore, the government's policy needs to be evaluated to develop a better alignment between the fire policies with small agricultural practices. The objective of this study is to identify the management of shifting cultivation done by the local people in Central Kalimantan.

## II. RESEARCH METHODS

### 2.1. Research Sites

The research was conducted in the area of Mantangai Tengah Village and Mantangai Hilir Village, Mantangai District, Kapuas Regency, Central Kalimantan Province. There is still a lot of active local farmers in this area. The level of community education is still low which about 52% of them only graduated from elementary school. They also have an average low income which is IDR 25,000-27,000 per day. This area is tropical and humid in between 60%-90% with a temperature of 21°-23°C. It has a moderate sunlight intensity with a rainfall in between 1000-2600 mm/year. The highest rainfall occurs in October-March while the lowest rainfall happens in June-August.

The topography is relatively flat with an altitude between 0-28m above sea level with the slope of the land ranging from 0-18%. The managed soil and farmland conditions are fine-to-medium-textured alluvial soils in general. It has a peat typology and acid-sulfate soils. The peat thickness of the soil ranges from 0-50 cm in type B to C and D consisting of deep peat and shallow peat. The degree of acidity (*pH*) of the soil ranges from 3.5 to 5.5 so that the tillage needs to be done carefully. In order to reduce the level of soil acidity, it is necessary to calcify the land so that it can be processed by farmers. The study was conducted for 12 months from May 2017 to May 2018.

### 2.2. Data Collection

The sample was determined by taking 70 people with purposive sampling method (Rianti, 2014) consisting of 60 farmers and 10 key informants. The criteria of the population is a native and a farmer in Dayak Ngaju so that the data about the condition of shifting cultivation in the area can be well received. The primary data comes from farmers while the secondary data comes from The Department of Agriculture, The Department of Food Crop, and The Central Bureau of Statistics as well as related institutions in Regency and Province of Central Kalimantan. The method of data collection was performed by using surveys, observations, and interviews with questionnaires based on the time, activities, patterns of crops, and types of commodities. The data collection was done with the survey, observation, and interview which was also used in several studies (Matinahoru 2013; Sairdekut *et.al* 2013).

### 2.3. Data Analysis

The method of data analysis was carried out by tabulating the data in which the results will be described with qualitative descriptive technique (Adijaya 2012; Jupir 2013). The data emphasized the socio-economic condition of the farming communities associated with: the identification of factors causing local communities to conduct shifting cultivation system, the way to perform shifting cultivation system, and the current condition of shifting cultivation system management in Central Kalimantan.

## III. RESULTS AND DISCUSSION

### 3.1. Identification Based On Activity and Time

The results of the identification in this study indicate that the shifting cultivation system in Dayak Ngaju community, Central Kalimantan is still done by local communities with a total active population of 1,097 households in a total area of 3,556 hectares and an average production of 2 tons per hectare. With rice crops as the main commodity, this cultivation system is intended to fulfill the needs of food or subsistence of life. From the planting process until the harvest, the management system takes place only once a year. Kafle (2011) said that shifting cultivation is a traditional form of land use that the majority of its use is for households subsistence living. Today, it is known that this practice is in transition along with the increasing population of farmers and with the shifting demand. It is widely used to produce food for the family.

The production process of paddy fields begins in April and ends in the next April which is also known as *Asep* (April-September). This technique is particularly done for rice crops. As for the other crops which grow in the field, the crops will grow and develop in accordance with the natural conditions. This process is shown in Table I as follows:

Table I. The Identification of Shifting Cultivation Management Process Based on the Activity and Time of Implementation within One Year of Paddy Field Production.

Time	Activity and Process in Activity
April	Land Search *) . The cultivators go into the forest looking for suitable land for farming
April-May	Land Clearing **) . Cultivators cleared the forests on a limited basis, only 1-2 hectares by cutting trees and shrubs to clear the land.
June-July	Land Cleaning and Processing ***) . The cultivators clear the land by burning twigs and collect the big chunks to be used as materials for the lodge. Before burning, the cultivators will create firebreaks by digging the land around 1 to 2 meters width so that the fire does not burn other people's land.
August	Hut Making (temporary storage house****) . The hut or cottage is made from big wooden chunks from the logging. The hut has used a shelter and a place to temporarily collect and store the harvest.
September	Planting ( <i>menugal</i> ) . Rice cultivation is done communally in a cultivation community within a village with a simple technology such as wooden slats to make planting holes.
October-March	Maintenance . Technically, there is no intensive maintenance process as it is generally allowed to grow by itself. It grows without fertilization and without watering, only by virtue of nature.
March-April	Harvest. Harvesting is done communally because the harvest is generally identical to the party ceremony. The party is generally opened with a prayer and followed with eating together as a gratitude for God Almighty.

April	In the harvest management, there is only drying and storage for the needs of family food.
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Source: Primary Data of 2017-2018

Description: \*) until \*\*\*\*\*) this process is only done once during the first opening of a field or the first year of opening.

The field is a dry land managed for one year of production to produce foods especially rice. The activity of shifting cultivation in the first year of land clearing begins with the clearing of shrubs and then the land is allowed to dry to be followed with the burning process. Subsequently, the land will be planted with the *tugal* system. The preparation activity starts from April to July and then the process of hut making and planting (*menugal*) begins in August and September. The process of waiting for harvest is generally carried out from March to April depending on the type of rice seeds. The activity of land clearing up to the making of the hut is only done in the first year of management. The subsequent management will only need the process of land clearing, land burning, and harvest until the third year. Furthermore, the land will be left behind and the cultivators will look for new land. The land will be left alone until rubber and other crops will grow on its own by the virtue of nature.

The previous studies conducted by Karthik *et.al* (2009) and Wangpakapattanawong *et.al* (2010) proved that shifting cultivation is a forest agrarian system which has been widely practiced by the hill community in Asia, Africa, and Latin America since the Neolithic period (13,000 to 3,000 BC). This is characterized by a cultivation phase through primary or secondary forest clearing for one to three years followed by a fallow phase to enable the restoration of soil fertility. In the land use system, forests will be felled (February) and burned (March) and planted with *gogo* rice or mixed crops (May-October/November). This will be cultivated for a year or more and then will leave a fallow for secondary forest regeneration and restoration of soil fertility as well as succession through several stages.

### 3.2. Identification Based on Planting Pattern

The farming activities for local communities are not just merely managing a land but as an effort of food security by diversifying the crops on the land. This has been done from generation to generation from their predecessors. This is reflected in the pattern of planting and business commodities as illustrated in this following Table II:

Table II. The Identification of Shifting Cultivation Management Based on Planting Patterns and Commodities Cultivated Annually for 4 Years Until the Next Period of Rotation and Fallow.

Time	Planting Pattern
Year -1	Food Crops-Vegetables- Horticulture- Fruit-Rubber
Year-2	Food Crops-Vegetables- Horticulture- Fruit-Rubber
Year-3	Food Crops-Vegetables- Horticulture- Fruit-Rubber
Year-4	Vegetables- Horticulture-Fruit-Rubber
Subsequent year Entering the rotation and fallow period (Minimum of 5 to 10 Years)- Period of tree enlargement	1. Fruits-rubber-other hardwood plants ( <i>Galam, mahang, karamunting, fern type (kalakai, paku), pawah (teki), Tingen (alang-alang)</i> ) 2. Rubber and <i>sengon</i> have started to enter the period of tapping (rubber plants can be tapped)
Subsequent year ( > 10 Years)- rubber production period*)	Rubber, <i>Sengon</i> , and some fruit trees are allowed to grow and rubber plants have become an effort to make money

Source: Primary Data of 2017-2018

Description: \*) after > 10 years, farmers only cultivate rubber (as an income) and several types of fruit (only a few).

The characteristic of the plants in the first year to the third year is still varied, but the number and variety will be decreased after entering the fourth year and continues until the next fallow and rotation. This is caused by the rubber plants which have begun to grow big and cover the sunlight which means the land is no longer productive to be used in paddy fields. This condition will decrease the commodity in the fifth year and so on because the rubber plants will enter the phase of enlargement and tapping period. The fallow and rotation period had been done at the beginning of the fifth year meaning that the cultivators had already cleared new land in which, generally, the location will not be far from the previous field. Grogan *et. al* (2013) told that the traditional shifting cultivation system remains an essential component of livelihood strategies throughout the region even

in households engaged in commercial practices where the traditional system continues to provide a form of food security and increases the income of farmers.

### 3.3. Identification Based On Variety of Business Commodity

The variety of crops managed in the fields depends on the habits and desires of the cultivators. Generally, it is in the form of crops, vegetables, and horticulture managed together in one area. This can be seen in the Table III below:

Table III. The Identification of Shifting Management Process Based on the Variety of Cultivated Commodities in a 4 Years Period Until the Next Rotation and Fallow Period.

Variety of Cultivated	Commodities
Main Food Crops	Local rice type: <i>Nampui, Sintang, Garagai, Manyahi</i>
Other Food Crops	Corn, Taro, Cassava, Sweet Putato
Vegetables/Horticulture	Eggplant, Cucumber, Summer Squash, Bird's eye chili, <i>Katuk</i>
Spices/Rhizomes	Ginger, Turmeric, Lemon Grass, Galangal, <i>Kaempferia galanga</i>
Fruits	Coconut, Palm, Jackfruit, <i>Cempedak, Rambutan, Pineapple, Banana</i>
Woods	<i>Galam, Mahang, Karamunting, Fern (kalakai, paku), Alang-alang (Tingen), Rumpu Teki (Pawah), sengan</i>
Woods and Latex	Rubber*)

Source: Primary Data of 2017-2018

Description: \*) After 10 Years, all types of food crops and wood trees will naturally die from not being able to compete with the rubber plants.

The types of commodity cultivated include short-term crops such as food crops, vegetables, and horticulture crops (corn, tubers, several types of eggplants, and spices) as well as long-term crops that become the characteristic of crops cultivation for food availability and family food security for an active production period of 1-4 years. This also indicates that the management of the shifting cultivation system is an effort of adaptation and food security for one year. It is reflected by the variety of crops that are planted, developed, and cultivated by the cultivators to meet the needs of the family. On the other hand, rubber plants and woods generally serve merely as an income of money for the family. Rubber plants are considered as family assets as well as a marker of legal ownership rights because the one entitled to tap the rubber plants and land with all its contents is the owner. Having an old period of harvest does not mean that the land is not cultivated but the productive crops planted this time are rubber plants, hard trees, and fruits. Those crops are functioned as a source of money.

In line with Takeuchi (2010) that shifting cultivation is a traditional agricultural practice often performed in tropical forests by integrating short planting phases (fallow) and long rotation phases. In the short planting phase, farmers grow rice and vegetables to sustain the balance of shifting cultivators' needs while in the long rotation phase, farmers would plant hard trees and fruits.

### CONCLUSION

The management of shifting cultivation is the traditional farming pattern of the Dayak Ngaju community in particular and the Dayak community of Central Kalimantan in general. Traditionally, it is done only to produce food for the family. In contrast, rubbers and other plants serve as a proof of ownership and a source of money to buy goods that farmers cannot produce by themselves. The results show that shifting cultivation activity with the slash-and-burn system is not the cause of forest and land fires because of the burned land only 1 to 2 hectares. There are firebreaks and the burning time is approximately 3 hours. The burning process is carried out communally and together. Traditionally, the extensive way of management is intended to fulfill the needs of foods for the family.

The results of this study provide an illustration that the location of the research is a relatively flat topography, has peat structure and contains poor nutrients. However, the area already has a canal on the sides of the land so that it changes the land use. The local communities manage the land throughout the year with the settled system without fallow and rotation. This has caused

an intensification of land to produce foods for the family. Although it is used intensively, its management still based on subsistence with a variety of plants that are potentially developed economically. However, it is known that rice is the most dominating food crops to be produced by the settled cultivators. There are other crops such as corns, beans, eggplants, peppers, cucumbers, squash, and tomatoes. Those are also intensively managed by farmers with the hetero-cultural system. Some of them also plant *sengon* trees along the sides of the land as a source of money.

### ACKNOWLEDGEMENT

The researchers would like to thank the local community in Mantangai District as a source of data as well as the Ministry of Research, Technology, and Higher Education of Indonesia for the scholarships and doctoral degree received by researchers through DRPM Directorate General of Research and Development. This support is very helpful for the succession of the study in this Doctoral Program. The researchers also like to thank Rotif, Crismanto, Afifudin, Triani, and Novita who helped and engaged in this research.

### ABBREVIATION

Dayak Ngaju : Dayak sub-ethnic in Central Kalimantan Indonesia

Subsistence: Land management that is limited only to the needs of farmers' family

Extensive: Limited land to a maximum of 2 Ha per family

Hetero-culture : Varied managed crops (more than two types of commodities in one growing field)

Agroforestry : A mixed land management system between seasonal crops (short term) and annual crops (long term)

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# Female Consumer Behavior towards Jewellery Products in Bangladesh: Evidence from Khulna City

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DOI: 10.29322/IJSRP.8.8.2018.p8090

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8090>

**Abstract:** Consumer behavior is the study of how people buy, what they buy, when they buy and why they buy. Accordingly this study aimed to know why the female consumers in Bangladesh purchase gold ornaments or what factors influence their purchase, how often they purchase and from where they purchase. Data used in the study was collected from 200 female consumers using a self-administered questionnaire. Convenient sampling method was used to select 200 female consumers. At first Data was analyzed using some descriptive statistics (mean, standard deviation and frequency). Later Factor analysis was applied to find out the factors driving or affecting the gold ornaments purchase decision in Bangladesh. Factor analysis revealed that 19 variables used in the study are loaded on 5 specific factors named as Social Status, Financial Security, Unique Design & Price, Occasion and Trust. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy statistic was found 0.677 and the cumulative percentage of variance explained in the current study was 53.229 implying that 5 factors are responsible for 53.229% of variance.

**Index Terms:** Factor analysis, Consumer behavior, Jewellery products, Khulna city.

## 1. INTRODUCTION

Among the luxurious items the history of gold jewelry is long and goes back many years with many different uses in different cultures. Jewellery ornaments are seen as a symbol of status in most cultures except Christian and Buddhist (Danziger, 2004). Even in the Bangladeshi customs and traditions, gold is a formidable part of showcasing. Traditionally Bangladesh is known as the finest gold ornaments producer (Sultana et al., 2015) and most of the people here wear gold jewelries during the religious festivals such as Eid or Puja, in the engagement or wedding session, even to celebrate the cultural programs like Pahela Baishakh, Pahela Falgun, valentine's day etc. (Mimnun, 2015). Women and teenagers wearing gold ornaments like rings, necklaces, earrings and bracelets to celebrate these occasions are very common here. So buying of gold ornaments is an essential part of Bangladeshi people specially in the occasion of birthday, marriage ceremony, religious ceremonies (Chitradevi, 2017). In association with the cultural and religious programs many other factors also motivate the women to purchase gold ornaments. Decrease or increase of the gold price, financial securities in the worst time, symbol of social status, Trust in the brand, Celebrity Endorsement, Promotion, Brand Name, Exhibitions, Launch of new collections, might be some influential factors to purchase gold jewelries. Some consumers view the gold purchase as future investment giving return in their crisis. In Bangladesh this Jewellery business can play an important role in the economic development. But the segment is rarely explored by the researchers. As a result this study aimed at exploring the factors which drive or affect the gold purchase decision of women in Bangladesh as well as their behavioral pattern towards the jewelry products. The

findings of this study can be essential for the jewellery industry comprising of companies who are involved in the creation, chasing, etching, or engraving of jewellery products. For the researcher, the study can help them uncover critical factors that many researchers will not be able to explore in future.

## 2. OBJECTIVES OF THE STUDY

The major objectives of this study were:

- To know about the behavioral pattern of Bangladeshi consumers towards jewellery products purchase decision.
- To find out the factors that influence the female consumers of Bangladesh in purchasing jewellery products.

## 3. LITERATURE REVIEW

Jewellery products are credence goods by nature. Product attributes like quality are difficult to measure even after experiencing in case of jewellery products. A number of internal and external factors affect the gold purchase behavior (Sultana et al., 2015). For every products internal factors like motivation, learning, perception, beliefs and attitudes in association with external factors like culture, environment, social class, religious, national economic condition and 4p directly or indirectly affect the consumer behavior (Kotler et al., 2002).

In one study Dubois & Duquesne (1993) concluded that income is one of the dominant internal factors limiting an individual's pleasure of consumption needs. Income must be considered as it indicates the social status or hierarchy of a person in the society. Motivation is another internal factor which influences consumer's needs and wants or leads the consumers to do something to get satisfaction. (Reid, 2002). In addition to income and motivation, perception defined as how consumers select, organize, and interpret the physical sensory elements such as sight, sounds, and smells also influence the consumer behavior (Solomon, 2004).

Solomon (2004) also noted that as the people belong to a society or group, group influence becomes an important external factor to influence the purchase behavior of the consumers because consumers ask suggestions or information regarding the products. Moreover religious, culture and environments are considered influencing factors in case of consumer buying decision process (O' Cass and Julian, 2003 cited in sultana, 2015). Finally, the marketing mix is also considered an important external factor. Marketing mix is generally known as the "4Ps" - product, price, promotion, and place (Grönroos, 2007; Kotler and Armstrong, 2004). Normally products can be measured through feature, quality and quantity; and the right balance between these 4P can either make or break a product. For instance, correct pricing strategy; placing the product in the right location to make it available or accessible to customers and right type of promotion to increase awareness can enhance the chance of the product being purchased.

Gold creates an emotional attachment to the female consumers because they consider gold as a precious metal or as a symbol of purity, luxury, wealth, status, prestige, beauty and affection. (Deepika, 2014; Gao, 2009; Goody, 2006). Asha et al. (2014) also noted that gold is considered as a glamorous metal and as a symbol of status among people. Moreover the historical events reveal that ancient women would wear gold ornaments as a symbol of status and dignity (Nia and Judith, 2000). Gold buying is ritualistic to the Bangladeshis because gold is worn in many religious festivals and occasion such as eid, puja or wedding ceremony (Dempster 2006). According to Ramaswamy and Namakumari (1983) factors like culture, education, economic status, and level of exposure or degree of sophistication induce consumers to purchase and wear gold ornaments whereas khadekar, et al. (2016) concluded that People are more directed toward gold because of their growing prices. It's seen to be a pure investment. Lakshmi (2016) also noted that most of

the Indian female customer purchase gold with intention of long term investment and prefer to buy quality marking (Halmark, KDM ECT) gold.

Berad, et al. (2015) concluded in their study that factors like design, price, purity, image, variety, display, service, promotion & offers, family & friends direct the women consumers to purchase the gold ornaments. In their study it was also observed that around 80% respondents preferred the branded jewellery items over the non-branded jewellery items. Gomathy & Devi (2015) also concluded in their study that maximum number of consumers are aware of the branded jewellery. And the main attraction towards the branded jewellery items is its unique style (Ramachandran & Karthick, 2014).

According to Kearney, (2013) the rise of the usage of the gold ornaments among the women is also driven by the rising income levels and the exposure of western concepts such as solitaire engagement rings. And In many situation the purchase decision of the women is influenced by their family, friends and needs.

#### **4. METHODOLOGY**

A descriptive study was conducted to know the behavioral pattern as well as the factors that affect female consumers in purchasing gold jewelry in Bangladesh. Data were collected from 200 female consumers living in Khulna city of Bangladesh using convenient sampling method. They were from different religions and from different professions like students, service holders, housewives and others. A total of 200 consumers were selected because in factor analysis we need 5 times or more of the number of variables used in the questionnaire. To collect data the consumers were provided with a self-administered questionnaire in which there were two parts; one part was designed with the demographic variables such as age, religion, marital status etc. and the other part was designed with one dependent variable (purchasing gold ornaments) and some independent variables such as reducing price, security, investment etc. Five point of Likert Scale (1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree) was used to express the consumer's opinions on each statement. After the data collection, internal consistency of the data was justified by the Cronbach's  $\alpha$  score which was 0.667. Later data were analyzed by some descriptive statistics (mean, standard deviation and frequency). Factor Analysis, a data reduction tool was applied to group the 19 variables on some significant factors. Kaiser-Meyer- Olkin (KMO) measure of sampling adequacy was used to prove the data appropriateness for factor analysis. Varimax rotation, a principal component of the factor analysis was used to identify the factors. All the data analysis was done using statistical package SPSS 20.

#### **5. DATA ANALYSIS AND FINDINGS**

Descriptive statistics (Mean, standard deviation and frequency) was used to know when, how often and from where the female consumers in Bangladesh purchase the Jewellery products. Table 1(Appendix) illustrates when the female consumers feel the necessity to purchase the gold jewelries. It is found that around 38% consumers purchase gold ornaments during a special occasion like Eid, Puja or wedding ceremony. Table 2 (Appendix) illustrates how the female consumers take the decision of buying gold jewelries. It is seen that around 48.5% consumers take the decision by themselves though some consumers seek suggestion from friends or relatives before purchase. Table 3 (Appendix) describes from where the female consumers purchase the gold ornaments. It is evident that around 60.5% consumers feel comfortable to purchase gold ornaments from their familiar jewelry shops. Table 4 (Appendix) illustrates the descriptive statistics (Mean & Standard Deviation) of the variables used in the study. Reliability test score of the variables used in the study is presented in the Table 5 (Appendix). Once the internal consistency of data was examined by the

Cronbach's Alpha score illustrated in Table 5 (Appendix), 19 variables used in the study were purified and validated through the factor analysis.

Table 6 (Appendix) of Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy represents the test of data appropriateness for Factor analysis. It is found that the value of KMO statistic is  $0.677 > 0.5$  supporting the application of Factor analysis and Bartlett's test of Sphericity with significance (.000) means that the relationship among the variables was strong. Once, it has been determined that factor analysis is an appropriate technique for analyzing the data, one method must be selected from the Common factor analysis (CFA) and principal component analysis (PCA). Principal component analysis (PCA) has been used as the aim of this study is to determine the minimum number of factors responsible for maximum amount of variance in the data. As shown in the table 7(Appendix) the cumulative percentage of variance explained in the current study is 53.229 implying that 5 factors are responsible for 53.229% of variance. Table 8 (Appendix) shows that 19 variables are loaded on 5 specific factors using varimax procedure, most commonly used orthogonal rotation method which minimizes the number of variables with high loading values on a factor. Each factor is composed of the variables with loading value of 0.30 or higher. And the factors have been titled and interpreted according to the variables of highest loading value.

## 6. RESULT DISCUSSION

The basic purpose of this study was to identify the factors that drive or affect the female consumers in Bangladesh while purchasing the gold ornaments. The study examined 19 variables developed from the previous studies related with consumer behavior towards jewelry products in different countries. Finally the factor analysis grouped the 19 variables into 5 specific factors titled as Social Status, Financial Security, Unique Design & Price, Occasion and Trust. **Social Status** explaining 16.796% of variance is composed of 5 variables with the highest loading value of .804. Most of the female consumers in Bangladesh feel proud to wear gold ornaments in any type of program. They would like to show off themselves or to increase their social status or self-esteem by wearing gold ornaments. **Financial Security** explaining 9.388% of variance is the second most influencing factor to the gold ornament users in Bangladesh. Consumers view the purchase of gold ornaments as one kind of investment or financial security. They believe that the gold might provide them financial support in case of any necessity like wedding of their daughter or opening of any business. The third factor of the findings is explained as **Unique Design & Price** responsible for 7.793% of variance. Sometimes the female consumers become motivated to make or purchase gold ornaments when a new design comes in the market. At the same time price reduction also induces them to make jewelry items. **Occasion** is the fourth influencing factor which accounts for 6.898% of variance explained. This factor is loaded by two variables with the highest loading value of .739. Most of the consumers in Bangladesh prefer to wear gold ornaments during any festive occasion like puja, eid or wedding ceremony. They target these occasions to purchase gold items. **Trust** towards the familiar jewelry shops or branded shops is another influencing factor which explains 6.450% of variance. Female consumers feel secured to buy gold jewelry from trusted and branded shop because this is very hard to judge the quality of gold even after using it.

## 7. CONCLUSION

This study has successfully identified a number of relevant factors associated with the purchase of gold ornaments. After the factor analysis we found five important factors that influence the female consumer in the Khulna city in purchasing gold ornaments. The factors are social status, price, security, durability, occasion, trust etc. It has been also found that around 38% female consumers in Khulna coity purchase gold ornaments during a special occasion like Eid, Puja or wedding ceremony, around 48.5% consumers take the decision by themselves though some consumers seek suggestion from friends or relatives before purchase and around 60.5% consumers feel comfortable to purchase gold ornaments from their familiar jewelry shops. The result may not be generalized reflection of all the customers of the country as the study was conducted only based on the opinions of Khulna city customers. The study might have failed to find out many other factors that also affect the customers to purchase gold jewelry. But what identified is obviously not less important. Similar findings were also identified in other studies. The results of this study have several practical and theoretical contributions. The marketers as well as the regulators can use the findings of this study.

**8. LIMITATION OF THE STUDY**

- The study is based on the opinions of only 200 female consumers of Khulna city in Bangladesh.
- The study has focused only on the behavioral pattern of female consumers and the factors that affect or influence their gold ornaments purchase decision.

**APPENDIX**

**Table 1: I Purchase Gold Jewelry**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Whenever I feel	76	38.0	38.0	38.0
	When need arises	48	24.0	24.0	62.0
	Special occasions	76	38.0	38.0	100.0
	Total	200	100.0	100.0	

**Table 2: I Prefer to Buy Gold Jewelry**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Buy myself	97	48.5	48.5	48.5
	When someone select jewelry for me	51	25.5	25.5	74.0
	According to friends, colleagues or relatives suggestions	52	26.0	26.0	100.0
	Total	200	100.0	100.0	

**Table 3: I Buy Gold Jewelry from**

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Branded Showrooms	79	39.5	39.5	39.5
	Familiar jeweler	121	60.5	60.5	100.0
	Total	200	100.0	100.0	

**Table 4: Descriptive statistics**

Statements	Mean	Std. Deviation
Reducing price enhances my purchasing level	4.14	0.94
Reasonable price enhances me to buy more	3.93	1.08
I always buy gold jewelry from trusted shop	4.28	.93
Unknown shop disheartens me in buying gold jewelry	4.03	1.07
Purchasing gold ornament give me a best support when my financial condition is very poor	4.12	1.13
I feel secured having gold ornaments to me than other ornaments	3.75	1.08
I think investment in purchasing gold jewelry will provide support in future	4.12	0.91
Unique design influence me in buying gold jewelry	4.00	0.97
Using gold jewelry helps me expressing personality	3.33	1.29
I feel proud when I wear gold ornaments in any type of program	3.18	1.20
I wear gold jewelry to show off my social status	2.93	2.55
Location of the shop is more important to me	3.65	1.11
Gold jewelry can be repaired easily than others	4.07	0.98
I buy jewels only during festive seasons	3.14	1.21
I usually buy gold in wedding season	3.56	1.02
I like gold jewelry for giving gift to special one	4.01	0.95
Color of the product as an important feature	4.25	0.90
I think Gold jewelry is more durable than others	4.12	0.86
Display of product in store attracts me to buy jewelry	4.02	0.96

**Table 5: Reliability Test**

Cronbach's Alpha	N of Items
0.667	19

**Table 6 : KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.677
Bartlett's Test of Sphericity	Approx. Chi-Square	668.673
	Df	190
	Sig.	0.000

**Table 7: Total Variance Explained**

Components	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.359	16.796	16.796	3.359	16.796	16.796	2.235	11.177	11.177
2	1.878	9.388	26.184	1.878	9.388	26.184	2.155	10.776	21.952
3	1.559	7.793	33.977	1.559	7.793	33.977	2.021	10.105	32.058
4	1.380	6.898	40.875	1.380	6.898	40.875	1.470	7.348	39.406
5	1.290	6.450	47.325	1.290	6.450	47.325	1.400	7.002	46.407

**Table 8: Rotated Component Matrix**

Factors	Factors Interpretation	Variables Loaded on the Factors	Loading Value
<b>F1</b>	Social status	• I feel proud when I wear gold ornaments in any type of program	0.804
		• Using gold jewelry helps me express personality	0.708
		• I wear gold jewelry to show off my social status	0.696
		• Location of the shop is more important to me	0.462
		• Display of product in store attracts me to buy jewelry	0.338
<b>F2</b>	Security	• Purchasing gold ornament give me a best support when my financial condition is very poor	0.672
		• I feel secured having gold ornaments to me than other ornaments	0.653
		• Gold jewelry can be repaired easily than others	0.612
		• I think Gold jewelry is more durable than others	0.579
		• I think investment in purchasing gold jewelry will provide support in future	0.339
<b>F3</b>	Price	• Unique design influence me in buying gold jewelry	0.725
		• Reasonable price enhances me to buy more	0.723
		• Reducing price enhances my purchasing level	0.713
		• Color of the product as an important feature	0.459
<b>F4</b>	Occasion	• I buy jewels only during festive seasons	0.739
		• I usually buy gold in wedding season	0.648
<b>F5</b>	Trust	• I always buy gold jewelry from trusted shop	0.778
		• I like gold jewelry for giving gift to special one	-0.501
		• Unknown shop disheartens me in buying gold jewelry	0.495

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# Study on the Knowledge, Attitude And Practice of Adverse Drug Reaction (ADR) Reporting Among Intern Doctors in a Tertiary Care Hospital of Assam.

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DOI: 10.29322/IJSRP.8.8.2018.p8091

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8091>

## Abstract:

**Aims& Objective:** The main objective of our study was to evaluate the Knowledge , Attitude and Practice on ADR reporting among the intern doctors in Assam Medical College & Hospital, Dibrugarh, a tertiary care hospital of Assam.

**Materials & Method:** A cross-sectional questionnaire based study was carried out among the intern doctors of Assam Medical College & Hospital, Dibrugarh. The questionnaire was designed to assess the Knowledge, attitude and practice of ADR reporting. The Intern doctors working in Assam Medical College during the study period were included in the study. A prior written informed consent was taken from the intern doctors. Only those who gave consent to participate were included in the study. The data of the completely filled up questionnaire was analyzed by using the Statistical Package of Social Sciences (SPSS) statistical software, version 16.

**Results:** 150 pretested questionnaire were distributed among the intern doctors and out of which 110 responded with completely filled up questionnaire. 23.63% of the intern doctors gave the correct definition on pharmacovigilance. Among the intern doctors, 76% of them have experienced adverse drug reaction in patients but only 13.63% have ever reported the adverse drug reaction to the Pharmacovigilance reporting centre indicating a poor practice. However 40.90% of the intern doctors were aware of the pharmacovigilance programme in India and 64.54% of them agreed that adverse drug reaction reporting is one of their professional obligation.

**Conclusion:** Our study demonstrated that though adverse drug reaction reporting is gradually increasing , however unfortunately the pace of ADR reporting is largely deficit. Hence steps should be taken to increase awareness of ADR reporting among them even in the undergraduate curriculum.

**Keywords:** Knowledge, Attitude, Practice, ADR, Pharmacovigilance.

**INTRODUCTION:** Adverse drug Reaction (ADR) is a global health problem affecting people of all ages leading to significant morbidity and mortality<sup>1</sup>. According to the WHO, ADR is defined as “A response to a drug which is noxious and unintended, which occurs at doses normally used in man, for the prophylaxis, diagnosis, or therapy of disease, or for the modification of physiological functions”<sup>2</sup>. In India the Pharmacovigilance programme was started in July 2010, with the primary objective of safeguarding people’s health and thereby reducing the global burden of disease<sup>3</sup>. The Pharmacovigilance Programme in India (PvPI) has established many ADR reporting centres throughout India for the successful reporting of the ADR by the health care professionals as well as the public but it is seen that the actual practice

of ADR reporting is largely deficit<sup>4</sup>. This could be due to the lack of knowledge, Attitude and practice of the health care workers towards the ADR reporting. Since the intern doctors would be the future health care professionals and would influence the society in many ways, hence this study was undertaken.

ADRs are regarded as a major threat to patient's health and the quality of life and thereby also increasing the health care cost considerably<sup>5</sup>. With the passage of time, there is a tremendous increase in the usage of drugs leading to several adverse drug reactions<sup>6</sup>. Hence a proper monitoring and reporting of the ADR is of utmost importance. In India all the health care professionals can report an ADR by filling up an ADR reporting form of the Central Drugs Standard Control Organization<sup>7</sup>. However they should know how to report and when to report an ADR to improve their ADR reporting<sup>8</sup>.

In India, the national Pharmacovigilance Programme of India (PvPI) was established by the Central Drugs Standard Control Organization (CDSCO) in 2004 to monitor ADRs and to provide drug safety reports to the WHO-ADR monitoring center in Uppsala, Sweden<sup>9</sup>. To coordinate ADR monitoring throughout India, the Drug Controller General of India (DCGI) and Indian Council of Medical Research (ICMR) have established many peripheral PV centers in various hospitals located in major Indian cities<sup>10</sup>. But despite of the constant endeavor of the PvPI, there is a lack in the spontaneous reporting of the ADRs<sup>11</sup>. Such under reporting of the suspected ADRs by the health care professionals has become a major problem in India<sup>12</sup>.

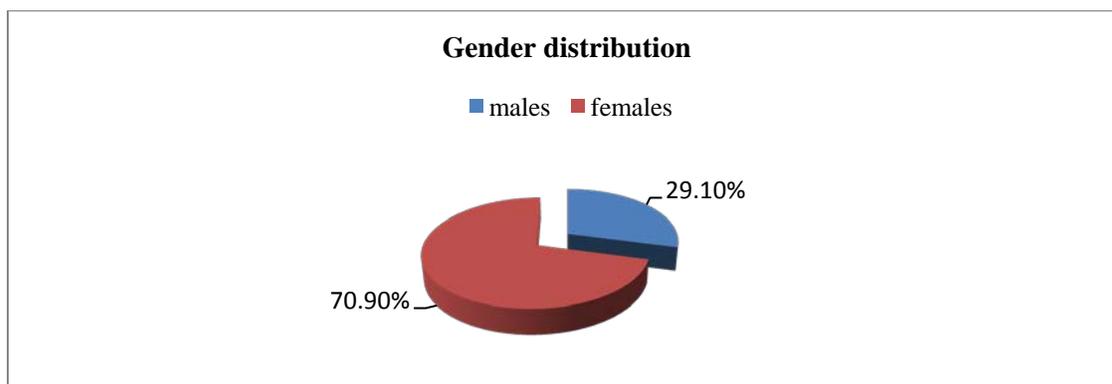
## 2. METHODOLOGY:

This cross sectional questionnaire based study was carried out among the intern doctors of Assam Medical College and Hospital who were working during the study period. The total number of intern doctors who participated in the study were hundred and ten. A prior written informed consent was obtained from the intern doctors before conducting the study. The aims and objectives of the study was explained to them before distributing the questionnaire. Any clarification needed in understanding the questionnaire was provided. The questionnaire consisted of four sections. The first section consisted of the demographic information of the participants , the second section consisted of questions on knowledge relate to ADR reporting, the third section consisted of questions related to the attitude towards ADR monitoring and finally the fourth section consisted of questions with the help of which practice of ADR reporting could be determined amongst the intern doctors. The data was collected and analysed using the statistical package for social sciences (SPSS).

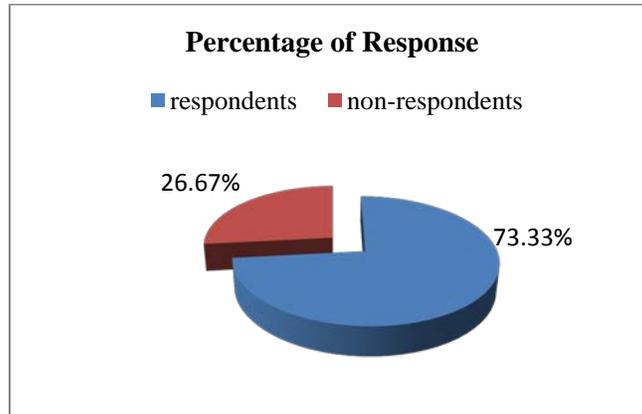
## 3. RESULTS:

### 3.1 Demographic characteristics:

In the present study a total of 150 questionnaires were distributed among the intern doctors, out of which 110 responded with completely filled up questionnaire, giving a response rate of 73.33%. 78(70.90%) of the intern doctors were females and 32(29.1%) were males. The mean age of the intern doctors were 24.



**Figure 1 : Gender distribution**

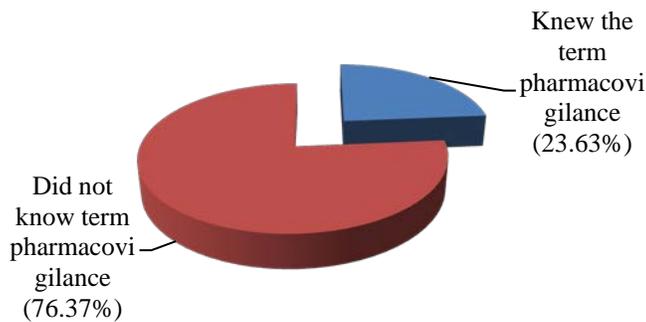


**Figure 2: Percentage of response of the participants**

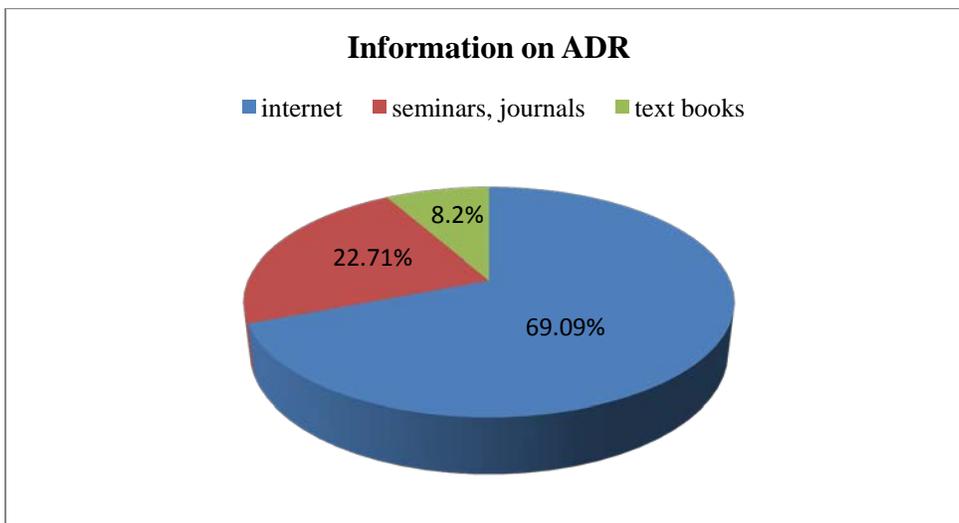
*3.2 Description of knowledge regarding ADR:*

There were 10 questions on assessing the knowledge of ADR among the intern doctors. 26(23.63%) knew the term pharmacovigilance 34(30.90%) of the intern doctors were aware of an adverse drug reaction (ADR). However only 19(17.27%) knew about the different types of ADR respectively. 20 (18.18%) knew about the WHO Upassala Monitoring Centre (UMC), online database for adverse drug reaction reporting, while 45(40.90%) knew about the Pharmacovigilance Programme in India (PvPI). The majority of the respondents 69.09% gathered information about ADR through the internet, 22.71% from seminars, journals, 8.2% from text books and journals directly. Among the respondents 35(31.81%) believed that all the adverse drug reactions seen in the patients should be reported immediately.

**Knowledge on Pharmacovigilance**



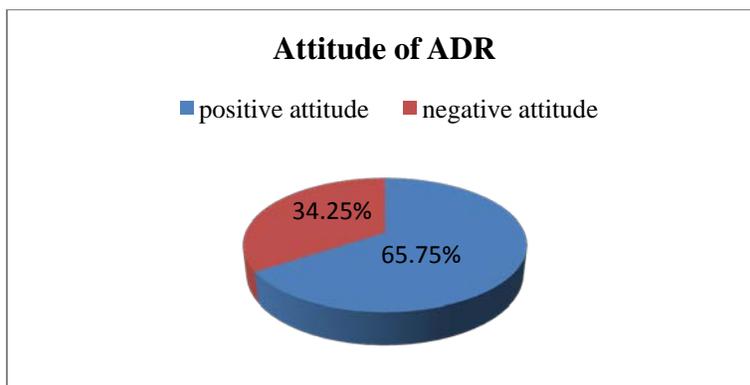
**Figure 3: Respondents familiar with the term Pharmacovigilance**



**Figure 4: Information on ADR of the respondents**

### 3.3 Description of attitude regarding ADR:

The majority of the respondents 78(70.90%) strongly agreed that ADR reporting is of utmost importance, 71(64.54%) strongly agreed that ADR reporting is one of their professional obligation and should be made mandatory. 68 (61.81%) ) strongly agreed that by reporting an ADR patient’s health can be safeguarded. However 70(63.63%) of the intern doctors were of the attitude that ADR reporting is time consuming and a tedious process. Overall most of the intern doctors 65.75% showed a positive attitude towards ADR reporting whereas only 34.25% showed a negative attitude.

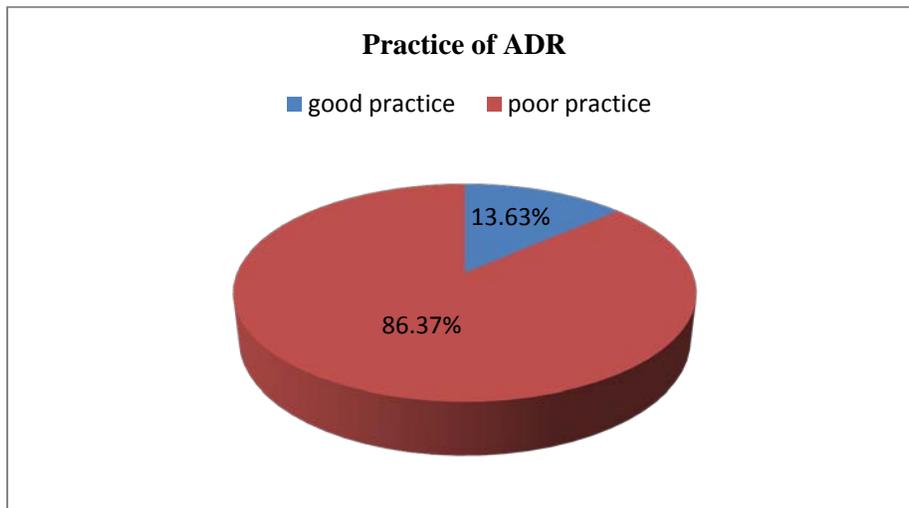


**Figure 5: Attitude of the respondents towards ADR**

### 3.4 Description of practice regarding ADR:

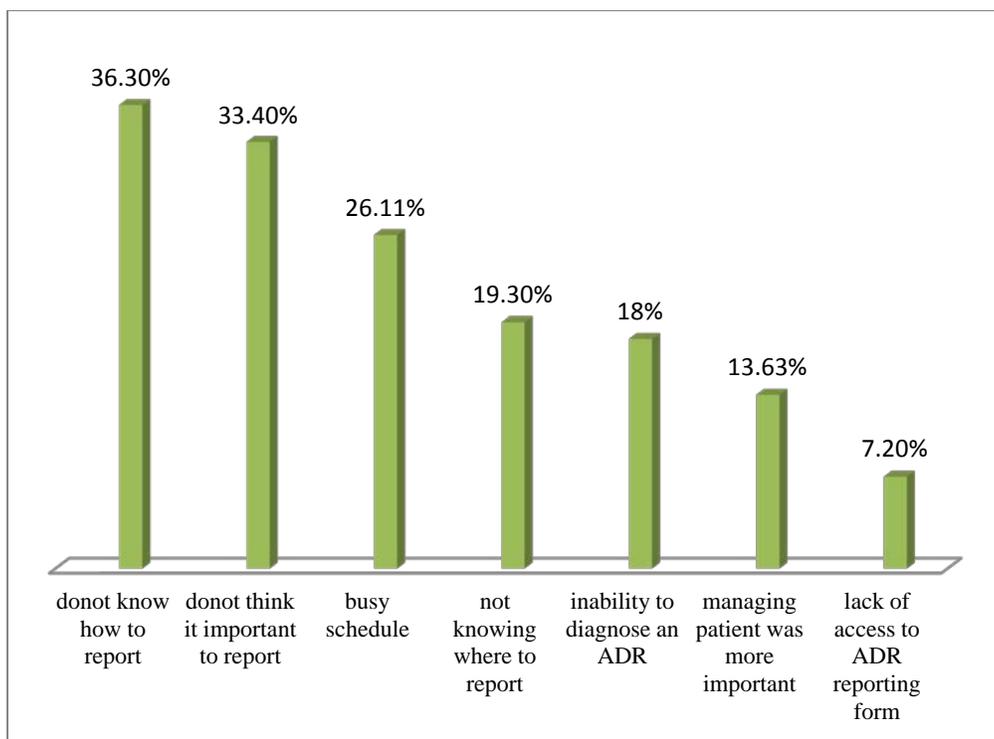
Despite having heard of the ADR reporting system, only 15(13.63%) out of 110 intern doctors have ever reported an ADR.. 96(87.27%) out of 110 intern doctors have never attended any seminars or CME regarding pharmacovigilance and ADR reporting indicating a lack of awareness among them. The main factors discouraging the respondents to report an ADR are did not know how to report an ADR(36.3%), donot think it important to report(33.4%), busy schedule(26.11%)

not knowing where to report(19.3%),inability to diagnose ADR(18%),managing patient was more important(13.63%),  
lack of access to ADR reporting form(7.2%).



**Figure 6: Practice of ADR reporting by the respondents**

**Factors discouraging the respondents to report an ADR:**



**Figure 7: Factors discouraging ADR reporting**

## DISCUSSION:

Various studies have shown that underreporting of ADR exists as an inherent problem affecting people's health<sup>13</sup>. This study was therefore undertaken to evaluate the knowledge, attitude and practice of ADR reporting among the intern doctors. Our study showed that despite of having an adequate knowledge and attitude among the intern doctors, only 13.62% of them have ever reported an ADR, indicating a poor practice. Though most of the respondents strongly agreed that ADR will improve the healthcare of the patients, however it was seen that factors like unavailability of ADR reporting forms, contact numbers & addresses of report agencies, lack of knowledge of how to report an ADR, an lack of enough time to report an ADR etc were the major causes of the underreporting of ADR.

In conclusion, our study has shown that though the level of ADR reporting and the attitude towards it was adequate among the intern doctors, yet they showed a poor practice of ADR reporting. Hence it is of utmost importance to create awareness on ADR reporting among the intern doctors as they are the future health care professionals through continuous medical education (CME), seminars, by providing adequate training to the doctors on how to report an ADR and also including pharmacovigilance awareness programmes in the undergraduate curriculum.

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# Bioleaching of Heavy Metals from Hospital Sewage Sludge using Cassava Peels Fermentation Extracts

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DOI: 10.29322/IJSRP.8.8.2018.p8092

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8092>

## Abstract

The geometric increase in urbanisation cum industrialization has resulted in drastic increase in the volume of wastewater and sludge which contain heavy metals which deteriorate the soil and ground water quality and bioaccumulate in food chains. The use of strain-specific microbial fermentation in the production of organic acids towards the removal of heavy metals has been extensively studied. However, the use of indigenous micro flora toward the bioleaching of heavy metals has not been well researched. This study assessed the bioleaching of heavy metals from hospital sewage sludge using cassava peels fermentation extracts. Sewage sludge sample was collected from the University College Hospital sewage treatment plant, Ibadan, Oyo State, Nigeria and analysed for selected heavy metal concentrations such as Copper (Cu), Zinc (Zn), Chromium (Cr), Nickel (Ni), Cadmium (Cd) and Lead (Pb) by Atomic Absorption Spectrophotometry using standard methods. Source-segregated cassava peels were collected from a market in Ibadan. *Aspergillus terreus* Fermentation Extract (ATFE) and Crude Fermentation Extract (CFE) were obtained each from 50g of CPs after 13-day fermentation using acid-producing strain of *Aspergillus terreus* and indigenous microbial populations respectively while the Commercial-grade Itaconic Acid (CIA) served as control. The batch study was performed by adding 10 ml of the treatment (extracts and controls) at room temperature (RT) and elevated temperature (ET) at the varied pH (3– 5) to 3g of the sample each. The mixture was centrifuged after a leaching time of 1-12 days at 1000 rpm for 1hour. The filtrate was analysed for heavy metals concentrations and compared with the standards. Data were analyzed using descriptive statistics, paired t-test and ANOVA at  $p>0.05$ . The mean heavy metal concentration (mg/kg) in the sludge were Zn(52.3±0.1), Ni(5.6±0.01), Cu (2.22±0.2), Cr (1.46±0.1) and Pb(1.9±0.1) and were below the permissible limits (mg/Kg) set by national standards. Optimum heavy metals removal for ATFE at room temperature was achieved on day 12 at pH 3.5 for Ni (78.4%) and at elevated temperature was achieved on day 1 at pH 4.0 for Zn (72.3%). The optimum pH for CFE lies between 3 – 4.5 for Ni (76.2%) at room temperature and Cr (76.6%) at elevated temperature. ATFE showed higher removal when compared with control, except Cr and Pb. Crude fermentation extract of cassava peel was found to be effective in removing the heavy metals from sewage sludge. Therefore, its use could be embraced and promoted for removing heavy metals from sewage sludge, thus safe disposal could be achieved.

**Keywords:** *Aspergillus terreus* Fermentation Extract, Crude Fermentation Extract, Hospital sewage sludge, Cassava peels.

## Introduction

The geometric increase in the urbanization coupled with industrialization has brought about the generation of wastes different forms in the environment. These wastes have posed a lot of threat to both man and the environment. This is due to industrialization, increasing population density and high urbanized societies [1,2]. Sewage sludge is the solid, semi-solid or liquid residue generated during the treatment of sewage in a treatment works. Sludge generated at these plants contains heavy metals at relatively high concentrations, which may vary considerably with time and mostly depend on industrial activities. Heavy metals such as Lead (Pb), Chromium (Cr), Nickel (Ni) and Cadmium (Cd) constitute toxic pollutants found in sewage sludge [3-5]. Heavy metals accumulate in soil and in plants when sludge is applied as fertilizer and eventually produce harmful effects in animals and humans. Due to the high level of awareness of the negative impacts of high concentration of heavy metals to the environment, stringent guidelines and verifications have been designed to limit the application of sewage sludge to agricultural soils [6].

In order to use sewage sludge as soil conditioner, it is necessary to remove or minimise the amount of heavy metals in sludge to prevent biomagnification and bioaccumulation. Inorganic chelating agents which are the most popular extracting reagents for heavy metal removal have been proved to be very efficient as they form stable complexes with most heavy metals over a broad pH range. Although, the use of inorganic and synthetic chelating agents for

heavy metal removal tends to decrease soil productivity and impaired the chemical and physical structure of soils due to mineral dissolution. These compounds are very stable and could remain adsorbed in the soil after extraction, thus making the soil unfit for further use [3,7].

In bioleaching of metals from sewage sludge, organic acids are more promising than inorganic chelating agents, since extraction can be at mildly acidic condition and are biodegradable, hence low environmental impact. Also, the use of organic acids as a better option for heavy metal solubilisation from sewage sludge have been explored by several authors to have low effectiveness compared to the synthetic chelates [8]. The use of strain-specific microbial fermentation in the production of organic acids has been studied [9,10]. However, the use of indigenous microflora towards the removal of heavy metals has not well been researched. Therefore, this study assessed the bioleaching of heavy metals from hospital sewage sludge using cassava peels fermentation extracts.

## Materials and Methods

### Study area

University College Hospital (UCH), Sewage Treatment Plant located in the University College Hospital (UCH), Ibadan, Oyo State, Nigeria (Fig 1). The Sewage Treatment Plant involved the conversion of the organic matter into inorganic matter before discharging the treated effluent into the recipient environment while the sludge is processed into organic manure for agricultural purposes.

### **Collection and Analysis of dewatered sewage sludge**

Sewage sludge sample was collected from the University College Hospital (UCH) Sewage Treatment Plant, Ibadan, Oyo State. The sample was prepared by drying and homogenised through a 0.2 mm stainless steel sieve, digested and analysed for the heavy metal content (Cadmium (Cd), Chromium (Cr), Copper (Cu), Nickel (Ni), Lead (Pb) and Zinc (Zn)) according to A.O.A.C [11].

### **Production of fermentation extracts (extractants)**

Itaconic acid producing strain of *Aspergillus terreus* was isolated from the soil using the pour plate method and screened using Czepak-Dox Agar. The *A. terreus* fermentation extract and crude fermentation extract were obtained from fermentation of 50g of cassava peels for 13 days using acids-producing strain of *A. terreus* as inoculum and no inoculation was carried out on the cassava peels for natural/crude fermentation. Therefore, the substrate (cassava peels) still retains its indigenous microflora which is needed for crude fermentation [12,13]. The *A. terreus* and crude fermentation extracts were used for the removal of heavy metals from sewage sludge while the commercial itaconic acid served as the control.

### **Extraction studies**

Extraction of heavy metal was carried out to determine the efficacy of extractants using varied optimum conditions (pH, temperature and contact time) as modified by Okareh and Enesi [14]. The unadjusted and adjusted pH (3, 3.5, 4, 4.5 and 5) were used to determine the effect of progressive acidification on the

removal of heavy metals using the fermentation extracts.. The adjustment of pH was done using 1M HCl. The extraction was carried out at contact time of 1, 3, 6, 9 and 12 days at ambient/room temperature (28°C) and the elevated temperature (45°C) for each extractant using 10ml for each extractant. Each tube containing 3 g of sieved sewage sludge in 25ml centrifuge tubes was filled with varied doses (ml) of the extractants. The tubes were stirred continuously on a rotary shaker at 150 rpm. Each tube was centrifuged at 1000 rpm for 1hour. The supernatant was decanted and filtered through a filter paper. The concentrations of heavy metals in the final solutions (filtrate) were determined by an Atomic Absorption Spectrometer.

### **Data Management**

The obtained data was subjected to statistical analysis using Statistical Package for Social Science (SPSS 21) to evaluate statistically significant effects. Adsorption/leaching model was used to calculate the amount of metal ion leached and percentage removal of heavy metals from the sewage sludge.

Removal efficiency:

$$\text{Efficiency (\%)} = \frac{(C_1 V_1)}{C_s M_s} \times 100$$

Where  $Q_e$  is the metal uptake (mg/g);  $C_1$  and  $C_s$  are the concentrations of the metal in supernatant (in mg/L) and sludge (mg/kg) respectively,  $M$  is the mass of the sewage sludge (kg) and  $V$  is the volume of the extractant (l).

## Results

### Heavy metal contents of Dewatered Sewage Sludge

The selected heavy metal content of copper, zinc, chromium, nickel, cadmium and lead are presented in mg/kg in Table 1.

**Table 1. Physico-chemical properties of dewatered sewage sludge**

Parameter	Unit	Values	NESREA	WHO
pH		6.20±0.2	6-9	6.5-8.5
Copper (Cu)	mg/KgDM	2.22± 0.2	100	15.0
Zinc (Zn)	mg/KgDM	52.33±0.1	421	1.0
Chromium (Cr)	mg/KgDM	1.46±0.1	100	0.05
Nickel (Ni)	mg/KgDM	5.63±0.01	70	NA
Cadmium (Cd)	mg/KgDM	ND	03	0.01
Lead (Pb)	mg/KgDM	1.92± 0.1	164	0.01

ND = Not detected, NA = Not available

The heavy metals concentrations in the sewage sludge were compared with the national and international maximum permissible standards.

### Efficacy of the fermentation extracts for heavy metal removal

#### Effects of Temperature on the heavy metal removal from the dewatered sludge

Optimum heavy metal removal of the fermentation extracts at room and elevated temperature (45°C) at different pH values of day 1 to day 12. At the room temperature, *A. terreus* fermentation extract had the highest optimum heavy metal removal of 78.4% and 73.2% for nickel and copper respectively; crude fermentation extract had the highest optimum heavy metal removal of 76.2% and 74.8% for nickel and zinc respectively; while commercial itaconic acid had the highest optimum heavy metal removal of 73.1% and 68.9% for copper and zinc respectively as

shown in Table 2. At the elevated temperature, *A. terreus* fermentation extract had the highest optimum heavy metal removal of 72.3% and 70.9% for zinc and copper respectively; crude fermentation extract had the highest optimum heavy metal removal of 76.6% and 76.3% for chromium and lead respectively; while commercial itaconic acid had the highest optimum heavy metal removal of 70.8% and 66.5% for copper, zinc and chromium respectively as shown in Table 3.

**Table 2: Removal of heavy metals at room temperature for *Aspergillus terreus* extract**

Heavy metals		Extractant			
		<i>Aspergillus</i> fermentation extract	<i>Tereus</i>	Crude fermentation Extract	Itaconic acid
Copper	Extraction	73.2		74.4	73.1
	Efficiency (%)				
	pH	3.0		3.5	3.0
	Contact time	12		9	12
Zinc	Extraction	69.3		74.8	68.9
	Efficiency (%)				
	pH	3.0		3.5	3.0
	Contact time	9		12	9
Chromium	Extraction	51.6		70.5	58.8
	Efficiency (%)				
	pH	4.0		3.0	4.0
	Contact time	12		12	12
Nickel	Extraction	78.4		76.2	67.8
	Efficiency (%)				
	pH	3.5		4.0	3.5
	Contact time	12		12	3
Lead	Extraction	71.1		71.6	67.8
	Efficiency (%)				
	pH	4.0		3.0	4.0
	Contact time	3		12	3

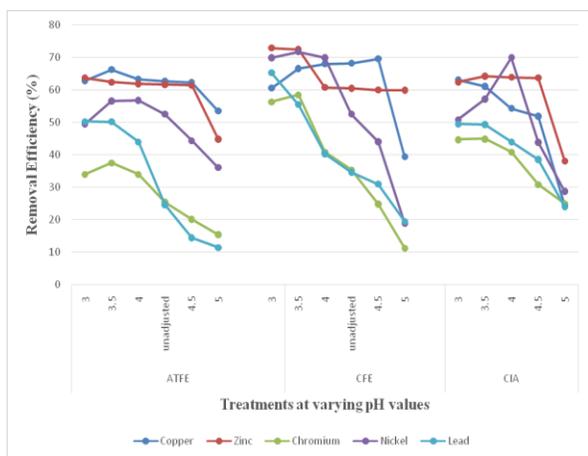
**Table 3: Removal of heavy metals at elevated temperature for *Aspergillus tereus* extract**

Heavy metals		Extractant			
		<i>Aspergillus</i> fermentation extract	<i>tereus</i> Crude fermentation Extract	Crude fermentation Extract	Itaconic acid
Copper	Extraction	70.9		75.6	70.8
	Efficiency (%)				
	pH	3.5		3.5	3.5
	Contact time	12		12	12
Zinc	Extraction	72.3		75.1	66.5
	Efficiency (%)				
	pH	4.0		3.5	3.5
	Contact time	1		12	12
Chromium	Extraction	65.7		76.6	66.5
	Efficiency (%)				
	pH	3.0		3.5	3.0
	Contact time	3		6	3
Nickel	Extraction	68.4		75.2	64.8
	Efficiency (%)				
	pH	3.5		3.5	3.5
	Contact time	12		1	12
Lead	Extraction	53.2		76.3	53.8
	Efficiency (%)				
	pH	3.0		3.0	3.0
	Contact time	9		1	9

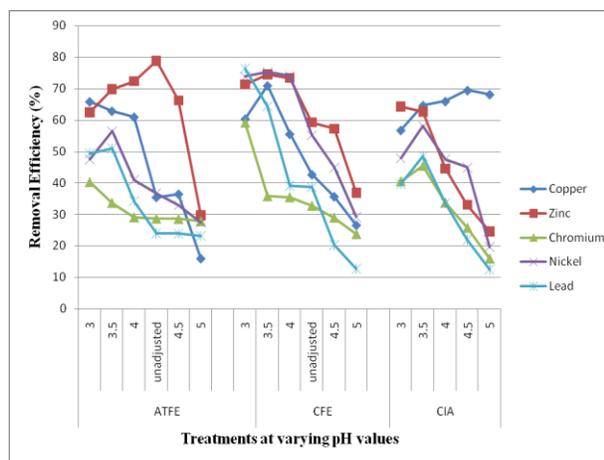
### Effects of pH on the heavy metal removal from the dewatered sludge

The heavy metal removal efficiency of the fermentation extracts and the control increases with increase in the pH values from 3 to 4.5, then decreased as pH

increases towards 5. In few, there was decrease in removal efficiency with increase in the pH values at different temperatures and contact times as presented in Fig.2 – 6.



a



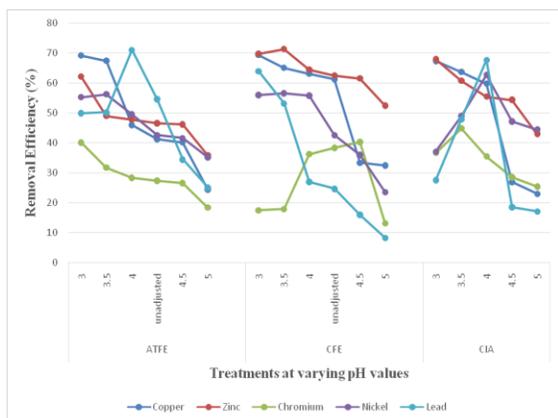
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Fig. 2a: Effect of pH on metal removal at room temp. on day 1 Fig. 2b: Effect of pH on metal removal at elevated temp. on day 1

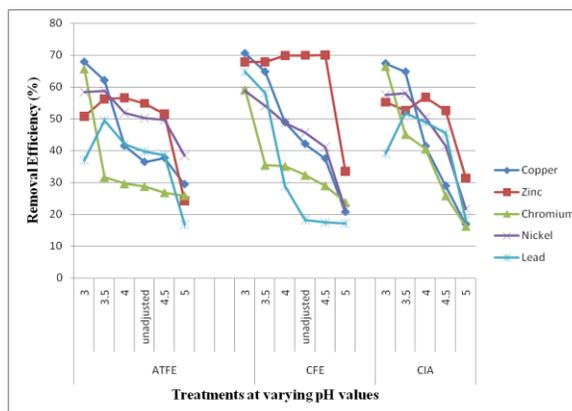
ATFE – *Aspergillus terreus* fermentation extract

CFE – Crude fermentation extract

CIA – Commercial-grade itaconic acid

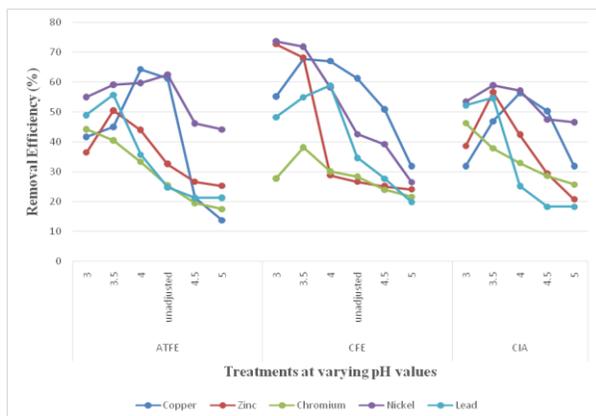


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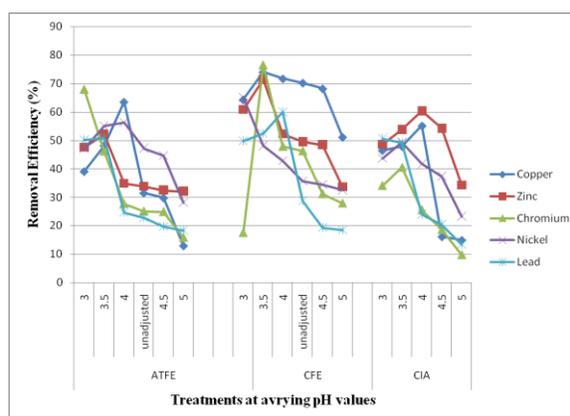


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Fig. 3a: Effect of pH on metal removal at room temp. on day 3 Fig. 3b: Effect of pH on metal removal at elevated temp. on day 3

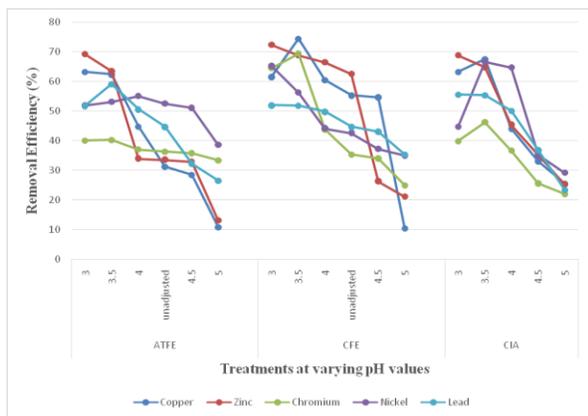


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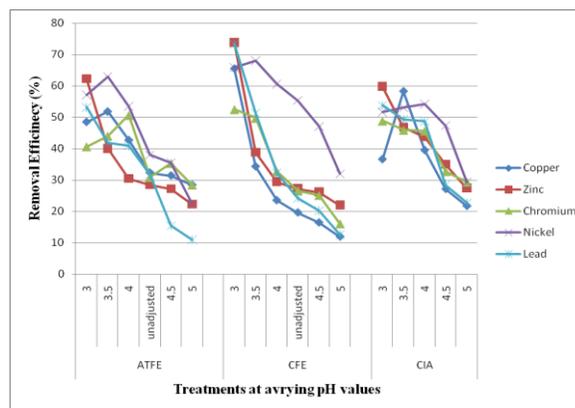


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Fig. 4a: Effect of pH on metal removal at room temp. on day 6 Fig. 4b: Effect of pH on metal removal at elevated temp. on day 6

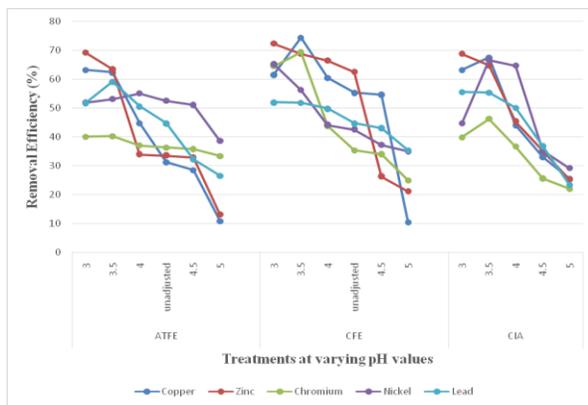


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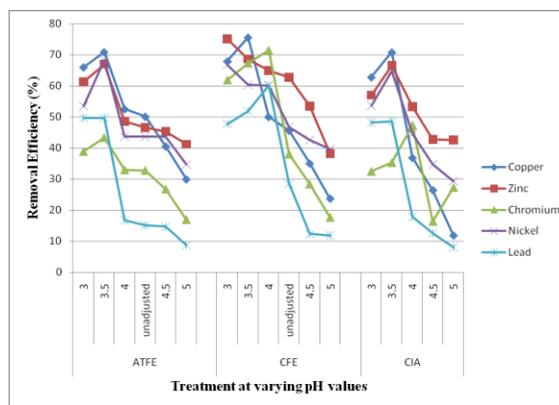


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Fig. 5a: Effect of pH on metal removal at room temp. on day 9 Fig. 5b: Effect of pH on metal removal at elevated temp. on day 9



a



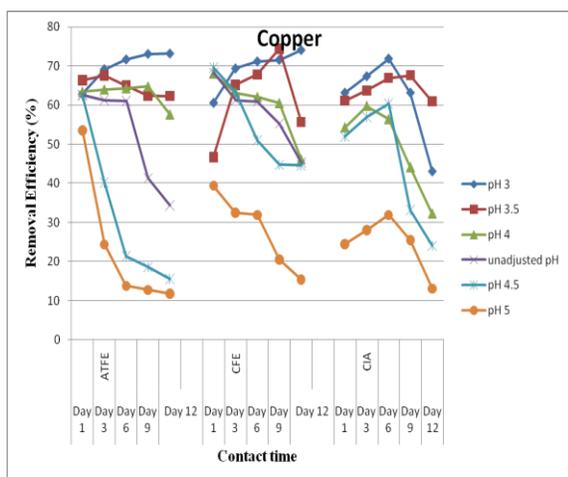
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Fig. 6a: Effect of pH on metal removal at room temp. on day 12 Fig. 6b: Effect of pH on metal removal at elevated temp. on day 12

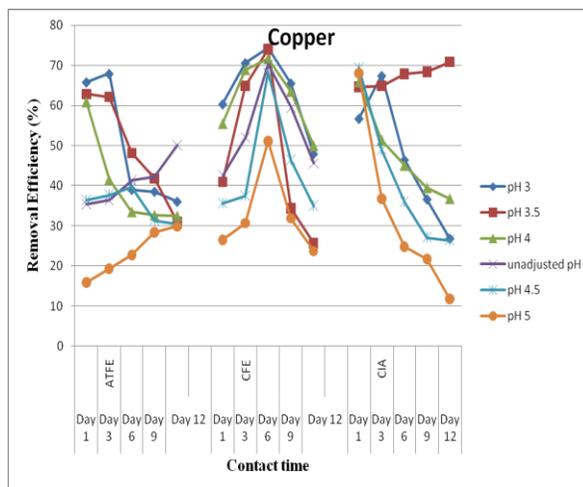
### Effects of contact time on the heavy metal removal from the dewatered sludge

Generally, there were initial increases in removal efficiency with corresponding increase in contact time from day 1 to 9, then decreased to day 12. In few, there was corresponding increase in removal

efficiency as the contact time increases while there was downward trend in removal efficiency as contact time increases in others. The effects of contact time on the heavy metals are represented in Fig.7-11.

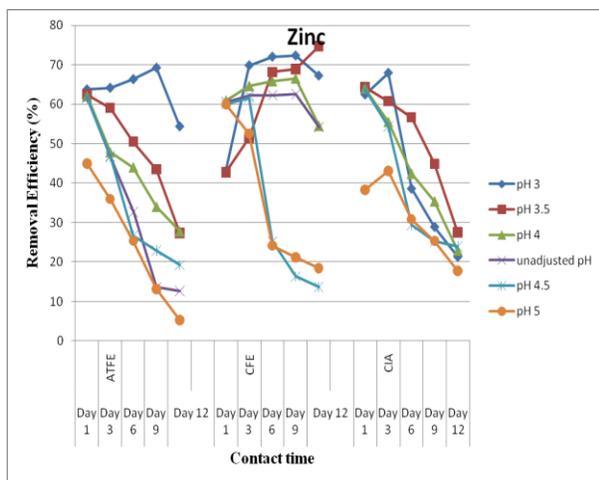


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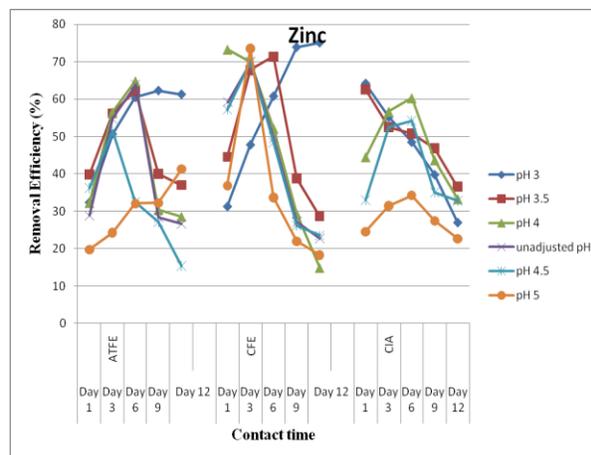


b

Fig. 7a: Effect of contact time on Copper removal at room temp. Fig. 7b: Effect of contact time on Copper removal elevated temperature

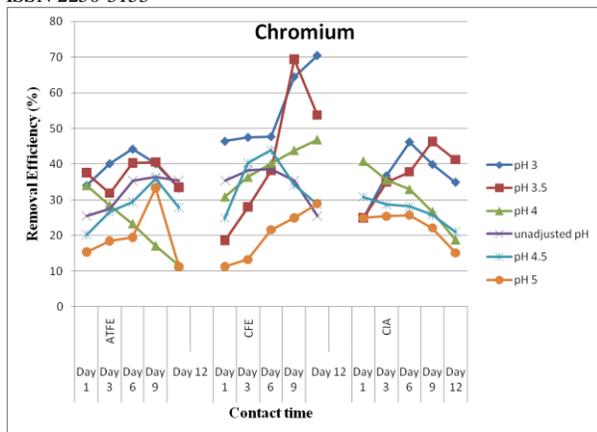


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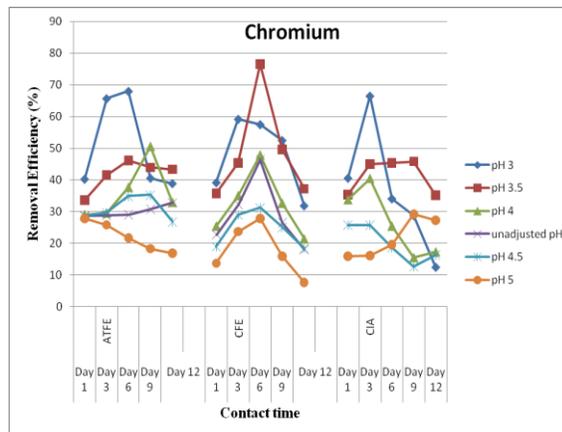


b

Fig. 8a: Effect of contact time on Zinc removal at room temp. Fig. 8b: Effect of contact time on Zinc removal elevated temperature

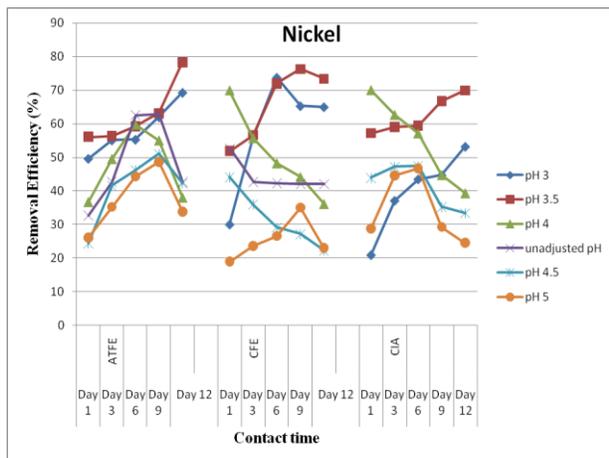


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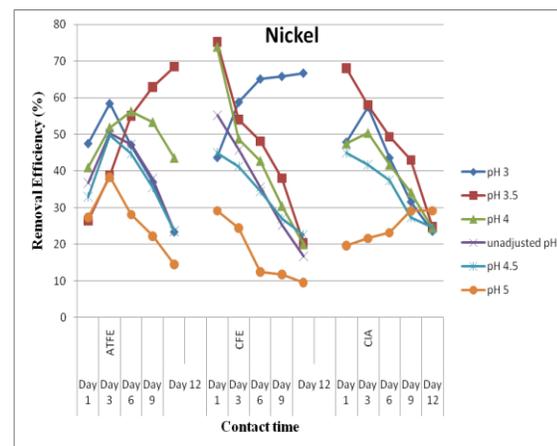


b

Fig. 9a: Effect of contact time on Chromium removal at room temp. Fig. 9b: Effect of contact time on Chromium removal elevated temperature

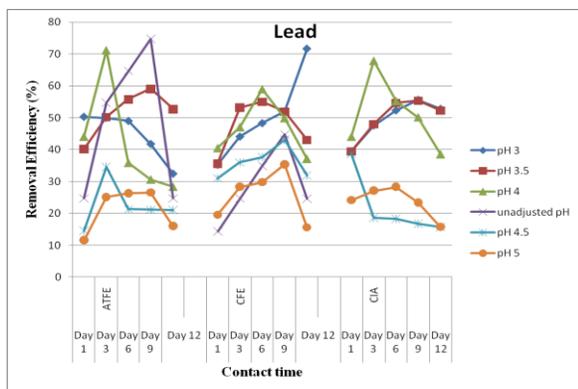


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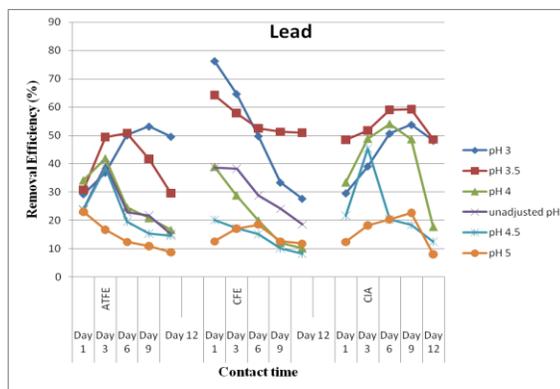


b

Fig. 10a: Effect of contact time on Nickel removal at room temp. Fig. 10b: Effect of contact time on Nickel removal elevated temperature



a



b

Fig. 11a: Effect of contact time on Lead removal at room temp. Fig. 11b: Effect of contact time on Lead removal elevated temperature

## Discussions

### Heavy metal concentrations of sewage sludge

The high concentrations of Zn in this study is consistent with the work of Tolosana and Erhlich [15] which showed that effluent from medical institutions in South Africa had high levels of Zn and Cu. The metal concentrations were below the permissible limits for the safe disposal of sludge. However, their removal is recommended due to bioaccumulation which constitutes serious threats to the environment, groundwater and food chain [16].

### Effects of Treatment/ Extractants on the heavy metal removal from the dewatered sludge

*Aspergillus terreus* fermentation extract was more effective in the extraction of heavy metals from sewage sludge at room temperature compared with commercial itaconic acid except for Cr while the extraction is more effective at elevated temperature when compared with commercial itaconic acid except the Cr and Pb. The extraction efficiency of crude fermentation extract is more desirable at elevated temperature because it showed appreciably higher extraction efficiency for the heavy metals assayed. Some organic acids had demonstrated their ability to solubilize some metals at higher concentration [8]. Zn showed the greatest solubility by the *A. terreus* fermentation extracts at elevated temperature. These findings confirmed the work of Enesi [17] which reported that zinc exhibits the same degree of mobility in sewage sludge.

Chromium showed the least solubility by the *A. terreus* fermentation extracts at both temperature. These findings were conformed with Jakubus and Czekala [18] who reported that, irrespective of the oxidation degree, the dominant part of Cr (80 – 90 %) was bound firmly, difficult to dissolve in the soil and sewage sludge.

### Effects of pH on the heavy metal removal from the dewatered sludge

The optimum pH for extraction lies between 3 – 4.5 which was most effective for the removal of Ni (78.4%) for *A. terreus* fermentation. Crude fermentation extract was effective for the removal of Ni (76.2%) at room temperature and Cr (76.6%) at elevated temperature. It should be noted that after pH 4, there was a decrease in the removal efficiency, which may be due to the formation of soluble complexes of filling up of the binding sites. At low pH values, the surface of the extractant would be closely associated with hydroxonium ions ( $H_3O^+$ ) by repulsive forces, to the surface functional groups, consequently decreasing the percentage removal of metal. As the solution pH increases, the onset of the metal hydrolysis and the precipitation began. When the pH of the extractant was increased from 3 to 4, there was a corresponding increase in deprotonation of the extractant's surface, leading to a decrease in  $H^+$  ion on the surface. This creates more negative charges on the extractant's surface, which favours extraction of positively charge species [16,19,20].

### Effect of contact time on the heavy metal removal from the dewatered sludge

There were initial increases in removal efficiency with corresponding increase from day 1 to 9. These findings showed a great disparity with Stylianou *et al.*, [16], which reported that using synthetic inorganic chelating agents, maximum heavy metal removal efficiency is attained in less than 24 hours. It is worthy to know that the initial faster rate was due to the availability of the uncovered surface area of the extractants since the kinetics depends on the surface area of the extractants. The extraction takes place at the more active binding sites and as these sites are progressively filled, the

extraction process tends to be more unfavourable.

### Conclusion

This study which determined the efficacy of two fermentation extracts of cassava peel wastes in removing heavy metals from sewage sludge indicated that crude fermentation extract of cassava peel waste can remove heavy metals from sewage sludge. The fermentation extract showed appreciable heavy metal removal efficiency when compared with commercial-grade organic acids. The cheaply available substrate for fermentation and the low cost of the fermentation process in obtaining the crude fermentation extract makes its use economically acceptable.

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# Exploring Ways of Reducing Carbon Footprints in Clothing Care and Maintenance among Tertiary Students in Ghana

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DOI: 10.29322/IJSRP.8.8.2018.p8093

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8093>

**Abstract-** Students clean their garments to eliminate dirt and to prevent them from smelling. Although often ignored, every load of washing and drying contributes to environmental consequence on tertiary campuses with extensive use of water, energy, detergents, and chemicals. The study thus investigated the existing patterns of student laundry application and the environmental implications of these practices. The sample used for this study were tertiary students in Ghana. Convenience sampling was used to select 150 students and administered with questionnaires. The major findings of the study demonstrate that one of the main problems with laundry as it stands is the lack of education about the environmental impacts of doing laundry. Students do not connect doing laundry with the number of resources necessary to make their clothes clean. This is especially true when considering detergents and the number of students who haphazardly pour detergent when cleaning their clothes.

**Index Terms-** Garment, Carbon Footprints, Clothing Care and Maintenance

## I. INTRODUCTION

Concerns regarding climate change have increased beyond the range of scientists and environmentalists and have permeated the general public. Although using washing machines as well as dryers is a practical and time-saving method of caring for clothes, it is also an energy, water, and chemical-intensive process that extends the ecological footprint with each load of wash. Saving energy and water also decreases pollution, acid rain, water and air pollution, and safeguards inadequate local water resources in many communities (Consumer Reports, 2007).

Students clean their garments to eliminate dirt and to prevent them from smelling. Most students wash or clean and maintain their clothes after using them only once, whereas others wash them rarely. Although often ignored, every load of washing and drying contributes to environmental consequence on tertiary campuses with extensive use of water, energy, and chemicals. Carbon footprints of clothing care and maintenance among tertiary students are the cause of a notable amount of environmental degradation and human diseases. All the organic substances present in the wastewater from laundry activities are

of immense concern in water treatment as they react with various disinfectants particularly chlorine. Chemicals dissipate into the atmosphere we breathe or are absorbed through the skin and becomes allergic reactions.

Controlling carbon emissions and measuring the carbon footprint is a challenge for many institutions today (Butner et al. 2014). Carbon footprints of clothing care and maintenance contribute to anthropogenic climate change. A considerable percentage of carbon footprints of clothing care and maintenance is due to laundry related activities. Waste management in clothing care and maintenance is responsible for producing hundreds of thousands of tonnes of greenhouse gas emissions every year, and these figures do not include other human activities that contribute to carbon footprints. With the addition of these amounts, they can be safely assumed to increase the overall carbon footprint for clothing care and maintenance far beyond the estimations of anyone.

The introduction of different detergents, bleach, softeners and so on can result in a dramatic increase in greenhouse gas emissions created through laundry methods such as using the washing machine. As Harbus (2008) inferred, depending on how one does it, and how many loads one gets through each week, laundry can contribute a surprising amount to carbon footprint. It is said that fashion is the second largest polluter, this is likely impossible to know, what is definite is that fashion carbon footprint is unbelievable. Washing and drying a load every two (2) days creates around 440kg of CO<sub>2</sub> every year, which is commensurate with flying from London to Glasgow and back with a 15-mile taxi trip to and from the airports (Berners-Lee 2011).

Berners-Lee (2011) infers that for a typical 40°C wash nearly three-quarters of the carbon footprint comes from the drying, which follows the common rule of thumb that the more energy an appliance generates, the more energy it needs to operate. Part of the quandary is that tumble dryers such as washing machines utilize electricity to produce their heat. This is ordinarily more than double the carbon-intensive as generating heat from gas. All the above and more necessitates the need to investigate the existing patterns of student laundry application and distinguish the environmental implications of these practices and offer recommendations on how tertiary students can reduce their environmental impact while keeping their clothes clean.

Specifically, the study explored ways of reducing the carbon footprints in connection with clothing care and maintenance practices among tertiary students in Ghana.

## II. RELATED WORK

### *The range of definitions for carbon footprint*

Several definitions of the term carbon footprint exist Growcom (2008). These descriptions are nonetheless grounded primarily on publications from “grey” rather than scientific literature. Notwithstanding a large number of publications, these articles mainly concentrate on measuring and decreasing greenhouse emissions of distinct processes and products and do not sufficiently address more basic definition concerns. The inadequacy of scientific literature on the conceptual interpretation of a carbon footprint is contradicted by the awesome quantity of information obtainable on carbon footprints in the public domain.

The lack of scientific literature on the theoretical connotation of a carbon footprint suggests some amount of discrepancy between the popularised understanding of a carbon footprint and the scientific processes typically associated with peer-reviewed journals. One author noted that it is conceptually incorrect to measure a carbon footprint in tons of CO<sub>2</sub> because footprints are spatial indicators, measured in hectares or square meters (Hammond 2007). Hammond hence asserted that a more appropriate term would be “carbon weight.” Similarly, Wiedmann & Minx (2007) infer that an estimation tool that includes the measurement of greenhouse gases in addition to CO<sub>2</sub> would be more appropriately called a “climate footprint” rather than a “carbon footprint.” Nevertheless, the obvious absence of scientific approval has not limited the growing application of this term in communications by the government, the media, and institutions.

### *Some definitions of a carbon footprint in the literature*

- i. Carbon footprint measures the demand on biocapacity that rises from combusting fossil fuels regarding the volume of forest area needed to separate these CO<sub>2</sub> emissions (Global Footprint Network 2007).
- ii. The term carbon footprint is generally employed to specify the total volume of CO<sub>2</sub> and other greenhouse gas (GHG) emissions for which a person or entity is responsible. Footprints may further be calculated for events or products (Carbon trust 2008).
- iii. Carbon footprint is a measure of the particular total volume of CO<sub>2</sub> emissions that directly and indirectly come about due to an action or is accumulated over the life phases of a product (Wiedmann & Minx 2007).
- iv. A measure of the volume of CO<sub>2</sub> emitted through the burning of fossil fuels; in the instance of an institution or company, it is the CO<sub>2</sub> emissions that result from their daily operations; in the case of a person or household, it is the CO<sub>2</sub> emissions

that occur as a result of their everyday actions; for a product or service, it involves further life-cycle CO<sub>2</sub> emissions along the supply chain; for materials, it is a measure of the integrated CO<sub>2</sub> emissions ascertained through life cycle evaluation (Carbon N Zero 2008).

Due to the absence of a globally affirmed description of a carbon footprint, a diversity of alternative terms has been formed to describe related theories or processes. Such terms encompass “greenhouse gas accounting” by Forsyth & Oemcke (2007).

### *The Units of Measurement*

Categorizing the units of measurement of a carbon footprint necessitates that a position is reached on two fundamental questions. The first relates to the distinction between an ecological footprint and a carbon footprint. Thus, must the measurement of a carbon footprint be expressed in tons of gaseous emissions or in area-based units tied to the natural regenerative capacity of the environment? (Growcom 2008). Assuming that a carbon footprint is measured in tons of gaseous emissions brings about a second definition issue: must the measurement of a carbon footprint be in tons of CO<sub>2</sub> or must it be extended to comprise a diversity of greenhouse gases articulated in tonnes of CO<sub>2</sub> equivalents? To comprehend this subject, a deeper perception of tools and mechanisms to decrease greenhouse gases, as established in international agreements like the Kyoto protocol, is needed.

The Kyoto protocol is a constitutionally binding international agreement among signatory countries to the United Nations Framework Convention on Climate Change (UNFCCC) to decrease greenhouse gases and of the stabilisation of anthropogenic greenhouse gas emissions. According to the Kyoto protocol, there are six (6) main greenhouse gases with the potential to cause climate change, each with a different global warming potential (Kyoto Protocol 2008). For the ease of reportage, the warming effect of CO<sub>2</sub> has been allotted a worth of one, while the global warming potential of the other greenhouse gases are applied to translate the non-carbon dioxide gases to CO<sub>2</sub> equivalents (CO<sub>2</sub>-e) (Carbon N Zero 2008). The warming potential of all of these gases over 100 years is depicted in Table 1.

**Table 1: global warming potential of different greenhouse gases covered in the Kyoto Protocol**

<i>Gas</i>	<i>Warming potential</i>	<i>Source</i>
Carbon dioxide	1	Mainly from fossil fuel use
Methane	21	Mainly from ruminant animals & organic waste
Nitrous oxide	310	Mainly from agriculture
Hydrofluorocarbons	140 to 11,700	Mainly from refrigerants
Perfluorocarbons	9,200 to 6,500	From aluminum production
Sulphur hexafluoride	23,900	Mainly from the electricity industry

### *Clothing definitions*

Woodward (2009) infers that clothing unifies roles with regards to identity, sexuality, and sociality, and thus clothing choices externalise the inner self in social contexts. Consequently, clothing is very intimate, close to our body, but also very closely connected to our external social roles and simultaneously our inner self, our identity. Kaiser (1990) notes that clothing can be understood through its temporal, fashion and aesthetic aspects, i.e., its cultural context, and through connections to group affiliation, social situation, immediate body space, personal characteristics, kinetic interaction and garment/body interaction.

Entwistle (2000) describe clothing as mean an embodied experience that is socially constituted and situated: i.e., the dress, the body and the self in the social context are perceived simultaneously. Breward (2000) elucidates that some objects can be defined to be the extenders of identity since they are so fundamentally profoundly associated with an individual. Clothing is one example of such a product. Appearance and clothing express the wearer's inner self, moods, and identity. Furthermore, clothing is connected to social class, status, gender, and age. Clothing is very intimate; it exposes and hides simultaneously.

McCracken & Roth (1989) indicates that clothing is an expressive medium and points out that clothing can be understood as a language or at least as a communication medium. Kaiser (1990) defines appearance communication as 'meaningful exchange of information through visual personal clues' (p. 11). Since appearance is constantly evaluated in social and temporal contexts, the identity construction process makes the appearance and clothing changes unavoidable. As Kaiser (1990) notes, these statements of who we are or are not or no longer are, are possible to coexist with ambiguous identity spaces that are under construction' (p. 43). Temporal symbolism means that objects' symbolic meanings change over time (Miller 1997).

### *Carbon footprints and clothing in general*

Clothes have a long and complicated life cycle consisting of various stages from raw material to final disposal (Allwood et al., 2006). However, the care phase of the clothing lifecycle has the most substantial overall negative impact on the environment according to Fletcher, (2008). The clothing life cycle starts with the selection of raw materials. After pre-treatment, the textile fibers are spun into yarns. The yarns are then knitted or woven into fabrics. After dyed, cut, sewed, trimmed and decorated, the fabric is finally turned into the finished garments. The finished garments are packed and shipped from the production factories to the distribution outlets. As noted by Ryttinger & Holtmaat (2014), the use, care, and maintenance stage happen once consumers purchase the garments and begin wearing them. During the consumer use stage, the garments are washed, dried and ironed. Finally, the garments are discarded when consumers no longer need them.

The growing popularity of fast fashion, including rapid production, short lead time, and cheap materials, has stimulated consumers to purchase garments at a higher speed. However, cheap fabric and poor garment construction force consumers to

discard them shortly, shortening the lifetime of a product (Fletcher 2010). Furthermore, the apparel and textile industry creates significant environmental and social footprint at each stage of the product lifecycle including fibre growth and manufacturing, dyeing and finishing, transportation and distribution, washing and drying, and ultimate disposal (Fulton & Lee 2010).

### *Clothing care and maintenance practices*

What individuals know and what they think they know is often different, and this is applicable with regards to laundering. According to Mowen & Minor (2006), "consumer knowledge is defined as the amount of experience with and information that a person has about particular products or services" (p. 64). Information comes to individuals through many facets that it is difficult for them to know what is truthful. "Green-washing" is an example of false knowledge retrieved from an outside source. Green-washing occurs when false claims are made to exploit green consumers. This can happen purposefully from various companies, although individuals can get incorrect information from other sources that do not know they are giving false information such as friends, family, and internet sites.

Many people accept as true that a product is better for the environment if the packaging includes environmentally friendly terms, although this is not necessarily true (Spack et al. 2012). Green-washing demonstrates how easily buyers can be manipulated. The word 'green' has become such an umbrella term that its actual meaning is not always clear to patrons, and green product perceptions do not necessarily translate into purchasing behaviour (Spack et al., 2012). The most common ways for patrons to learn about washing machines are through the internet and appliance stores. Consequently, the internet does not always provide accurate information. As online consumer reviews typically highlight the problems of an appliance rather than the positive attributes (see Hustvedt et al., 2013).

This may deter consumers from purchasing a machine that otherwise meets their needs. With regards to laundry, consumers are typically not as knowledgeable as they think they are. People tend to follow 'general norms' in their everyday lifestyle tasks as inferred by Jack (2013). Individuals are rarely aware of the fibre content of their clothing, even though clothing is required to be labelled with this information. With this chosen ignorance, buyers frequently assume their laundry is primarily cotton and wash it as so, often and with high temperatures. Sorting of laundry is usually done on the basis of colour, rather than fibre type, which can ruin clothing and also use additional water and energy (see Fletcher & Goggin, 2001).

Laundering behaviours are continually changing and developing with social, cultural, and moral norms. Recent changes in social norms have led to an increase in laundry and personal hygiene (see Laitala et al., 2012). The increase in demand for cleanliness has come with the increased demand for energy, water use, and detergent consumption. This has also led to laundry being carried out in smaller loads more frequently. Laitala et al. (2012) stressed the need for consumers to improve their laundering behaviours by using low wash temperatures, using eco-program

settings, filling the machine to capacity, decreasing washing frequencies, and using the correct detergent dosages.

Many individuals wash clothing habitually after every use without ever evaluating its soil (stain) level. Since laundry is done as a habit, many people are unnecessarily washing clothing and using resources. Laitala et al. (2012) found that men and older people tend to wait longer between washing which is helpful in reducing carbon footprint, although that is not their motivation. Laundry is frequently generated out of laziness according to parents involved in a study by Gram-Hanssen (2007). Teenagers would instead put clean clothing back into a laundry bin rather than taking time to fold, sort, and put them away.

Even though many individuals change and wash clothing daily (Gram-Hanssen, 2007), some products are typically washed less than others such as towels and jeans. Most agree that underpants should only be used one day before washing, but woollen sweaters can easily be worn more than ten times before washing. The number of laundry loads can be reduced with better utilisation of the size of the washing machine (Conrady et al., 2013). The most typical reason for not using a dryer is to protect the clothing from damage not to prevent carbon footprint (Braun & Stamminger, 2011).

The electricity and water use from laundering in homes varies by the technology of the machine, the number of washes, the wash temperature, and the size of the load. Many consumers indicate that they would like to reduce their environmental impact but not at the cost of extra effort or money or if it conflicted with other goals and values. Failure to follow instructions on care labels can also have lasting effects on clothing which eventually leads to higher clothing consumption. The impacts of ignored instructions may include colour loss, shrinkage, deformities, and other quality degradations of clothing.

When consumers disregard instructions, potential savings are lost for fibres that do not require frequent washing. Consumers not only ignore instructions written on their clothing, but there are also studies that show consumers ignore instructions on other laundering products. In their research, Laitala et al. (2012) found that only 12% of their participants accurately followed the detergent instructions and used a measuring cup while doing laundry.

Similarly, some consumers from a study in Germany actually use the same amount of detergent for every cycle despite the size of the load or the soil level of the garments (Conrady et al., 2013). Although it is vital not to use too little detergent to ensure proper cleaning, overdosing detergents greatly increases the quantity of chemicals in the wastewater that goes back into our water supply (Fijan et al., 2008). The correct dosage of detergent does influence the cleanliness of clothing (Conrady et al., 2013). A recent study in Norway suggests that detergent labelling can be improved to help consumers in this aspect as previously mentioned.

By giving more accurate information about dosage to use according to the hardness of water, dirtiness of laundry, and size of the washing machine, consumers may be more likely to stop overdosing. Consumers may also be more likely to purchase detergents with eco-labelling (Jarvi & Paloviita, 2007), though environmental claims that are more specific are perceived more positively than general claims (Spack et al., 2012). Many people depend on product packaging for information on how sustainable a product is and how the product should be utilised.

Buyers actually regarded detergent packaging information as the most important source of information for product sustainability. Eco-labeling has been intended to help consumers purchase products that are less harmful to the environment, although, as previously noted the terms are often misunderstood or have no significant meaning (Jarvi & Paloviita, 2007). Use of fabric softener has an impact on the level of laundry behaviour. Fabric softeners are not considered sustainable due to the chemicals added to the wastewater after use. In a study by Laitala, et al. (2012), indicated that individuals reported using fabric softener as a means of scenting their laundry. The study went on to prove that laundry treated with fabric softener became malodorous sooner than non-treated laundry. Hence, using fabric softener not only contributes to water pollution and additional product consumption but also may cause consumers to wash their clothing more frequently than if they had not used the fabric softener at the beginning (Laitala et al., 2012).

Behavioural change in relation to the environment has proven to be difficult unless a clear and direct financial incentive is applied, even if the consumers are aware that consumption affects the energy supply which in turn affects prices of energy (Hustvedt, 2011). Consumers must link their own behaviour to environmental and social impact in order to motivate a behavioural intention change (Bhamra et al., 2011).

### III METHODOLOGY

In this study, both descriptive and exploratory research design was chosen to investigate the effects of clothing care and maintenance practices on carbon footprints among tertiary students in Ghana. This study adopted the quantitative methodology. Quantitative research as inferred by Saunders et al. (2012) provides clear statistical data for inference and supports larger sample sizes which translate to more generalizability over the population being studied. Again Creswell (2014) notes that one benefit of the quantitative approach is that the outcomes are valid, reliable and generalizable to a more significant population. The quantitative approach was selected based on the nature of the study and its methodological foundation. This investigation attempts to explore the everyday life of tertiary students behaviour in terms of their approaches to clothing care and maintenance in their natural setting. The study involved only a limited sample of tertiary institutions in the country as a result of limited tertiary institutions offering higher fashion education. This limitation might affect the generalization of the findings but might nevertheless provide valuable information on carbon footprints

of clothing care and maintenance practices on the various campuses. Convenience sampling was used to select 150 students from various institutions and administered with questionnaires.

### III. RESULTS

#### *Carbon footprints associated with clothing care and maintenance practices among tertiary students*

**Table 2: Carbon footprints of clothing care and maintenance practices**

	Descriptive Statistics				
	N	Min.	Max.	Mean	±SD
Laundry accounts for about one-quarter of the carbon footprint of clothing	160	0	5	3.82	1.218
Not following clothing care instructions in labels carefully and thoroughly	160	0	5	4.23	.984
Ineffective laundry machines	160	0	5	4.06	1.137
Heating up wash water	160	0	5	4.21	1.078
Not using detergents that work in cold water	160	0	5	4.08	.997
Usage of harmful detergents and bleach	160	0	5	4.06	1.100
<b>Total average</b>	<b>160</b>	<b>0</b>	<b>5</b>	<b>4.07</b>	<b>1.08</b>

1=strongly disagree 2=disagree 3=neutral 4= agree 5= strongly agree

Table 2 provided a presentation of the means and standard deviations of respondents' views of carbon footprints of clothing care and maintenance practices. From the table it could be observed that the majority of the respondents agreed that laundry accounts for about one-quarter of the carbon footprint of clothing (M=3.882, SD=1.21), not following clothing care instructions in labels carefully and thoroughly (M=4.23, SD=.984, ineffective laundry machines (M=4.06, SD=1.137), heating up wash water (M=4.21, SD=1.078), not using detergents that work in cold water (M=4.08, SD=.997), and usage of harmful detergents and bleach (M=4.06, SD=1.100) are some of the approaches to clothing care and maintenance that impacts the environment. From the trend of the responses, it can be concluded that the tertiary students are aware of the fact that laundry and the failure to clothing care instructions in labels account for about one-quarter of the carbon footprint.

Table 3 gives a presentation of the best practices in clothing care and maintenance for reducing carbon footprints. Responses were measured on the range "to a very large extent" to "not at all." From the table, chlorine bleach is known to be extremely toxic to the environment hence its use must be reduced to a very large extent according to 40 respondents representing 25%. While 53 respondents representing 33.1% indicated to a large extent, 40 respondents 25% indicated to some extent, 16 respondents representing 10% indicated to a less extent while 11 representing 6.9% indicated not at all (M=3.59, ±SD=1.16). From the results, it can be determined that the tertiary students recognise that chlorine bleach is acknowledged to be very toxic to the environment hence its use must be reduced.

Again, respondents were asked to indicate the extent to which they agree or otherwise with the notion that clothes must be

designed for easy recycling. From the results, it could be observed that 61 constituting 38.1% of the respondents indicated that clothes must be designed for easy recycling to a very large extent. Again, 43 respondents representing 26.9% indicated to a large extent, 35 representing 21.9% indicated to some extent, 15 representing 9.4% indicated to a less extent while six representing 3.8% indicated not at all (3.59, SD=1.16). From the mean and standard deviation statistics, it could be inferred that the surveyed tertiary students recognise that designing clothes that are recycle-friendly can be a sure way to reducing carbon footprints.

More, the respondents were also asked whether environmentally-friendly detergents should be used for doing laundry. Summary of the responses points out that about half (n=84, 52.5%) of the respondents indicated that environmentally-friendly detergents should be used to a very large extent. While 41 representing 25.6% indicated to a large extent, 31 representing 19.4% indicated to some extent while four representing 2.5% indicated to a less extent (M=4.28, SD=.863). From the responses, it can be concluded that to reduce carbon footprints environmentally friendly detergents should be used to a very large extent.

The responses were asked to indicate the extent to which clothes should be worn in order to reduce carbon footprints. From the responses it could be observed that nearly half (n=76, 47.5%) of the respondents asserted clothes should be worn 2 or 3 times before washing to a very large extent, 45 representing 28.1% indicated to a large extent, 24 representing 15% indicated to some extent, 12 representing 7.5% indicated to a less extent, three representing 1.9% indicating not at all (M=4.12, SD=1.04). The outcome of the responses implies that to reduce carbon footprints on the environment clothes to a very large extent have to be washed only after 2 or 3 of wearing them.

Also, respondents were asked to indicate the extent to which clothes must be designed to reduce chemical impacts when washed as a practice of reducing carbon footprints. As can be seen in Table 4.6 the results show that more than half (n=85, 53.1%) of the respondents asserted that to a very large extent, clothes must be designed to reduce chemical impacts when washed. Meanwhile, 43 making up 26.9% of the respondents indicated to a large extent, 22 representing 13.8% indicated to some extent, seven representing 4.4% indicated to a less extent while 3 representing 1.9% indicated not all. Mean statistics (M=4.25, ±SD=0.978) on the item revealed that the students believe that to a very large extent clothes must be designed to reduce chemical impacts when washed. That notwithstanding, it can be concluded from the results that fabric manufacturing companies should do well to reduce the chemical composition of the clothes they produce so as to reduce its impact on the environment when washed.

**Best Practices for reducing carbon footprints associated with clothing care**

**Table 3: Best practices for reducing carbon footprints**

Statement	Responses					Mean	SD
	5	4	3	2	1		
Chlorine bleach is acknowledged to be very toxic to the environment hence its use must be reduced	40 (25)	53 (33.1)	40 (25)	16 (10)	11 (6.9)	3.59	1.16
Clothes must be designed for easy recycling	61 (38.1)	43 (26.9)	35 (21.9)	15 (9.4)	6 (3.8)	3.86	1.14
Environmentally-friendly detergents must be used	84 (52.5)	41 (25.6)	31 (19.4)	4 (2.5)	0	4.28	.863
Clothes should be worn 2 or 3 times before washing	76 (47.5)	45 (28.1)	24 (15)	12 (7.5)	3 (1.9)	4.12	1.04
Clothes must be designed to reduce chemical impacts when washed	85 (53.1)	43 (26.9)	22 (13.8)	7 (4.4)	3 (1.9)	4.25	.978
Clothes must be designed to reduce energy and water use	67 (41.9)	54 (33.8)	32 (20.0)	7 (4.4)	0	4.11	1.00
Clothes to be washed should be sorted out on the basis of the fibre type. (cotton, woollens, silks & synthetics; whites should be washed separately from coloured ones)	76 (47.5)	39 (24.4)	31 (19.4)	14 (8.8)	0	3.98	1.05
Very dirty clothes should be washed separately	66 (41.3)	43 (26.9)	36 (22.5)	12 (7.5)	3 (1.9)	4.13	1.065
Care labels on clothes must be read and followed thoroughly	80 (50)	39 (24.4)	27 (16.6.9)	10 (6.3)	4 (2.5)	3.42	1.40
Sponging can be done sometimes	52 (32.5)	27 (16.9)	38 (23.8)	22 (13.8)	21 (13.1)	4.32	.927
Modest changes across clothing life-cycles could reduce each of the carbon footprints	40 (25)	52 (32.5)	46 (28.8)	14 (8.8)	7 (4.4)	3.65	1.08
Total Average	66 (37.5)	44 (27.5)	33 (20.6)	12 (7.5)	5 (3.1)	4.00	1.06

1= not at all 2= to a small extent 3= to moderate extent 4= to a large extent 5= to a very large extent

However, concerning designing clothes to reduce energy and water use suggested that the majority (n=67, 41.9%) of the respondents believe that clothes must be designed to reduce energy and water use whereas 54 constituting 33.8% of the respondents indicated to a large extent, 32 making up 20% asserted to some extent while seven representing 4.4% indicated to a less extent (M=4.11, ±SD=1.00). From the results, it can be determined that the to reduce carbon footprint on the environment to a very large extent close must be designed to reduce energy and water use.

Again, on the subject of sorting clothes for washing, the results suggest that almost half (n=76, 47.5%) of the respondents asserted that to a very large extent clothes to be washed must be organised out on the basis of the fibre type to a very large extent, 39 representing 24.4% indicated to a large extent, 31 representing 19.4% indicated to some extent while 14 representing 8.8% indicated to a less extent. From the mean statistics (M=3.98, SD=1.05) gives the impression that most of the tertiary students accept that as a practice geared towards reducing carbon footprint clothes has to be organised out on the basis of the fibre type.

Also, another practice that was asked of the respondents was for them to indicate the extent to which washing should be done to reduce the carbon footprint on the environment. Summary of the responses shows that about one-fourth (n=66, 41.3%) of the respondents maintained that to reduce the impact to a very large extent clothes should be washed separately, whereas 43 comprising 26.9% indicated to a large extent, 36 representing 22.5% indicated to some extent, 12 representing 7.5% indicated to a less extent while 3 representing 1.9%

indicated not at all (M=4.13, ±SD=1.065). From the results, it can be inferred that to curtail the impact of the effect of carbon footprints filthy clothes should be washed separately.

Again, the respondents were requested to specify the extent to which care labels on clothes must be read and followed as a way of reducing carbon footprints. From the responses, it could be observed that just about half (n=80, 50%) affirmed that to a very large extent care labels on clothes must be read and followed thoroughly. Meanwhile, 39 comprising 24.4% of the respondents indicated that to a large extent, 27 making up 16.9% to some extent, 10 representing 6.3% indicated to a less extent while four representing 2.5% indicated not at all (M=3.52, ±SD=1.40). From the responses it can be concluded that to reduce carbon footprint on the environment individuals should read and follow thoroughly care labels on clothes.

Finally, when asked about again regarding practices to reduce carbon footprints on the environment about one-third (n=52, 32.5%) of the respondents affirmed that to a larger extent there have to be modest changes across clothing life-cycles could reduce each of the carbon footprints. Additionally, 40 (25%) of the respondents also noted that to a very large extent to that effect. However, it is worth noting that 10 (6.3%) of the respondents stated to a rather small extent modest changes should be made across clothing life-cycles. Mean and standard deviation statistics on the item showed (M=3.65, ±SD=1.08) gives the impression that more must be done to ensure that carbon footprints and its impact on the environment are reduced.

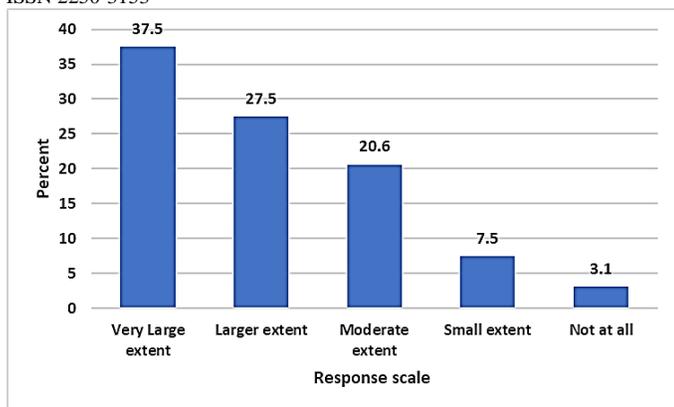


Figure 1: Summary of responses

In summary, 66 respondents representing 37.5% strongly agreed to various carbon footprints control practices, 44 representing 27.5% agreed, 33 representing 20.6% remained neutral, 12 representing 7.5% disagreed while five representing 3.1% strongly disagreed. The mean score was 4.00 indicating that majority of the respondents agreed to these practices as they apply to carbon footprints control. From the summary, it could be observed that to a larger extent more efforts need to be done to reduce the effects of clothing care and maintenance on the environment.

### CONCLUSION

Students are aware of the fact that laundry and the failure to read clothing care instructions labels account for about one-quarter of the carbon footprint. From the results, it can be resolved that tertiary students recognise that chlorine bleach is acknowledged to be very toxic to the environment hence its use must be reduced. Students also recognise that designing clothes that are recycle-friendly can be a sure way of reducing carbon footprints. From the responses, was concluded that to reduce carbon footprints environmentally friendly detergents must be used to more. Further, the outcome of the responses implies that to reduce carbon footprints on the environment clothes must be washed only after being worn for 2 or 3 times. In order to limit the impact of the effect of carbon footprints, very dirty clothes must be washed separately. Also, to reduce carbon footprint on the environment, individuals must read and follow thoroughly care labels on clothes and more has to be done to ensure that carbon footprints and its impact on the environment are reduced.

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# Obstructive Jaundice Due to TB Lymphadenitis: A Rare Case Report

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DOI: 10.29322/IJSRP.8.8.2018.p8094

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8094>

**Abstract-** Abdominal tuberculosis commonly affect intestines, lymph nodes, peritoneum. [1] However abdominal tuberculous lymphadenopathy as a cause of obstructive jaundice is rare.

**Keywords:** Abdominal tuberculosis, obstructive jaundice, cholangiocarcinoma, tuberculous lymphadenitis.

## I. INTRODUCTION

Abdominal tuberculosis may cause obstructive jaundice but it is extremely rare. It may be cause due to enlargement of head of pancreas, stricture of CBD, pericholedochal lymph nodal enlargement or primary biliary tuberculosis. [2] It is often confused with malignancy as both conditions present as mass on contrast enhanced CT scan. However early diagnosis will help in better outcome and hence tuberculosis should be considered as differential diagnosis for obstructive jaundice after malignancy has been excluded.

## II. CASE REPORT

We describe case report of a 23 years old female patient presenting with complaints of jaundice and pain in abdomen which on serial investigations was diagnosed as extrinsic compression on CBD due to pericholedochal tubercular lymph nodes.

## III. CASE DESCRIPTION

A 23 years old female patient presented with pain in abdomen and jaundice since 4 months. On clinical examination abdomen was unremarkable, blood investigations were within normal limits except for deranged LFT which showed total bilirubin 4mg/dl, SGOT/SGPT 72/44 respectively, and alkaline phosphatase 392. Her viral markers HIV, HBsAg, HCV were negative.

Patient was investigated further with USG which showed mild hepatomegaly with central and peripheral IHBR dilatation with? mass lesion in CBD. On further investigation CECT showed dilated CBD of 16.9 mm and moderately large mass like lesion near pancreatic head region with few internal calcifications and involving lower end of CBD measuring 25.7x24.7 mm suggestive of moderately large periampullary mass lesion? etiology ? cholangiocarcinoma. However it showed a lymph nodal mass and tumor markers were within normal limits.

As CECT could not give definitive diagnosis in this case patient underwent EUS (endoscopic ultrasound) which showed heterogeneously enlarged lymph node of 2.1x1.9 cm extrinsic to CBD and involving distal end of CBD. On EUS [Figure 1] guided FNA caseous material was aspirated however final cytological report couldn't give definitive diagnosis. 10 French stent was inserted which relieved obstruction and patient improved symptomatically. [Figure 2]



**Figure 1** EUS picture showing heterogeneously enhancing LN extrinsic to CBD and causing compression.



**Figure 2** AXR with arrow pointing at CBD stent in situ after ERCP

However for the definitive diagnosis patient was planned for diagnostic laparoscopy. On diagnostic laparoscopy hard lymph node of size approximately 2.5x2.2 cm was found near distal end of CBD of which biopsy was taken.

Histopathological report showed presence of calcification and no definitive opinion was possible. Patient was started empirically on Cat 1 AKT. On follow up CT after 2 months

showed decrease in size of mass at distal CBD and patients well-being was also improved.

#### IV. DISCUSSION

Obstructive jaundice due to abdominal tuberculosis is extremely rare. Tuberculous lymph node often cause periadenitis and intense inflammation. In case of pericholedochal lymph nodes due to intense inflammation and matting these lymph nodes often gets impinged on CBD causing external compression. Sometimes due to severe inflammation fistula may develop between lymph nodes and biliary tract.

Often tuberculous lymph nodes are confused with biliary malignancy.[3] In both cases there will be non enhancing mass on contrast enhanced CT scan with smooth narrowing of distal CBD. Often history is of short duration and is non conclusive. Tumor markers may or may not be raised in case of malignancy although they do carry prognostic importance. FDG PET scan cannot differentiate between tuberculosis and malignancy as both show increased uptake. However if accurate diagnosis is not made pre operatively often patients undergo morbid procedure as it is mistakenly diagnosed as neoplastic mass.[4]

Often ERCP guided FNAC/brush cytology helps in diagnosis. In case of ambiguous diagnosis on histopathology, diagnostic laparoscopy and sos empirical AKT trial can be given in case of strong suspicion of tuberculosis especially in areas where tuberculosis is endemic.

The greater benefit of diagnosing abdominal tuberculosis at earlier disease stage lies in fact that more conservative management can be followed in case of early abdominal tuberculosis. If stenting is not possible in case of mass of matted lymph nodes causing obstruction laparoscopic LN removal so as to relieve obstruction and allow stenting can be done followed by anti tubercular drug treatment. Whereas if definitive diagnosis cannot be made pre operatively and in late stages where CBD scarring has been occurred due to long standing lymph nodes treatment usually includes morbid operative procedures like Whipple's surgery/Roux-en-Y choledochojejunostomy. It

#### V. CONCLUSION

Abdominal tuberculosis though rare cause of obstructive jaundice, should be considered as differential diagnosis

especially in country like India where it is endemic. Careful history taking and appropriate investigations helps in differentiating it from hepatobiliary malignancy. Early diagnosis of abdominal tuberculosis helps in conservative management and better outcome. [5]

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# Statistical Analysis of Risk Factors Associated with Cholelithiasis: A Case Control Study in Multan

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DOI: 10.29322/IJSRP.8.8.2018.p8095

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8095>

**Abstract-** Gallstones are crystal like collections that formed by merging of normal and abnormal gallbladder content. Usually there are two types of gallstones exist *i.e.* cholesterol stones & pigment stones. The current paper focuses on symptoms of the disease, major cause for the disease and on the treatments that majority of patients preferred. For this purpose, sample of size 170 data from different hospitals in Multan is collected by using convenience sampling. Main demographic factors involved in this study are Gender, Age group, marital status for patients of GSD. Frequency distribution has been formed for these different demographic and social factors and a bar chart is constructed for differentiating between gender as gender is also an important factor in GSD. For weight factor, paired t test is applied to see the difference between before and after weight after having treatment. Findings show that 67 percent people prefer govt. hospitals because of the people suffering from this disease were from backward areas or villages & their income not meet to pay the private hospitals expense.

**Index Terms-** Biostatistics, Gallstone, Treatment, Hospital, Descriptive Analysis.

## I. INTRODUCTION

This article summarize the factors that effected on Gallstone. People defined GSD in their own way as according to **Adler et al. (2004)** Gallstones are not really stones. They are pieces of solid material form in gallbladder, a small organ located under the liver. Gallstone may develop when there is too much cholesterol. However, if your liver makes more cholesterol than your bile can dissolve, hard stones may develop. In the majority of patients cholesterol stones are present. In many people the cause for gallstone appears to be interaction between hereditary cause and the diet. Many People Previously worked on gallstone as **Chen et al. (2006)** Studied the risk factors and prevalence of gallstone disease and their aim was to determine the prevalence and risk factors of gallstone disease (GSD) by taking adult Chinese population from Taiwan. **Loria et al. (2005)** reported insulin resistance is a risk factor of the gallstone disease in non-fatty liver (NAFLD). They diagnosed by ultrasonography complete with (NAFLD) in 61 patients out of 161 patients. **Festi et al. (2008)** studied the gallstone incidence and risk factors in a large population through questionnaire and physical examination. They found that 9618 out of 18179 (86.5%) subjects were gallstone free at the cross sectional study and age in men and BMI in females were predictors of pain. By using logistic regression analysis, odd ratio, hazard regression, multivariate analysis increasing age and BMI represent true risk factors for gallstones disease; pain in a right hypochondrium and epigastria is confirmed as the only symptoms related to gallstones. **Leitzmann et al. (1998)** discussed about physical activity that it cause decreases risk for symptomatic gallstone disease in men or not by taking data of 45813 men aged 40 to 75 years old were followed from 1886 to 1894. They used multivariate logistic model and found that 34% of cases of symptomatic gallstones disease in men could be prevented by increasing exercise to 30 minutes of endurance type training pre times per week. **Tsai et al. (2005)** studied consumption of trans fatty acids in relation to the risk of gallstone disease in a cohort of 45918 men transfatty acid consumption was assessed using a validated semi quantitative food frequency questionnaire. Newly diagnosed gallstones disease by radiology or cholecystectomy was ascertained biennially. During 14 years of follow up were documented 2356 new cases of symptomatic GS. They used multivariate analysis and the result suggested the higher intake of trans fatty acid modestly increase risk of GS disease. This adds to the concern that partial hydrogenation of vegetables oils to form shortening and margarine can lead to adverse health effects.

## II. Research Elaborations

For the analysis, data was taken from different private and govt. hospital from Multan by using convenience sampling. There were 170 observations of Patients in sample study. For the analysis, descriptive statistics is constructed on different questions from questionnaire and frequency distribution is formed for different variables. For percentage, a column of percentage is constructed for different characteristics in the sample. Paired t test is performed to see the difference between weight increments. For the analysis purpose *SPSS* software is used.

## III. Results or Findings

### A. Frequency Distribution

The total number of sample was 170 in which the male and female percentage can be shown from the following table also different age groups for the patients in sample can be categorized as below:

**Table 3.1** Socio-Demographic Characteristics of the Sample

Gender	Frequency	Percentage
Male	48	28.2%
Female	122	71.8%
<b>Age Group</b>		
18-27	27	15.8%
28-43	64	37.6%
44-60	65	38.2%
61 or above	11	8.2%
<b>Marital Status</b>		
Single	29	17%
Married	124	72.9%
Widowed	15	8.8%
Divorced	2	1.17%
<b>Occupational Status</b>		
Private Hospital	61	35.8%
Government Sector	109	64.1%

The sample description shows that there are 48 males and 122 females in the survey while if we talk about the age description then 27 persons were lying in the range of 18-27, 64 persons were lying in the range of 28-43, 65 persons were lying in the range of 44-60, and 14 persons were lying in the range of 61 or above. The selected sample was also distributed according to the marital status. There were 29 single persons, 124 were married, 15 were widowed and 2 was divorced person. The sample was also considered according to the profession. 61 persons were from private hospital, 109 persons were from govt. hospital. We also analysed about the last symptoms of the disease that the patients feel last time before diagnosis so there was following symptoms they feel last time before diagnose the disease:

**Table 3.2** Frequency Distribution Last symptoms of disease

Last Symptoms of Disease	Frequency	Percent
Pain	41	24.1%
Nausea	7	4.1%
Vomiting	35	20.6%
Pain & nausea	13	7.6%
Pain, nausea & Vomit	11	6.47%
Others	63	37.1%

Last Symptoms of Disease	Frequency	Percent
Pain	41	24.1%
Nausea	7	4.1%
Vomiting	35	20.6%
Pain & nausea	13	7.6%
Pain, nausea & Vomit	11	6.47%
Others	63	37.1%
<b>Total</b>	<b>170</b>	<b>100%</b>

The above table shows the frequency and percentage of last symptoms of GSD. It is clear that the percentage of others symptoms is higher than the other factors which show that more person felt different other symptoms of GSD. Similarly nausea has less frequency as compare to other symptoms it means that only 7 people felt it as a last symptoms of GSD. There are certain treatments that people preferred for this disease. The following table represent the frequency distribution about the types of treatments that people took after diagnosis the disease.

**Table 3.3** Frequency Distribution of Types of treatment

Type of Treatment	Frequency	Percent
X-ray	51	30%
Scan	2	1.2%
Endoscopy	8	4.7%
Ultrasound	76	44.7%
X-ray, scan and ultrasound	33	19.42%
<b>Total</b>	<b>170</b>	<b>100%</b>

The above table shows the frequency and percentage of type of treatment of GSD. It is clear that the percentage of ultrasound is higher than the other factor which shows that more persons follow the treatment of ultrasound. Similarly scanning has less frequency as compare to other type of treatments it means that only 2 people took it as a treatment of GSD. From literature, it is clear that there are certain causes by which people effects from this disease so the following table show the analysis of different reasons people think are the reason of effecting for this disease:

**Table 3.4** Frequency Distribution of causes of GSD

Causes of GSD	Frequency	Percent
your genes	3	1.8%
Weight	17	10%
Diet	97	57.1%
Others	51	30%
Weight & Diet	2	1.2%
<b>Total</b>	<b>170</b>	<b>100%</b>

The above table shows the frequency and percentage of causes of GSD. It is clear that the percentage of other causes is higher than the other factors which shows that more person felt different other causes of GSD. Similarly weight & diet less frequency as compare to other causes it mean that only 2 people felt it as a causes of GSD. There was a question about the general symptoms of GSD. All the responses are calculated and given in the table below;

**Table 3.5** Frequency Distribution of General symptoms of GSD

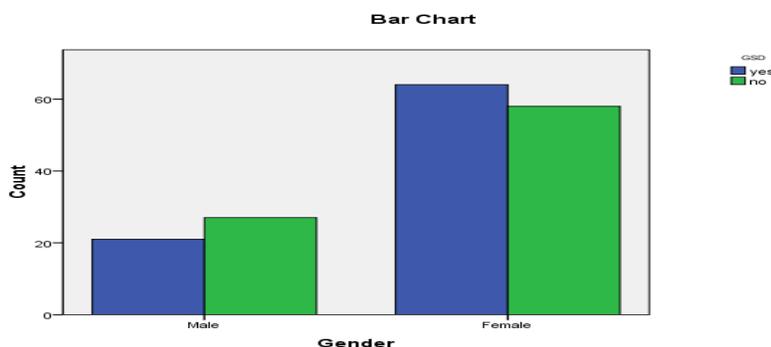
General Symptoms	Frequency	Percent
------------------	-----------	---------

Constipation	22	12.9%
Swelling	20	11.8%
Indigestion	14	8.2%
Pain in abdomen	46	27.1%
Any two or three from above	40	24%
Others	28	16.5%
<b>Total</b>	<b>170</b>	<b>100.0</b>

The above table shows the frequency and percentage of general symptoms of GSD. It is clear that the percentage of pain in abdomen is higher than the other factor which shows that more people felt pain in abdomen. Similarly indigestion has less frequency as compare to other symptoms it means that only 14 people felt it as a general symptoms of GSD.

*B. Bar Char*

Gender is considered as an important factor in GSD as female effected more as compare to male in general from this disease so the following graphical representation can help us to see the situation in our sample. The following figure of diseased & Non Diseased in Gender are given below.



**Figure 3.1** Frequency Distribution of Disease or no Disease in Gender

The above bar chart shows the gender and the GSD, from chart it is clear that female have more chances of gallstone disease as compare to men and also from our collected data, more female were observed to having this disease.

*C. Paired t-Test*

As on gallstone, cholesterol level is a very important factor in having this disease. We can see that almost patients have more weight before the treatment than having after the treatment. So we checked this assumption by using paired t test as follows.

$H_0$ : Patients have more weight after the treatment i.e.  $\mu_D \geq 0$

$H_1$ : Patients have less weight after the treatment i.e.  $\mu_D < 0$

**Table 3.6** paired samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Weight before treatment	66.95	170	10.151	.779
weight after treatment	65.34	170	9.617	.738

**Table 3.7 Paired Samples Correlations**

	N	Correlation	Sig.
Pair 1 Weight before treatment & weight after treatment	170	.884	.000

From the above table, it can be seen that before treatment sample mean is greater than after treatment sample mean and the result can be justified by testing of hypothesis as  $P < 0.05$ , so the results are significant i.e. patients have less weight after the treatment as compare to before treatment.

#### IV. CONCLUSION

From the above results, the frequency for different causes and symptoms of the GSD can be seen and overall the majority reasons for GSD, main symptoms of GSD and the treatments that majority of patients preferred can be seen from the descriptive analysis. From Paired t test it is clear that people have less weight after the treatment as compare to before treatment while mostly people like to go in govt. hospitals for the purpose of treatment because majority of them was from backward areas.

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# The impact of the use of the electronic accounting system on the efficiency and effectiveness of the work of internal auditors

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DOI: 10.29322/IJSRP.8.8.2018.p8096

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8096>

**Abstract:** Modern economic conditions of the post are audited by high auditors in terms of expected quality audit work. On a reliable basis financial statements are based on the whole system of financial markets what means that an independent and competent opinion on financial reports has a lot of information value. On the other side, opinion in which should be expressed is for all auditors it's not as companies are globalizing; they expand their scope and types of activities, process. It should be borne in mind that the auditors are continuously imposed price and time pressures with limited resources as effective implemented the verification procedure and expressed its opinion. Downloads her responsibility for the expressed opinion ungrateful since it is difficult for a dawn to obtain a reasonable assurance that the finds are sufficient and for expressing opinions. At a time when thousands of accounts are ongoing it is not easy to be sure in own conclusions. Besides, the auditor works with a different informative environment. It is a fact that information technology is changing very rapidly what clients follow more or less success. Same software platform can different in different companies that provide different accounting quality processing depending on the performance of the process and customization software, personal training resistance to change, etc. Independent and efficient internal audit is based on a harmonized unified legal regulation, adoption of policy documents, and the adoption of appropriate audit standards. It is a need for establishment of a central unit for harmonization and control introducing a robust and quality management system control based on common standards and practices.

**Key words:** audit, modern, system, companies, performance

## Information Technology in Audit practice

Information Technology (IT - Information Technology) can affect the internal audit through the study and evaluation of internal audits accounting controls and opportunities to use computer-assisted auditing technique (CAAT- Computer Audit Assist Technique). The internal auditor must observe in parallel IT components and manual system components. Integrated IT and manual control allows the auditor to evaluate he system as unity and create tests IT and manual controls to achieve the audit goals. Each

company or bank, or some other financial institution must consider its IT capability vision when it awards IT audits. Tasks have to be based in IT training internal auditors and complexity of IT systems, including hardware, system software and application software. The hardware complexity can be assessed primarily by type of processor, memory capacity and number of terms. System software, like what is its database management system or telecommunication software can additionally contribute to the complexity of the system. Complex application is evaluated by functions performed by software and number is sophistication of the subsystem interface. On-line programs in telecommunication environment further contribute to the complexity of processing. Many courses are offered as an aid to auditors to acquire in training and basic knowledge of computer systems and programs. Internal Audit Association of Financial Managers, Institute of Internal Affairs Auditor, Association of Auditors Information Systems and Controls (ISACA @ Association Auditors IS and Control @ Association of information system auditors and control only), local faculties and private companies have such courses. Some companies offer computer software for audit and necessary training for internal auditors. Banks and other financial institutions predominantly use outside service centers. In-house IT issues are equally applicable to spoofing service centers for data processing. IT performed by financial institutions includes several special processing types. The system of an institution is usually consists of several working stations on numerous locations that communicate online with central computer. An institution or an external service center can run a central computer. The telecommunications network may consist of point of sale, terminal and ATMs. Online processing is usually done during some work a twenty-four-hour operating cycle. In addition to the posting memo in the account balance data, and the departments use on-line system to enter deposits and changes in interest rates for loans, name the client and the change of address, the new structure accounts. Diary transactions they show processed and rejected items, they are later used in balancing to provide completion of processing. Reports used by other departments within bank are also produced during night treatment, they contain delayed credit and reports, various reports general ledgers, credit and deposit probation balances, client statements, etc. Banks and other financial institutions depend on their functioning information systems. Errors in processing financial transaction can result in large losses per institution, with actions and dissatisfaction client. Operating problems that result in operating system can affect the timely processing of transactions. Blessed one processing is critical not only to meet the legal requirements that apply availability of funds and time constraints for return items, but such and for expectations clients in connection with telegram transfer and services cash management. Although the organization and administration of IT departments is in giving an internal assessment audit controller, environment inside IT department works can finally to determine the success or error of the control environment. In larger companies, or banks, this can be done IT to consolidate IT center and reducing the number of employees. In the smaller ones, construction of hardware and software can be postponed, and employees might be waiting for many to do different functions that are

not consistent with responses racial segregation debts. Outsourcing IT features is became popular in recent years, even among major institutions.

The IT department may not spend adequate time on the move and system testing, which can result in errors in processing, excessive system shutdown or user inefficiency. Therefore the auditor must evaluate the authorization of IT management in total IT strategic planning. In addition, they should review the composition of the IT Board to make sure they are senior management. Planned IT audit time is critical to guarantee that the internal auditor is diligent the environment in which the review should be carried out. Surroundings consists of many questions for consideration including the following: configuration of hardware ratios; software operating system; complexity of processing; adequate systemic documentation; organizational structure, etc. Internal auditors should also be examined any previous working paper that relates to the liquid and the system and consider each one earlier conclusion.

### **Information's as a need for audit efficiency**

Different information's at all levels of the organization are required: financial information, business information, compliance information, and information about external events, activities and conditions. The information must be identified, received and transmitted in the form and timeframe that will allow users to perform their duties and obligations. The most important system for internal control is the accounting system, which is considered as a series of tasks and posting of an enterprise through which transactions are processed in order to maintain financial records. The entire process must be monitored and, if necessary, must be modified. This is achieved by the permanent monitoring and monitoring activities, by special assessments or by combining these two procedures. From an analytical point of view, internal control can be divided into two broad categories of supervisory activities: administrative control and accounting control. Both controls are control functions, and in most cases they intertwine so that no precise limit can be drawn between them. The auditor is much more engaged in internal accounting than administrative control. Activities that are not directly financial in nature include administrative internal control, with the task of ensuring efficiency in the business and that this business is carried out in all sectors and departments of the company in accordance with the proclaimed business policy. Effective administrative internal controls have an impact on business performance. Accounting control includes the activity and includes the organization, methodology and records in order to ensure the protection of assets and the credibility of the financial statements, and it is designed to provide reliable evidence that transactions were carried out according to the management's powers, that transactions were recorded in such a way that , in the first instance, the preparation of financial statements was enabled, and afterwards provision was made for the appropriate disclosure of the value of the assets, that the access and disposal of funds was permitted only under the

management's authority, that the carrying amount of the assets was compared with the current state at appropriate intervals. The definition of financial control, in principle, excludes the issue of performance, value of money and compliance with legal regulations. Whether and how a company uses a bank safe to deposit short-term securities, or uses a bank safe to deposit cash, companies are examples of accounting controls. Examples of administrative controls are checks of the biography of a potential future employee and a check of employees' salaries.

Experienced and less experienced auditors react differently when gathering evidence of a particular control sector. Namely, younger auditors are not always sure which method is right for obtaining the necessary information for questionnaire textual description and schematic representation. On the other hand, more experienced auditors are more likely to personally conduct an on-the-spot inquiry by providing an objective and final response to the questionnaire. Reliance solely on staff testing in any case would be contrary to the basic principles of the audit. The size of the company is influenced by the organization and effectiveness of supervision. It is more complicated to improve internal control in a small enterprise than in a large one, for the simple reason that, for example, in a small enterprise, seven employees cannot be edited with a satisfactory delimitation of authority. In addition, it has to do with costs. The conclusion that can be drawn from the above is that the structure of internal control must be adapted to the individual needs of each company individually.

Internal control, or even more precisely internal audit, has the primary goal of preventively acting on combating fraud, which is defined as deliberately misinterpretation of facts with the aim of misleading and misleading a third person. In the case where accounting supervision reveals irregularities, it treats them as deliberate mistakes entered in accounting records, books of account, and financial statements for fraudulent purposes. Irregularities can be defined in two groups: employee scams and frauds made by the management. Reducing the risk of fraud, forgery and other dishonest actions of employees would result in the distribution of the power over the transactions to a good extent. The term "attachment of loyalty" means the insurance of this unusual risk, that is, the type of contract by which the insurance company is obliged to pay the employer of the damage caused by deceit from employees attached to the faithfulness. In demonstrating the profitability of the company, all costs should be taken into account, namely, the management and the management board are responsible for controlling the total costs, and only with the constant control it is possible to adequately manage the costs. In order to improve profitability, the company's management can decide, by its decision, on the modality of reducing resources to produce a product or to make it more productive or obtainable at lower costs. There is an alternative that management raises the prices of those products that use large resource inputs and in this way stimulate production with cheaper inputs.

## Conclusion

The internal audit technology has reached the point of time in which each one is aspect internal audit process supported by some software product. Analysis data, risk management, malware research, document management and the analysis of internal control are, for example, processes they are being performed today with the help application of the information system. Software applications in a high degree improve the efficiency and effectiveness of internal audits and extend the scope of internal audit work. The most represented in the audit engagement tasks are software applications intended for extraction and analysis of business data transactions. From the more familiar specialized applications of this kind although using the spreadsheet application and database access type Microsoft Access and significantly lower the cost of software acquisition and training for its staff. Methods of data analysis and corresponding software enable they learn internal auditors quickly understand the structure of data and access to specific ones areas of interest for the analysis of abuse. Practice and the transaction analysis is the most powerful and effective methods of discovering finance abuse. It consists of a series of tests that are so designed and reveal different indicators, for example: which allow data and transactions to be compared and from different parts information system, take into account standard abuse schemes as well specific, bound for certain functions of, all transactions within the given area and test them in relation to parameters that serve as indicators of financial abuse, all analyzes are performed in real time transaction, ideally before finalizing the transaction, they continuously monitor operational data and they can early detect abuse and a reduction in financial losses. Introduction of such methodology of detection and prevention financial misuse requires significant time and money resources as well high technical expertise of the internal auditors. It can also be concluded that by applying certain software tools significantly increases the efficiency of the work of the internal auditors, significantly with increase efficiency and effectiveness of the internal audit. Vary soon paperless audits will become common as audit clients increasingly shift to paperless systems. New audit software is developed that allows auditors to complete most procedures on-line. Future auditors will have to incorporate on-line audit software as their primary audit tool and gather evidence electronically.

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# Causality of Macroeconomic Variables with Third-Party Funds of Shariah Banking in Indonesia on Period 2009-2016

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DOI: 10.29322/IJSRP.8.8.2018.p8097

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8097>

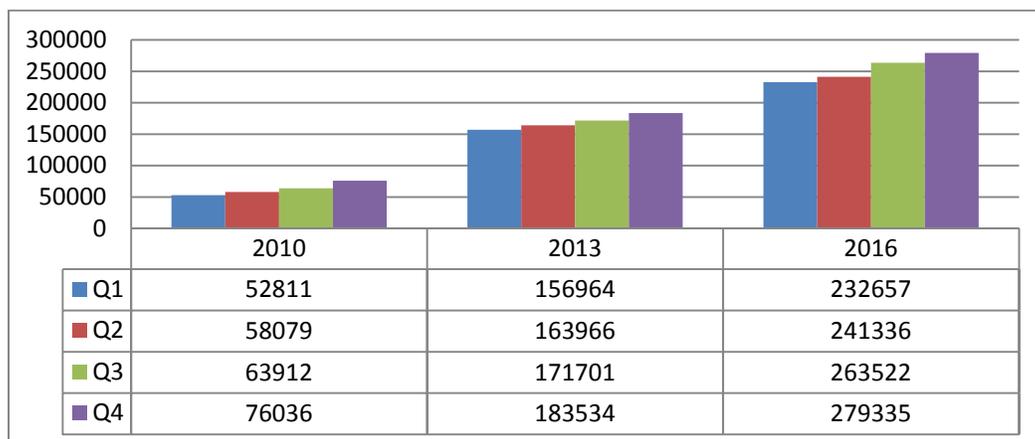
**Abstract-** The purpose this studies to determine the causality of macroeconomic variables, including gross domestic product, inflation and exchange rates with third-party funds of Shariah banking in Indonesia. The data used is secondary data obtained from Bank Indonesia (BI) and Central Agency Statistics (BPS) in the period of quarter I 2009 to quarter IV 2016. Model used in this study is Granger Causality. Research result using granger causality test shows that, the variable of third-party funds have a causal relationship with the variables of gross domestic product and exchange rates, while the variables of third-party funds with inflation have one-way relationship. That is variable of inflation impact to variable third-party funds of Shariah banking in Indonesia.

**Index Terms-** Third-party Funds, Macroeconomic Variables, Granger Causality

## I. INTRODUCTION

Islamic banks are bank that operate according to the principles and provisions of Islamic law (Mawaddah, 2015). Islamic banking provides a variety of products to develop and perform the functions as a banking institution. Karim (2011) classifies shariah banking products into three categories, namely fund distribution products (priciples of murabaha (trade) and ijara (rent) principles, fund raising (principles of wa' diah (deposit) and mudhrabah (profit sharing) priciples and banking services (trade and investment).

Santoso and Rahmawati (2016) said that one of the most important products in maintaining the continuity of shariah banking, namely the collection of funds called third-party funds. There are several forms of fund raising offered by sharia banking, including demand deposits, saving accounts and deposits based on wadiah and mudharabah.



**Source: Report of Bank Indonesia**

**Figure 1.1 Growth of Third-Party Funds in Sharia Banking on Period Q1 2009 to Q4 2016**

Based on figure 1.1 can be seen in 2013 the growth of third-party funds has increased each quarter. In quarter IV of 2016 third-party funds increased to 279.335 Billion Rupiah. In 2010 also increased in the first quarter to reach the highest value in quartal 4 to 76.036 billion rupiah.

The growth of third-party funds sharia banking is influenced by internal and external factors, internal factors such as the level of profit sharing and the number of banks. While external factors include national income and inflation (Wulandari, 2015). The growth of third-party funds also has an impact on economic activities and macroeconomic variables through financing.

Third-party funds can be affected by macroeconomic factors, this is revealed through research conducted by Adim (2017) found that gross domestic product positively affects the growth of third-party funds. Other Macroeconomic variables, in addition to gross domestic product such as inflation and exchange rate. Research conducted by Sutono and Kefi (2014) found that inflation has a negative effect on third-party funds, while the exchange rate has a positive effect on third-party funds.

Based on description of the relationship between research variables and previous research, the researchers will examine the causality of variables of gross domestic product, inflation and exchange rate with third-party funds of sharia banking in Indonesia. The update conducted by the researchers is in terms of analysis that not only see the influence of one-way but also see the causality between research variables. The variables used in the research there are updates using the three macroeconomic variables, namely gross domestic product, inflation and exchange rate.

**II. RESEARCHS ELABORATIONS**

**2.1 The concept of Third-Party Funds in Sharia Banking**

One of the goals of establishing a banking institution is to raise funds from the public or costumers. According to Febianda (2017) Third-party funds is a public savings fund consisting of savings, demand deposits and time deposits. Piliyanti dan Wahyuni (2014) Third-party funds raising is one of the functions of banks to raise funds from those who are over money and distribute to the parties who need funds. Veratama (2013) Third-party funds are funds collected from the public based on the wadi'ah and mudharabah agreement.

The following formulation of the structure and choice of fundraising products in sharia banking according to Suhartatik (2014).

$$\text{Third-party funds} = \text{Savings} + \text{current account} + \text{deposit} \dots \dots \dots (1)$$

**2.2 Gross Domestic Product**

Gross domestic product is good and services produced within a certain period. According to Rahardja and Manurung (2004) GDP value of a certain period resulted from the multiplication of the price of goods the quantity of goods produced. Increasing GDP will increase the profitability of banks because there will be the ability of the public to save or invest money in the bank.

McEachern (2000) measures gross domestic product through two approaches, namely the expenditure approach and income approach, with the following formula:

$$GDP = C + I + G + (X-M) = \text{Aggregate Expenditure} + \text{Aggregate income} \dots \dots \dots (2)$$

## 2.2 Inflation

Inflation is defined as the continuing rise in prices in the economy caused by changes in aggregate demand and aggregate supply (McEachern, 2000). According to Sutono and Kefi (2014) inflation can also be interpreted the process of continuous decline in currency values. Which is also caused by the high level of speculation and the distribution of goods that are not smooth.

Sukirno (2011) classifies inflation based on causes of the price increases, namely demand pull inflation, inflation pressure and imported inflation. Inflation can be calculated using two components, namely consumer price index (based on production cost) (Rahman, 2015). Here's an example of inflation calculation based on consumer price index:

$$\text{Inflation} = \frac{CPI - CPI_{n-1}}{CPI_{n-1}} \times 100\% \dots \dots \dots (3)$$

## 2.3 Exchange Rates

The exchange rate is defined as the amount of a particular currency if it wants to be exchanged or get one unit of another currency (Roswita, 2003). Mankiw (2007) exchange rate is the value of currency exchange agreed upon by both residents of the state in exchange or trade. Determination the exchange rate can be done by transfer to market mechanism or also use fixed exchange rate or non-market mechanism (Rahardja & Manurung, 2004).

According to Putranti (2015) a declining currency will reduced the purchasing power of the income or profit earned by the community, on the contrary the value of the increased currency will increase the purchasing power of income and profits. Foreign Exchange rates determine the level of domestic economic stability that also affects the banking in Indonesia (Veratama, 2013). According to Roswita (2003) there are several factors causing the exchange rate changes, including as follows:

- a. Change in taste
- b. Price change of export goods
- c. Increase inflation in the country
- d. Interest rate changes
- e. The rate of economic growth
- f. People's speculation on exchange rate fluctuation.

## 2.4 Theory of economic growth in Islam

Zuhdii (2003) argued that the main difference between the concept and theory of Islamic economic growth with conventional lies in the principle based on Al-Quran and Hadith, as for the principle in question, is Tauhid, Rububiyah, Khalifah and Tazkiyah.

According Naqvi (1991) economic growth in Islam includes a balance between the material and moral-spiritual aspects of humans with the following summary:

- a. Economic growth in Islam ensures a fair distribution of income or prosperity and maintains a safe growth rate.
- b. Economic growth must maintain intergenerational equity, where capital formation must coincide with the formation of human resources as a long-term investment.

## **2.5 Islamic Inflation Theory**

According to some Islamic economists submitted in Karim (2011), inflation leads to bad things for the economy, including the following:

- a. Inflation can interfere with the function of money, especially on the saving function or the reduced value of the store, then the decline in the function of cash payment and the function of the calculation
- b. Inflation lowers people's enthusiasm and motivation to save or decrease Marginal Propensity to Save.
- c. Inflation raises the tendency to shop for non-primary goods or luxury goods (rising Marginal Propensity to Consume)
- d. Inflation pushes investment toward non-productive wealth-building by buying land, buildings, precious metals and foreign currencies.

## **2.6 Theory of Exchange Rates in Islam**

Karim (2011) argues that the causes of exchange rate fluctuations as well as inflation, namely natural factors and human error. In addition there is a scenario of exchange rate discussion in Islam. Firstly, that the occurrence of domestic price changes affects the exchange rate and Secondly, the fluctuation of the exchange rate is due to the changes of the price abroad.

According to the fatwa of the National Sharia Board (DSN) NO.28 / DSN-MUI / III / 2002 on sale and purchase transactions of currency. Sale and purchase transactions in principle may be subject to the following conditions:

1. Not for speculation (chance)
2. There is a need for transactions or to be on guard (savings)
3. If the transaction is made to a similar currency then the value must be the same and in cash (at-taqabudh).
4. If the type is different then it must be done with the exchange rate (exchange rate) applicable at the time the transaction is made and in cash.

## **III. FINDINGS**

### **3.1 Types and Data Sources**

The type of data used in this study is secondary data. Third Party Funds Data are obtained from annual and monthly reports of sharia banking published by Bank Indonesia's official website ([www.bi.go.id](http://www.bi.go.id)) and the Financial Services Authority ([www.ojk.go.id](http://www.ojk.go.id)). While macroeconomic variable data obtained from the official website of the Central Bureau of Statistics ([www.bps.go.id](http://www.bps.go.id)).

### 3.2 Data Analysis Model

Granger causality is a concept that looks at the relationship of the two variables analyzed. Granger Causality uses the test method of two time series data sets that are linearly related to X and Y variables formulated in the form of two regression models (Gujarati, 2012). Form the regression model as follows:

$$X_t = \sum_{i=1}^m a_i X_{t-i} + \sum_{j=1}^n b_j Y_{t-j} + \mu_t \dots \dots \dots (4)$$

$$Y_t = \sum_{i=1}^r c_i X_{t-i} + \sum_{j=1}^s d_j Y_{t-j} + v_t \dots \dots \dots (5)$$

The hypothesis contained in this test is as follows:

Ho: There is no causal relationship between variables

Probability < 0.05: Ho is rejected

Probability > 0.05: Ho is accepted

### 3.3 Determination of Lag Length

The result of lag length determination can be seen from the value marked with symbol (\*). Lag with the sign (\*) is the optimum lag that will be used in the next stage of research is the test of causality. The use of lag 0 to 5 is adjusted with the number of variables studied, because this study has four variables, then the lag tested is 0 to 5, then selected lag 5 in accordance with the star attached to the number of each indicator.

**Table 1.1 Determination of Lag Length of Research Variables**

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-933.0826	NA	1.64e+25	69.41352	69.60550	69.47061
1	-836.8248	156.8644	4.38e+22	63.46851	64.42839	63.75393
2	-820.2994	22.03399	4.60e+22	63.42958	65.15736	63.94334
3	-797.0948	24.06394	3.44e+22	62.89591	65.39160	63.63801
4	-757.6263	29.23593	1.04e+22	61.15751	64.42110	62.12794
5	-682.2918	33.48203*	4.28e+20*	56.76235*	60.79385*	57.96113*

\* indicates lag order selected by the criterion

LR: sequential modified LR test statistic

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Based on Table 4.5 it can be concluded that the lag to be used for the test of causality of the research variable data is lag 5, it can be seen from the star signs contained in five criteria that is, LR, FPE, AIC, SC and HQ.

### 3.4 Granger Causality Test

The probability value is the most important thing to look at, so it can be determined whether  $H_0$  is rejected or accepted. If the probability value is lower than the value of  $\alpha$  in this test is set at 5% (0.05), then  $H_0$  is rejected which means that there is a causal relationship between variables. Conversely, if the probability value is greater than 0.05 then  $H_0$  is accepted.

**Table 1.2 Granger Causality Test Results**

Null Hypothesis:	Obs	F-Statistic	Prob.
ER does not Granger Cause DPK	27	8.42351	0.0005
DPK does not Granger Cause ER		5.23558	0.0049
INF does not Granger Cause DPK	27	2.97809	0.0436
DPK does not Granger Cause INF		0.44315	0.8120
PDB does not Granger Cause DPK	27	3.65608	0.0214
DPK does not Granger Cause PDB		2.93140	0.0458

Based on the Granger causality test shown in Table 4.6, there is causality between Third Party Funds of Syariah Banking and Gross Domestic Product of Indonesia. The Probability of Gross Domestic Product against Third Party Funds and vice versa, is below 0.05 of 0.0214 and 0.0458, respectively. That is, it can be stated that  $H_0$  is rejected, so both variables have a two-way relationship or causality

Similar results were also obtained on the causality test between the Rupiah Exchange Rate and Third Party Funds. The probability values generated respectively 0.0005 and 0.0049 or below 0.05 which can be deduced that  $H_0$  is rejected. Means that both variables have interrelated relationships or causality.

Two-way relationship is not found between the variables of Third Party Funds and Inflation seen from the probability value of Third Party Funds of 0.8120 greater than 0.05 so  $H_0$  is accepted, meaning Third Party Fund has no effect on Inflation. In contrast, the probability value of Inflation to Third Party Funds is 0, 0436 (<0.05), meaning  $H_0$  is rejected thus Inflation has influence on Third Party Funds.

#### IV. CONCLUSION

Based on the study that has been done can be drawn some conclusions, including as follows:

- a. This study found the causality of Third Syariah Banking Funds with Gross Domestic Product and Third Party Funds of Syariah Banking with Rupiah Exchange Rate to US Dollar. This means that the development of Third Party Funds of Sharia Banking is interacting with the development of Gross Domestic Product and Rupiah Exchange Rate.
- b. Third Party Funds Sharia Banking with Inflation there is one-way relationship, namely inflation affecting Third Party Funds of Sharia Banking. In contrast, the development of Third Party Funds of Sharia Banking does not affect the fluctuation of Inflation in Indonesia.

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# Correlation-based Recognition System for Myanmar Currency Denomination

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DOI: 10.29322/IJSRP.8.8.2018.p8098

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8098>

**Abstract-** One of the interesting and important fields of research in pattern recognition is paper currency recognition. Every person of various countries uses currencies in their daily activities. The concentrate of this paper is on automatic and reliable currency recognition. The recognition operations for Myanmar currency denominations comprise six stages: image capturing, preprocessing, target region extraction, number segmentation, currency value recognition, and output with screen displaying and voice. This paper also presents the simulation of currency counting machine to replace the manual counting process. Myanmar currency recognition system is implemented by computing the correlation coefficient to compare the similarity for each currency value template via image processing steps in Matlab environment. To demonstrate the effectiveness of the proposed system the numbers of currency images are experimented with two kinds (fresh, and medium) of each seven types of denominations. Our system achieves quite low classification error. And counting machine simulator not only accurately counts the number of each currency denomination but also displays the total amount of sum of currency contained in the money containers.

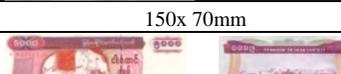
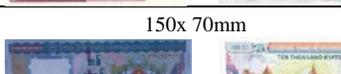
**Index Terms-** Counting machine simulation, Currency recognition, Image processing, Template matching.

## I. INTRODUCTION

Currency recognition generally defines as the classification of currency notes by denomination which means the value of currency note of various countries. Classification and counting of all currency notes by hand would be tedious, lengthy time and error prone. Therefore automatic and reliable currency recognition and counting are good options for transactions dealing with different types of task such as goods selling, public transport, gas- stations, banks etc. Until current time, there are many works developed for single-currency recognition (currency of a specific country) for example Indian currency [5-8], Chinese currency [3, 12, 13] and Bangladeshi currency [4, 11]. A number of works have also been devised on multi-currency recognition (currency of more than one country) such as [9, 10, 15]. Although the plenty of research works on currency recognition for different countries there is a little work done on paper currency recognition for Myanmar [14, 16]. For this reason the

interest of this work is to design and develop a framework that can recognize seven types of Myanmar currency denominations that are currently circulation in daily life (50, 100, 200, 500, 1000, 5000, and 10000 Kyats). Table I shows seven types of Myanmar currency notes used in this work. In addition to this, the proposed solution will simulate as a money counting engine to feel free from the manual counting problems of boring, error facing, and time consuming. The organization of remaining sections is as follows: Section II is devoted to creation of template database used for correlation. The proposed approach for Myanmar currency recognition is discussed in section III. Experimental results are demonstrated in section IV. In Section V conclusion of the work is given.

Table I: Myanmar currencies

No.	Denominations	Size	
		Obverse	Reverse
1.	K 50	145x 70mm 	
2.	K 100	145x 70mm 	
3.	K 200	150x 70mm 	
4.	K 500	150x 70mm 	
5.	K 1000	150x 70mm 	
6.	K 5000	150x 70mm 	
7.	K 10000	150x 70mm 	

## II. TEMPLATES FOR CURRENCY VALUE

Before building the architecture of currency recognition system, we initially investigate the different currency denomination regions. Denomination regions for each of seven notes are shown in the first two columns of table II. These regions are specified to automatically extract the denomination information for all types of notes used in our system. The numerical value at the first position of each region is regarded as a template. Each template is shown in the third column.

Table II: Region of interest (ROI) and templates for each note

Top left region	Bottom right region	Template
50 K 	-	
100 K 	-	
200 K 	-	
500 K 	-	
-	1000 K 	
5000 K 	-	
-	10000 K 	

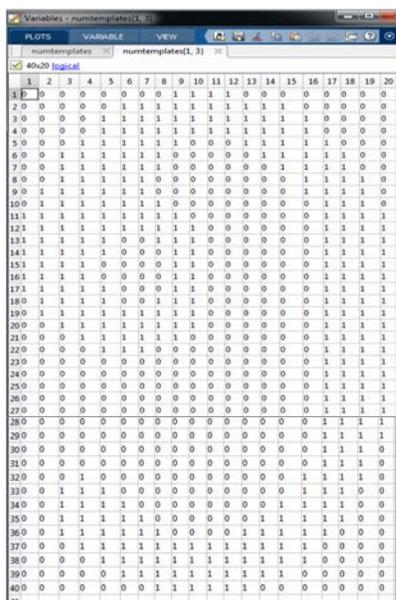


Figure 1: Template for numerical value ၀

All reference templates used in this system is bi-level format and size is 40x20 pixels. Binary images are transformed to a set of reference number array using mat2cell function. An array consists of 6 cells along a single row and each cell having 40 rows and 20 columns. Then this array is saved in the form of a template database and it is called by the currency recognition routine for correlation. Figure 1 is an example template for numerical value ၀. After collecting the necessary information from currency notes we designed the proposed system.

## III. SYSTEM ARCHITECTURE

The organization of the proposed system is depicted in figure 2. The system is divided into two phases: recognition and simulating counting machine for Myanmar currency denominations. There are six main stages in the recognition phase. They are image capturing, preprocessing, target region extraction, number segmentation, currency value recognition, and output. In the second phase, the system will simulate as a counting machine for producing the total amount of currency.

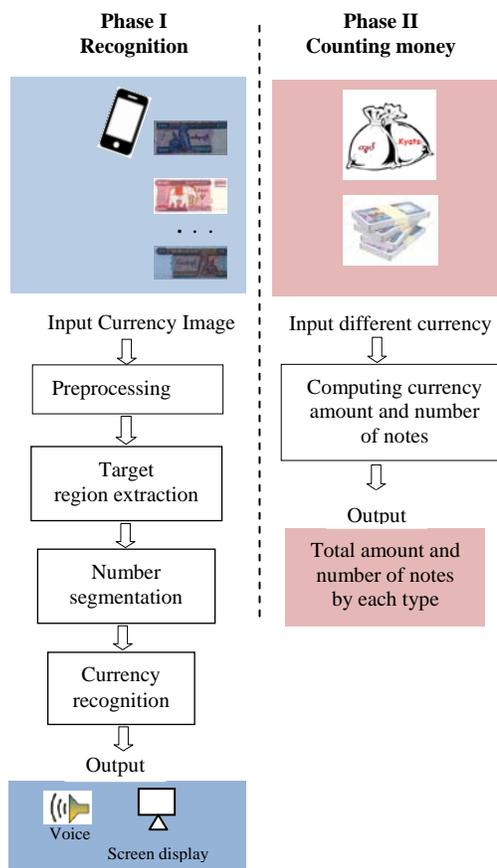


Figure.2: The architecture of proposed system

### A. Image Capturing

The proposed recognition system classifies seven types of Myanmar currency denominations from obverse currency images. Therefore currency images are collected for the system.

Each of the different types of paper currency is superimposed onto a paper and taken by HUAWEI G520-0000 camera model with auto brightness level under low illumination condition. Because of the unnecessary (white) region in the captured image it is necessary to crop the desired currency image region with paint tool as shown below and saved as JPEG (Joint Photographic Experts Group) format. The captured images are fed as input to our recognition system.

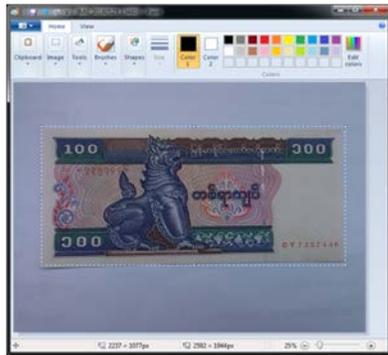


Figure 3: Cropping currency region

**B. Preprocessing**

Preprocessing serves as the front end for recognition system, which transforms the coarse image data into a suitable format. In the preprocessing of the images, the following process steps are needed: gray scale converting, image binarization, noise filtering, morphological operation, and black area extraction for all types of currency images.

**Gray scale converting**

Typically images from the camera or scanner are in the form of 24-bit true color images. Therefore, an image is first converted to grayscale and resized the image to 799x372 pixels that will be more easily and effectively processed for successive steps.

**Binarization**

The grayscale image is further processed into a binary image that will reduce storage space and fast process speed. For this process, Otsu's method [2] is used. Otsu's method finds the threshold level of image and then the calculated threshold that minimizes the variance within the classes, i.e. black and white. Each black pixel is assigned value to 0 and each white pixel is assigned value to 1. Original and converted binary image for denomination 50 K is shown in figure 4 (a-b).

**Noise filtering**

Various noises can appear in digital images during capturing and transmission due to environmental condition and the quality of sensors. Noise may affect segmentation and pattern matching. Hence we want to eliminate salt and pepper noise and we work with non-linear filter known as median filter. They are also called order-statistics filter, because their response is based on the ordering or ranking of the pixels contained within the mask. It preserves edges while removing unwanted noise [1]. In our system 5x5 size of mask is used. Filtering operation produces the output as given in figure 4 (c).

**Morphological operation**

In order to clean the region of denomination, we choose two morphological operations clean and majority provided by image processing toolbox. Clean operation removes isolated pixels (individual 1s that are surrounded by 0s), and majority operation sets a pixel to 1 if five or more pixels in its 3x3 neighborhood are 1s; otherwise, it sets the pixel to 0. Both operations are applied repeatedly until the image no longer changes. Figure 4 (d) shows the resultant currency image after applying the two morphological operations. Enhanced denomination region is depicted by zooming.

**Black region extraction**

After getting the enhanced image, the next preprocessing step includes clipping some useless segments. There are white areas at the border of the enhanced image, which are not relevant to the identification of denomination. This is the reason for clipping. Doing so requires clipping left and right border of the images by 10 pixels and top and bottom border of the images by 2 pixels. Black regions of entire image are extracted with the find function of image processing techniques. Figure 4 (e) shows the extracted black area image.

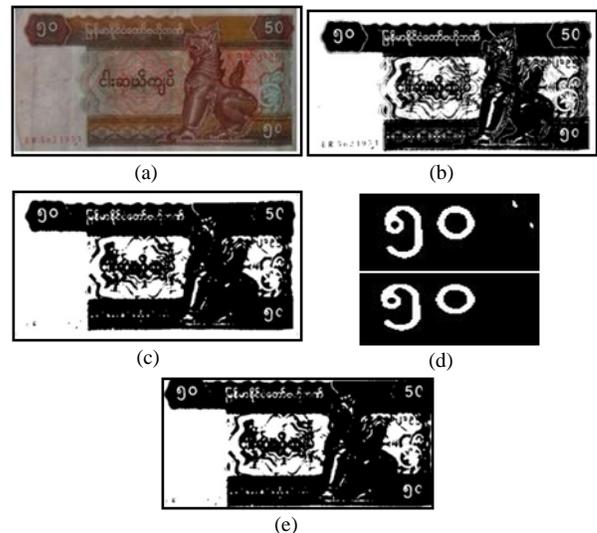


Figure 4: (a) Original image, (b-e) Preprocessing results of (a)

**C. Target Region Extraction**

The denomination information for Myanmar currency is usually located at the top left corner of all notes except 1000 K as described in table 1. In order to classify the value of currency, we use only these denomination regions instead of using the characteristics of the whole image. Top left region and bottom right region are identified for 50, 100, 200, 500, 5000 Kyats and for 1000, 10000 Kyats respectively. To obtain these target regions, coordinates y and x values are specified on the resultant image of preprocessing steps. For 50, 100, 200, 500, and 5000 Kyats, start and end values of y and x are (16:65, 24:145). This gives a 122 x 50 pixels size of target region. Coordinate values for 1000 kyats are (266:310,630:746) and size is 117 x 45 pixels. Coordinate values for 10000 Kyats are (278:342,632:774) and size is 143x 65 pixels. Sample extracted top left region for 50 Kyats is shown in figure 5 (a).

**D. Numerical Segmentation**

In order to differentiate each numerical value present in the ROI, we have used the connected component labeling algorithm [1]. The individual numbers are cropped into different sub images. Sub images are treated to be of certain fixed size 40x20 pixels as template size for pattern matching. The numbers of connected components are recorded that are useful for currency classification routine. For 50 K, sub image of initial value is shown in figure 5 (b) and number of connected components is 2.



Figure 5: For 50 K (a) Top left region, (b) sub image at first position

**E. Currency Recognition**

Sub image in Figure 5 (b) is compared with six template cells. For this matching process corr2 function is used as below:

$$sim = corr2(numtemplates\{1,n\},imgn)$$

corr2 computes the correlation coefficient between two 2-D arrays P and Q using the following equation:

$$c = \frac{\sum_m \sum_n (P_{mn} - \bar{P})(Q_{mn} - \bar{Q})}{\sqrt{(\sum_m \sum_n (P_{mn} - \bar{P})^2)(\sum_m \sum_n (Q_{mn} - \bar{Q})^2)}} \quad (1)$$

where,  $\bar{P}$  and  $\bar{Q}$  are mean of P and Q respectively. After computing the correlation coefficients, the operation detects the maximum value of it by find function. In this way, recognition routine produce the recognized denomination result using the following segment of code for input currency image, where Ne means the number of connected components. Table III shows the similarity values (maximum similarity highlight in red) and recognized currency value, 50 Kyats.

```
.....
elseif id==3 && Ne==2
    Evalue='50';
    Eword='Fifty';
    Mvalue='ig;q,f'; % % Myanmar winInnwa font
```

Table III: correlation coefficient values and recognition result

Sub image	Templates						Recognized value
	1	2	3	4	5	6	
	-0.1057	0.1238	<b>0.8293</b>	0.3912	0.4751	0.0515	50 Kyats

**IV. EXPERIMENTAL RESULTS**

In order to check the validity of the proposed currency recognition system, 52 images for 50 K, 64 images for 100 K, 26 images for 200 K, 32 images for 500 K, 33 images for 1000 K, 37 images for 500 K and 11 images for 10000 K are used as testing input. Figure 6 shows the interface of the currency recognition system and recognized denomination along with step by step processing results for input image 1000 K. For this testing input image, the number of component is 3 and largest similarity value is 0.701.



Figure 6: System interface with recognized value 1000 K

The next testing sample image is currency 5000 K in which ROI is successfully extracted as in figure 7. Although the largest similarity value 0.5422 is correctly matched for the first component, the number of connected components, Ne, is 3 instead of 4 due to blurring the input image. Image blurring is caused by instability of the camera at the time of image capturing. In this testing the system produced the incorrect result 500 K for input currency value 5000 K.



Figure 7: Incorrect recognized value 500 K for input 5000 K

When the user has not been properly cropped the currency image area the system cannot be extracted the precise denomination region. Also the system cannot be completely worked if the border of currency note is physically damaged by stains, scratches, writing, etc as in figure 8. These facts lead to decrease the performance of the currency recognition system.



Figure 8: Damage image

Computed similarity values for some of recognized currency notes are presented in table IV.

Table IV: Similarity value (maximum value in red)

Recognized value	Similarity value					
	1	2	3	4	5	6
50 K	-0.0591	0.0667	<b>0.8770</b>	0.3581	0.4366	0.0534
	-0.1090	0.0465	<b>0.7596</b>	0.3601	0.4329	0.0259
100 K	<b>0.9198</b>	-0.2746	-0.1018	0.0680	-0.1965	0.0314
200 K	-0.3070	<b>0.8553</b>	0.1477	0.0128	0.5693	0.0057
500 K	-0.0020	-0.0460	0.3122	0.7675	0.2031	0.1468
1000 K	-0.0340	0.3571	0.4120	0.3235	<b>0.7380</b>	-0.0789
	-0.0376	0.4001	0.3054	0.2236	<b>0.7010</b>	-0.1790
5000 K	0.1222	-0.0731	0.3617	<b>0.6695</b>	0.2182	-0.0092
10000 K	-0.1006	-0.0969	0.0017	0.0141	-0.0993	<b>0.4246</b>
	-0.0376	-0.1565	-0.0440	0.0309	-0.1562	<b>0.3416</b>

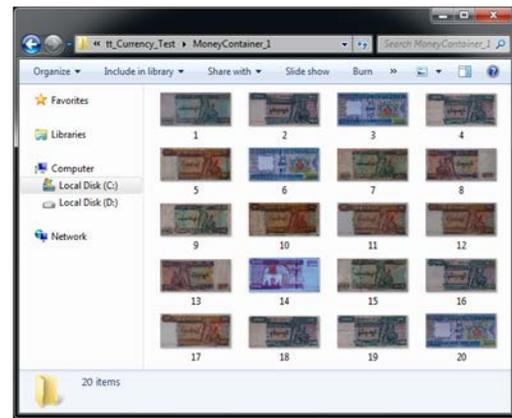
Evaluation rate of the recognition system is calculated using the Equation 2. The recognition accuracies are described in Table V.

$$\text{recognition accuracy} = \frac{\text{number of correctly classified denomination}}{\text{total number of testing images}} \times 100 \quad (2)$$

Table V: Accuracy rate of Myanmar currency recognition

Denominations (Kyat)		Number of samples	Number of correct classification	Accuracy rate
50	medium	4	4	100%
	fresh	48	48	
100	medium	6	6	100%
	fresh	58	58	
200	medium	2	2	100%
	fresh	24	24	
500	medium	19	17	94%
	fresh	15	15	
1000	medium	19	18	96%
	fresh	14	14	
5000	fresh	37	35	94%
10000	fresh	11	10	90%
Total		257	251	97%

According to the experimental results the proposed system can be able to use the real life transactional areas: bank, gas-station, and shops, etc. In these areas user computes manually the total sale amount at the end of the daily transaction. Presence counting machine can be able to count only on homogeneous currency type. For counting the different notes need to rearrange them. To compensate for this difficulty we simulate the counting machine at the second phase of this work. The proposed counting simulator not only computes the total sum of different notes but also automatically inform the number of each type of notes to user. Figure 9 (a) describes 20 different currency notes present in MoneyContainer\_1. Figure 9 (b) shows UI window of counting machine simulator. Total amount of sum is 41250 Kyats and the number of each type of notes is automatically extracted as shown in this window.



(a)



(b)

Figure 9: (a) 20 different notes in money box (b) Result of total amount and number of notes by each type

## V. CONCLUSION

In this paper, an automatic tool is developed for Myanmar currency recognition on front view of seven types of currency images. The design could be simply deployed a correlation based method to reduce human power required for currency classification routine with very less amount of time. This work also successfully created a currency counting machine simulator

to replace the manual counting process. The simulator could be able to count the number of currency notes and compute the total sum of notes in money containers. According to the experimental results the proposed system ready to use as a real time application in several market areas. The reliable of currency recognition system depends not only on precise extraction of denomination region but also on connected component labeling results. Sometime the system could not be able to extract the target regions if we have carelessly cropped the currency image region with paint tool before feeding to the system. In some cases the number of connected component is not correct. This is due to the instability of hand, various distance, and environmental condition at the time of image acquisition with camera. The better recognition performance can be achieved by carefully cropping the entire currency image region and by using scanner instead of camera. Any orientations of input images are not acceptable by our system. This will be further step of the coming time.

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# Literature review of Applications of Business Intelligence, Business Analytics and Competitive Intelligence

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<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p8099>

**Abstract-** *Indian Organisations are undergoing evolution in terms of Customer requirements, New Technologies, Government Policies & Regulatory Changes at par with developed countries, surmounting competition and cost consciousness of Indian customer. Organisations needs to realign strategies to sustain and grow in business, needs to come up with future Products & Services. In a nut shell, future Organisations needs to be wiser. This paper covers research paper study on recent techniques such as Business Intelligence (BI), Business Analytics (BA) and Competitive Intelligence (CI). Study discovers that, though BI and BA works on data differs in its use, BI is analysing past and BA is exploring future. CI essentially means understanding and learning what's happening in the world outside within your business, so you can be as competitive as possible.*

*Study provides conceptual view to formulate framework for future Strategic Decision Support System (DSS) integrating with Organisational Processes, encompassing CI to provide Competitor information, BI provides past data analysis, and BA to support future prediction.*

**Index Terms-** Business Intelligence (BI), Business Analytics (BA), Competitive Intelligence (CI), Decision Support System (DSS), Strategy.

## I. INTRODUCTION

Indian Industry is ever evolving and rate of evolution is quicker than making decisions of future sustainable organisation. To illustrate, few examples from Automotive Industry like-

- 1) Dynamic Customer requirements –advance features like telematics and connected cars.
- 2) New Technologies - Alloys and Composites for vehicle light weighting, autonomous vehicles.
- 3) Regulatory requirements – Global Vision of e-mobility by 2030, Emission norms, Fuel millage.
- 4) Competition and consciousness of Indian customer for Price.

All these needs are at par with developed countries, and Indian Industry is compelled to make huge investments on continual basis. To sustain in business, Organisations needs to come up with future Products & services and hence Organisations need to make not only more wiser decisions but with speed and objectivity in decision making. Knowing this purpose, Study was conducted for various applications of Business Intelligence and Business Analytics and Competitive Intelligence in Automotive Industry.

1. Business Intelligence (BI) refers to application of technologies and practices for the collecting, integrating, analyzing, and presentation of business information. Transformation of data into knowledge in Business Intelligence supports better decision making. BI systems are data-driven Decision Support Systems (DSS) and hence support gaining business advantage with strong BI tool instead of making decisions with more just a gut feeling. Creating a data or fact-based“decisioning” framework via a strong computer system provides confidence in any decisions made.

BI leverages software and services to transform data into actionable intelligence which prompts to organization’s strategic and tactical business decisions. BI tools access and analyse data sets and present findings in reports, summaries, dashboards, graphs, charts and maps which provides users with detailed intelligence about the state of the business.

There are five major components of BI –

- **OLAP (On-line analytical processing):** It refers to the way in which business users can slice and dice data using sophisticated tools that allow for the navigation of dimensions such as time or hierarchies. Online Analytical Processing or OLAP provides multidimensional, summarized views of business data and is used for reporting, analysis, modelling and planning for optimizing the business. OLAP techniques and tools can be used to work with data warehouses or data marts designed for sophisticated enterprise intelligence systems. These systems process queries required to discover trends and analyse critical factors. Reporting software generates aggregated views of data to keep the management informed about the state of their business. Other BI tools are used to store and analyse data, such as data mining and data warehouses; decision support systems and forecasting; document warehouses and document management; knowledge management; mapping, information visualization, and dash boarding; management information systems, geographic information systems; Trend Analysis; Software as a Service (SaaS).

- **Advanced Analytics:** This is referred as data mining, forecasting or predictive analytics. It takes advantage of statistical analysis techniques to predict or provide certainty measures on facts.

- **Corporate Performance Management (Portals, Scorecards, Dashboards):** It usually provides a container for several pieces to plug into so that the aggregate tells a story. For example, a balanced scorecard that displays portlets for financial metrics combined with say organizational learning and growth metrics.

- **Real time BI:** It allows the real-time distribution of metrics through email, messaging systems and/or interactive displays.

- **Data Warehouse and data marts:** The data warehouse is the important component of business intelligence. Data warehouse helps the physical transmission of data to various enterprise records for integration, cleansing, aggregation and query tasks. Data warehouse also contains the operations data used for which is used for tactical decision-making of a subject area. Though it contains live data, not snapshots but retains minimal history.

Data marts contains historical operational data for trends and experiences which helps business experts to formulate strategies. The need for data mart can be predicated based on a specific organizational requirement which calls for a certain grouping and configuration of select data. Organisation can have multiple data marts inside an enterprise. A data mart supports a business function, business process or business unit in maintaining historical operational data.

- **Data Sources:** Data sources can contain various types of data such as operational, historical, external data for example data from market research regarding customer and competition or web-based information from the already existing data warehouse environment. Data from data sources can be relational databases or any other data structure that supports the line of business applications. They also can reside on many different platforms and can contain structured information, such as tables or spreadsheets, or unstructured information, such as plaintext files or pictures and other multimedia information.

**2. Analytics –** It involves studying past historical data to identify potential trends, analyses of the effects of certain decisions or events, or to evaluate the performance. Application of analytics mainly comprises to improve the business by gaining knowledge which can be used to make improvements or changes.

- **Business Analytics (BA)** relates to the exploration of historical data from many sources through statistical & quantitative analysis, data mining, predictive modelling and other techniques to identify trends and understand information that can drive business change, support sustained business practices.

Business Analytics is the use of statistical tools & technologies to:

- Find patterns in data for analysis e.g. change in customer requirement
- Find out variability from the huge data points e.g. New Government Regulation
- Identify relationships within the data variables for further prediction e.g. drastic Loan Interest rate changes will change purchase decision of Customer
- Provide insights as to what will happen next e.g. which of the Customers are leaving us

There are 6 major components in analytics -

- **Data Mining:** Create models by discovering previously unknown trends and patterns in vast data e.g. detect insurance claims frauds, Retail Market basket analysis. There are various statistical techniques through which data mining is achieved. Classification is-

- Regression
- Clustering
- Associations & Sequencing Models

- **Text Mining:** Discover and extract meaningful patterns and relationships from text collections e.g. understand sentiments of Customers on social media sites like Twitter, Face book, Blogs which are used to improve the Product or Customer service or understand how competitors are doing.

- **Forecasting:** Analyze & forecast processes that takes place over the time e.g. predict seasonal energy demand

- Predictive Analytics: Create, manage and deploy predictive scoring models e.g. Customer churn & retention, Credit Scoring, predicting failure in shop floor machinery
- Optimization: Use of simulations techniques to identify scenarios which will produce best results e.g. Sale price optimization, identifying optimal Inventory for maximum fulfilment & avoid stock outs
- Visualization: Enhanced exploratory data analysis & output of modelling results with highly interactive statistical graphics.

3. Competitive Intelligence (CI)– Competitor intelligence is process that transforms disaggregated competitor information into relevant, accurate and useable strategic knowledge about competitor positions, performance, capabilities and intentions. The purpose should not be to obtain business or strategic plans but rather to gather continuously, in a systematic manner, a wide range of information that, when collated and analysed, provides a fuller understanding of a competitor's structure, culture, behaviour, capabilities and weaknesses, and possible future plans.

Competitor Intelligence is the purposeful and coordinated monitoring of your competitor(s), wherever and whoever they may be, within a specific marketplace. Competitors are those firms which are considered as rivals in business, and with whom you compete for market share. It also has to do with determining what business rivals will do before they do it.' This is to gain early warning of their plan in order to devise counter actions. It is the process of collecting and analyzing information about competitors' strengths and weaknesses in a legal and ethical manner to enhance business decision-making. Competitive intelligence is different from corporate or industrial espionage, which use illegal and unethical methods to gain an unfair competitive advantage.

Though BI, BA, CI looks similar, but they are different –

Table 1. Comparison of BI vs BA

Business Intelligence	Business Analytics
It reports on what happened in the past or what is happening in now, in current time.	It investigates why it happened & predict what may happen in future.
<ul style="list-style-type: none"> <li>• Basic querying and reporting.</li> <li>• OLAP cubes, slice and dice, drill-down</li> <li>• Interactive display options – dashboards, Scorecards, Charts, graphs, alerts.</li> </ul>	<ul style="list-style-type: none"> <li>• Identifying relationships between key data variables</li> <li>• Applying statistical and mathematical techniques.</li> <li>• Reveal hidden patterns in data</li> </ul>
It Provides – <ul style="list-style-type: none"> <li>• Dashboards with “how are we doing” information</li> <li>• Standard reports and preset KPIs</li> <li>• Alert mechanisms when something goes wrong</li> </ul>	It provides- <ul style="list-style-type: none"> <li>• Response to “what do we do next?”</li> <li>• Proactive and planned solutions for unknown circumstances</li> <li>• The ability to adapt and respond to changes and challenges</li> </ul>

Table 2. Comparison of BI vs CI

Business Intelligence (BI)	Competitive Intelligence (CI)
Business Intelligence is management of a company’s internal data. This will help business to make better decisions based on its own historic information and can therefore project possible future trends.	Competitive Intelligence is gathering and analyzing of intelligence about the behavior of the competitors you deal in, to make certain decisions based on market trends.
BI technologies provide historical, current, and predictive views of business operations	CI enables business to monitor competitor behavior to pinpoint their weak/strong points.
Focus is internal business environment.	Focus external business environment.
A BI professional needs intensive database and database design skills as well as technical IT skills	CI professional need skills in strategic thinking, should have extensive analytical abilities and should be

in BI and ETL tools.	familiar with various scientific analytical methodologies.
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## II. LITERATURE REVIEW

The Literature review was conducted with relevance to study and application areas of BI, BA and CI in Automotive Industry and understand specificity.

Around 600 research papers were studied and for content and relevance, 50 published journal papers selected for research paper study.

Table 3. Paper Search

Research Search	Literature review		
More than 600	BI	CI	BA
	17	17	16

Table 4. BI Literature review

S.N	Title	Results / Findings	Industry
1	An Intelligent Decision-Support System, IEEE, Zbignie M, et.al (2005)	Distributing used cars to various automobile- problem with multiple variables - Marketing Head reviews the solution and possible changes required (less than 1%)	Transportation & Logistics
2	Progress in BI System research: A literature Review, IJBAS-IJENS - Rina Fitriana (2011)	The topic that integrated research are- SCM, CRM, Data Mining, Data Warehouse, DSS, Performance Scorecard, KM, Business Process Management, Artificial Intelligence, ERP, Extract Transformation Loading, OLAP, Strategic Management.	Agro Industry
3	Integrating KM with BI Processes for Enhanced Learning, Software Engineering and Its Applications - Rizwan Shehzad, et.al (2013)	Integrated KM model with BI Model, can check how interaction of BI with a KM model can support organizations to better manage their resources. The adopted model examines organizational efficiency improvement through enhanced learning.	IT
4	BI: concepts, components, techniques, JATIT - Jayanthi Ranjan (2009).	The paper explores the concepts of BI, its components, benefits, factors influencing, technology requirements, designing and implementing BI.	Management Studies
5	A Knowledge-Based Approach for BI in Strategic Technologies: Bio-Mems, AIS, Francisco J. Cantu, et.al (2005)	IT uses Biological-Micro-Electrical-and-Mechanical-Systems industry (Bio-MEMS). The model identifies the main actors, defines their roles and specifies the issues to be addressed. It handles information about main products, market trends, companies, research centers, products, standardization.	Management Studies
6	An Analysis on BI Maturity in Malaysian Organizations, IJISE -In Lih Ong (2013)	Maturity model comprises of factors: organizational process, technology, and outcome, spanning across 5 levels of maturity. Study result indicate most of Malaysian Organizations are at low level of maturity.	Management Studies
7	Business Intelligence, CAIS - Solomon Negash (2004)	Provides framework, importance of unstructured data & need to develop BI tools for acquisition, integration, cleanup, search, analysis and delivery.	Management Studies
8	A BI Technique for forecasting Automobile Sales using Adaptive Intelligent Systems, International Journal of Computer Applications - Alekh Dwivedi, et al. (2013)	The forecasting of sales data in automobile industry at Maruti, based on monthly sales for past 5 years. Methods used Moving Average and Exponential smoothing to forecast values as a input for ANFIS (Adaptive Neuro Fuzzy Inference System). Empirical results demonstrate that the ANFIS gives better results than ANN and Linear Regression models.	Automotive
9	Critical Success Factors for BI, CIS - William Yeoh, et al. (2009)	Findings reveal that organizations which address the CSFs from a business orientation approach will be more likely to achieve better results.	IT
10	The effect of BI Tools on Raising	The main role of management accounting is to use available	Management

	the Efficiency of Accounting, IRMBR, Ziad Al-Zubi, et al. (2014)	information in the best possible way to make decisions. The study concludes that the decision process can be more effective, and Management can save time and money by using BI.	nt Studies
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Table 4. BI Literature review (Contd.)

S.N	Title	Results / Findings	Industry
11	BI and CRM, Conference on IT Interfaces, Aida Habul, et al. (2010)	Study concludes use of CRM systems and BI, provides a approach in customers profiling, simpler detection of customers, measuring the success in satisfying its customers and create a comprehensive CRM. BI can detect incentives to increase sales, like faster conversion of clients, less number of outgoing customers, increase sales to existing customers.	Social Media
12	A Classification for BI Agility Indicators, AIS Electronic Library - Henning Baars, et al. (2013)	A review of related work and the analysis of multiple case studies lead to a differentiated and multi-level agility classification for content, functional, and scale related BI agility concepts differentiated w.r.t architectural layer and reach.	IT
13	Business Intelligence Tools for Big Data, Journal of Basic and AER-Labhansh A, et al. (2016)	BI allows easy interpretation of large volumes of data; identifying new insights & implementing effective strategies, helping organizations in long-term decision making and competitive market.	Managem nt Studies
14	Factors influencing BI Systems implementation success, AISEL, PACIS -Shin-Yuan Hung, et al. (2016)	IT focuses CSF for BI implementation. Results suggested that technical characteristic (i.e., relative advantage), organizational size, Top management support, and environment characteristic (consultant ability and training) were significant in affecting	Managem nt Studies
15	BI in Nutshell, IJIRCCE - Navita Kumari (2013)	Paper explores the concepts of BI, data quality and issues, types of BI tools and delivery mechanisms and the key features of BI architecture.	Managem nt Studies
16	Application of BI-Agriculture “2020 “System to Improve Efficiency, Journal of Global Communication - Gupta Anuraj (2016)	This paper contains the approach to make Modern Agricultural more effective by using BI. It contains fact and dimensional approach to support the decision-making capability of the farmer by making simple reports.	Agro Industry

Table 5. CI Literature review

S.N	Title	Results / Findings	Industry
1	Planning and Strategy in Reforming Romania's SRI, Counter Intelligence Niculae Iancu, et al. (2012)	Capacity development to anticipate, prevent and counter security threats	Govt. Intelligen ce, Security
2	U.S Intelligence Community Reform Post-9/11: Strengthen U.S.'s Ability to Fight Terrorism?, IR-Bernardyova, Alzbeta, et al. (2010)	Reform of the U.S. intelligence community to counter terror attacks.	Govt. Intelligen ce, Security
3	Assessing Uncertainty in Intelligence, Harvard School - Jeffrey Friedman, et al. (2012)	Provides a analytic framework for thinking about estimative intelligence in general	Managem ent Studies
4	Measuring CI effectiveness: Insights from the, Wiley Online Library - Leigh Davison, et al. (Nov 2001) advertising industry	Develop CI Measurement Model (CIMM), provides concrete measures for determining CI effectiveness. Additionally, the model aids in the calculation of the return on CI investment. CIMM classifies CI output into two categories: short-term and long-term strategic.	Advertisi ng
5	CI: A Key Business Success Factor, Management and Sustainability - Cynthia A. Bulley, et al. (2013)	Though Companies are aware of importance of CI yet to fully utilize its potential. It is found that no coherent CI process is established but rather a series of ‘ad-hoc’ measures are used. It implies the need to develop procedures for generating CI data.	Managem ent Studies
6	CI Adds Value: Five Intelligence Attitudes, Elsevier - Daniel Rouach,	The authors report on the growing importance of competitive intelligence as a management practice in the majority of leading	Managem ent

	et al. (2001)	companies	Studies
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Table 5. CI Literature review (Contd.)

S.N	Title	Results / Findings	Industry
7	Social media competitive analysis and text mining, Elsevier, Wu He, et al. ( 2013)	The results reveal the value of social media competitive analysis and the power of text mining as an effective technique to extract business value from social media data. Recommendations are also provided to help companies develop their social media competitive analysis strategy.	Foods Industry
8	Assessing the impact of using the Internet for CI	The findings indicate that research and use of Internet is significantly related to quality of CI information. However, the relationship between internal use and quality of CI information is not significant.	Management Studies
9	CI : concept, context and a case of its application, Elsevier, Tsokanas Nikolaos, et al. (2012)	The paper analyzes the uniqueness of the Pharmaceutical Industry as opposed to other industries and reviews the presence of CI in this industry	Pharmaceutical Industry
10	CI collection and use by sales & service representatives, Springer Link, Adam Rapp, et al. (2014)	Using social identity theory as a conceptual background, this paper reports two studies which investigate how organizational identification and role conflict impact the collection and use of individual competitive intelligence & how this impacts performance.	Management Studies
11	Generating CI Organizations, Springer Link, Bernard J, et al. (2002)	It describes three interdependent phases of CI-organizing for CI, searching for information, and sense-making. It also identifies core components of CI generation process, highlighting its iterative nature, and identifying for its success.	Management Studies
12	Self-Organizing Maps for Competitive Technical Intelligence Analysis, CIS, Lu An, et al. (2012)	Self-Organizing Map (SOM) technique used to identify key competitors and determine key technical attributes of electronic products. The cell phone SOM display was projected into space constructed by key technical attributes and SWOT of competitors were explored.	Cell Phone Industry
13	Connecting strategy and CI to produce strategy inputs, Strategy Leadership Journal - Liam Fahey (2007)	Generating intelligence of value to strategy makers.	Management Studies
14	A Process-Oriented View of CI and its Impact on Organizational Performance, CI and Management - Kersi D. Antia, et al. (2007)	Competitive strategy and the CI administration - influences the subsequent analysis and extent to which information is disseminated. When CI is located in the marketing area, there is greater dissemination within marketing, relative to other functional areas in the firm.	Management Studies
15	The effect of infrastructure, culture, organizational, structure and CI in Organization, Journal on Academic of OB and HRM - Maryam Sadat Hashemi (2016)	It shows effects of corporate culture, organizational structure and impact of information technology on CI in Organizations.	Management Studies
16	The Usefulness of CI & Relationship to the Strategy of the Firm, AMS Conf.-Donna Cartwright, et al. (2014)	CI framework design suitable to meet the needs of the key strategic marketing decision makers.	Management Studies
17	CI in social media Twitter: iPhone 6 vs. Galaxy S5, Emerald, Yoosin Kim, et al. (2016)	The analysis showed that social media data contain CI. The volume of tweets revealed a significant gap between the market leader and follower; the purchase intention data also reflected this gap, but to a less extent.	Social Media
18	Planning and Strategy in Reforming Romania's SRI, Journal of CI Nicolae Iancu, (2012)	Capacity development to anticipate, prevent and counter security threats	Govt.



Table 6. BA Literature review

S.N	Title	Results / Findings	Industry
1	Integrating BA into strategic planning for better performance, Business Strategy-Tobias Klatt, et al. (2011)	This paper combines insights on the best usage of business analytics from the perspective of strategic planning experts, with recommendations for the integration of business analytics into the performance management.	Management Studies
2	The impact of big data and BA on SCM, Transport & SCM Journal - Hans W. Ittmann (2015)	Extracting value from the huge amounts of data available in the SCM area	Automotive
3	Big data analytics in logistics & SCM, Elsevier, IJPE - Gang Wang, et al. (2016)	Paper proposes framework for Logistics Analytics within SCM naming as SCA, based on four capability levels- functional, process-based, collaborative agile SCA, and sustainable SCA.	Automotive
4	Innovations in Business Forecasting: Predictive Analytics, Business Forecasting - Charles W Chase (2014)	Proactively predicts demand instead of replenishing requirements - access data, analyses & provide insights to make decisions to put you ahead of demand curve. Using DSR information for demand sensing to identify major market signals and using them to shape future demand.	Management Studies
5	Barriers to the Adoption of Big Data Analytics in the Automotive Sector, AISEL, AMCIS - Christian Dremel (2017)	Paper identifies barriers for Automotive Industry – (1) sufficient and skilled resources, (2) the collaboration of different business departments, supported by (3) appropriate organizational structures, (4) data-driven culture, (5) defined business value, (6) access to relevant data pools.	Automotive
6	Performance Management Analytics For Automotive Industry: Study, University of Porto - Joao Carlos Dias Correia Pinto (2016)	Study compares several algorithms: Random Forest, Partial Least Squares, M5, Artificial Neural Network, Support Vector Machines and K Nearest Neighbors were tested. Thirteen different sets of predictive variables were tested.	Automotive
7	BA in SCM, Lodz University- Anna Walaszczyk, et al. (2017)	SCM and BI solutions with their capacity to integrate with other systems to perform product segmentation and presents results.	Foods Industry
8	Integrating BA with performance management, IJSER - Sultan Gashgari (2016)	BA is associated with affective decision making and better performance management. Proper integration of performance management with business analytics provides basis for affective and rational decision making for the management.	Management Studies
9	IOP Conference - Taufik Djatna (2017)	Paper reveals the feature selection gain ratio & k-NN outperforms forecasting models, implying the proposed approach is a promising alternative to stock market tendency of warehouse receipt document exploration with accuracy level rate - 95.03%.	Agro Industry
10	Role of BA in Management Education, Eureka - Surabhi S (2017)	Inclusion of Business Analytics in Management Studies	Management Studies
11	Customer Attrition Analytics in Banking, BA and Intelligence - Mihir Dash, et al. (2017)	The company realized that its trust accounts were getting closed after a period of seven to twelve years. Model was built in analytics to predict customer churn and come up with strategies to retain customers.	Banking
12	Management challenges in creating value from BA, Elsevier, Richard Vidgen, et al. (2017)	Presents a Delphi study on the challenges of big data analytics. Provides insight into analytics as a complex socio-technical entanglement and need for data driven management.	Management Studies
13	How do top & bottom performing company differ using BA? Emerald, Guangming Cao, et al. (2017)	It recommends BA, data-driven environment. Also provides management insights into the effective use of BA for improving organizational performance.	Management Studies
14	eMobility market platforms – Applications of BA, Springer, Christoph Willing, et al. (2017)	The number of urban travel modes has increased significantly and now includes services such as car sharing, ridesharing and bike sharing. This paper, describes the business model of MMPs.	e-Commerce
15	Applications of BA in healthcare, Elsevier, Business Horizons - Michael J. Ward, et al. (2014)	This article explores Healthcare applications, barriers and ways to goals of the modern healthcare system: high-quality, responsive, affordable, and efficient care.	Healthcare

Table 6. BA Literature review (Contd.)

S.N	Title	Results / Findings	Industry
16	Perception, reality, adoption of BA: Evidence from North American professional sport Orgs, Elsevier, Omega -Michael Troilo, et al. (2016)	Professional sports teams have made extensive use of analytics to improve their on-field performance. However, it is not as apparent that these same organizations use analytics to improve performance on the “business” side.	Sports
17	Gaining Business Value through BDA: A Case Study of the Energy Sector, AISEL, Decision Analytics - AMCIS - Mariya Sodenkamp, et al. (2015)	Using datasets containing annual electricity consumption of private households, we apply and test in field experiments a Support Vector Machines algorithm that predicts probabilities of individual costumers to sign up on an energy efficiency portal.	Energy Sector

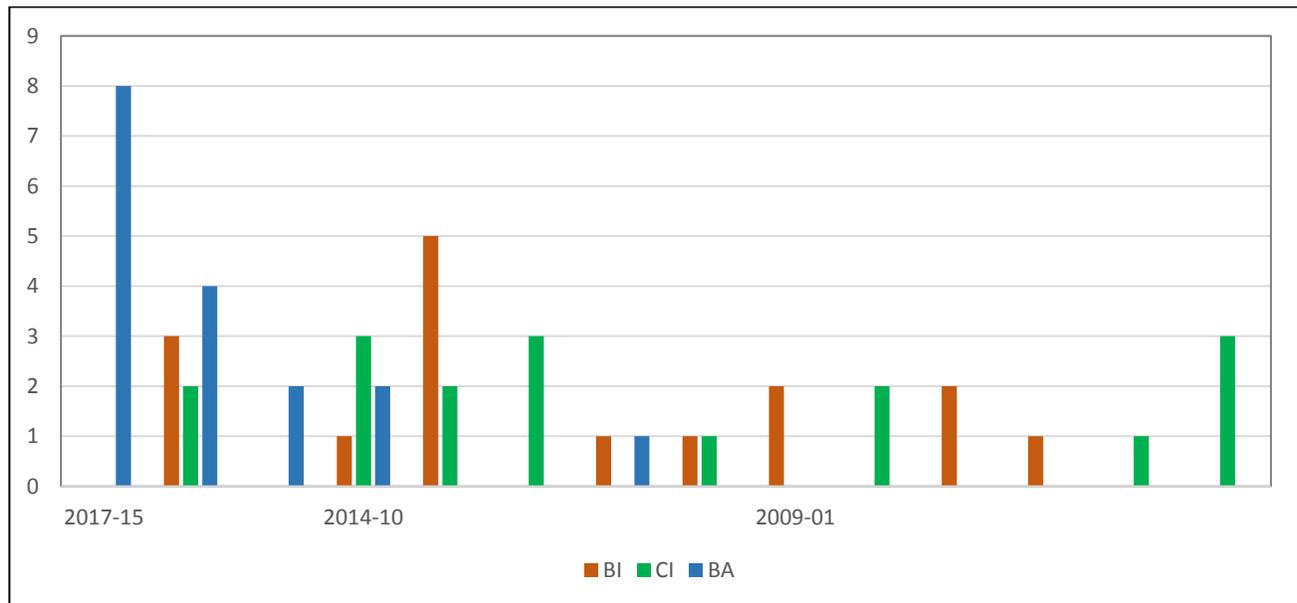
### III. FINDINGS

The Literature review conducted with 50 papers provides valuable information such as-

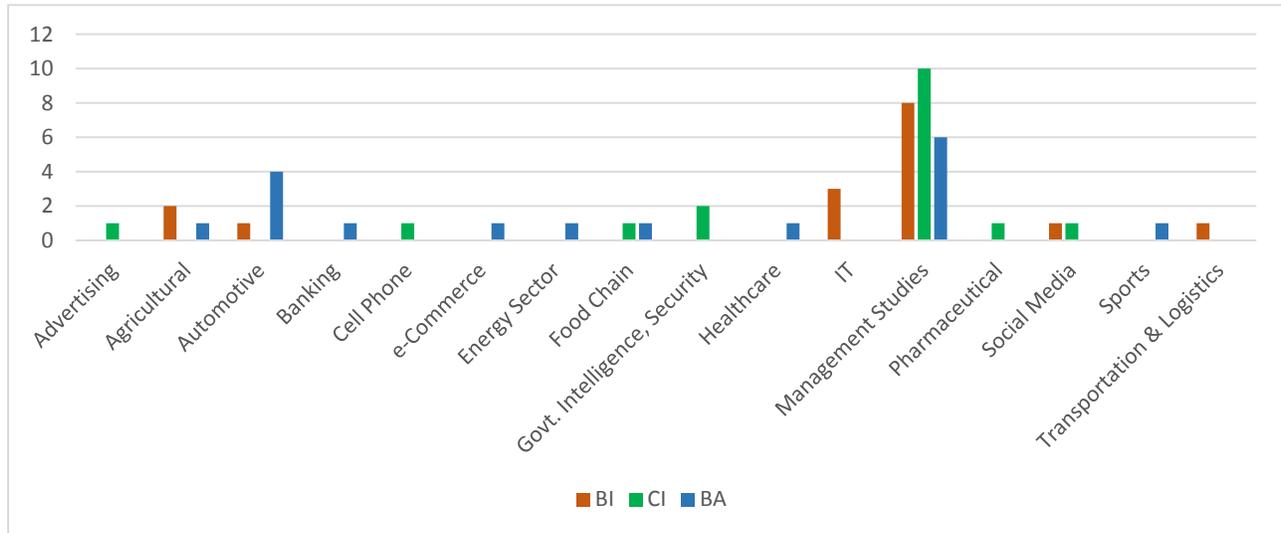
1. BI Concept, framework, influencing factors, issue for implementation, and applications areas of BI such as KM, DSS, Forecasting, Management Accounting, CRM.
2. CI concept, importance, framework, Organisational factors effecting CI, measure for CI effectiveness and application areas like Security Intelligence, Food Chain Industry and usage of internet, social media for CI.
3. BA Concept, role of BA in Management, barriers, and application areas – SCM, Strategic Planning, Business forecasting, Performance Management, buying and selling transaction of Stock Market, Customer management in Banking, e-Mobility market, Healthcare, Energy sector.

BI and BA are trending terminologies applied to business data and BI is needed to run the business while BA is needed to change the business over the years. BA is getting more attention for studies.

Graph 1. Journal Papers Spread



Graph 2. Research Paper Industry Spread



#### IV. CONCLUSION AND WAYFORWARD

This paper covers basic concepts, definitions, process and framework for integrating BI, BA and CI into Organisation processes. Points to summarise -

- Business Intelligence is needed to run the business while Business Analytics are needed to change the business.
- BI is about analysing past historic data to gain knowledge and BA is about exploring future. BI is important to improve your decision-making based on past results, while business analytics will help you move forward and understand what might be going to happen.
- CI essentially means understanding and learning what's happening in the world outside your business, so you can be as competitive as possible. It means learning as much as possible--as soon as possible--about your industry. Businesses now operate in a world in which information is more readily and publicly available than ever before.

Today's businesses have access to more data than ever before. Companies produce, collect and store vast amounts of data, from internal and external customer feedback surveys to manufacturing and delivery statistics. To summarise, future sustainable organisations need to be more data driven and this will make saying more propounding that "Numbers do not lie, people do, fortunately we can use analytics to understand data in new and meaningful ways that can make business for us". IOT (Internet of Things) every information is available at the click of a mouse.

So, while Organisations are discussing of Integrated framework for future Strategic DSS, CI technique provides competitor intelligence, BI provides past data analysis, and analytics will support future prediction.

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# Dietary methionine and lysine requirement of snakehead (*Channa striata*) fingerlings

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DOI: 10.29322/IJSRP.8.8.2018.p80100

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80100>

**Abstract-**This study was aimed determine the dietary methionine (Met) and lysine (Lys) requirement for snakehead fingerlings (2-4 g fish<sup>-1</sup>). Basal diets in two experiments contained approximately isonitrogenous 42 % and isoenergetic 20.3 KJ g<sup>-1</sup>. In the first experiment on Met requirement, L-Met was added to the basal diets including six treatments containing from 7.3 to 14.8 g Met kg<sup>-1</sup> diet (17.5 to 35.3 g Met kg<sup>-1</sup> protein) interval increasing of 1.5 g kg<sup>-1</sup> diet. In the second experiment determining Lys requirement, L-Lys HCL was added to basal diets including seven treatments containing from 12.6 to 36.6 g Lys kg<sup>-1</sup> diet (30.1 to 87.2 g Lys kg<sup>-1</sup> protein), interval increasing of about 4 g kg<sup>-1</sup> diet. The experiments were randomly designed with four replications for each treatment. The first experiment indicated that optimal weight gain, special growth rate, protein efficiency ratio was found in the diet containing 28.2 g Met kg<sup>-1</sup> protein and there were significant differences in those parameters between diet treatment containing 24.8 g Met kg<sup>-1</sup> protein and other diets containing lower Met levels. The hepatosomatic index and protein content in whole-body fish were significantly affected by dietary Met levels. Feed conversion ratio (FCR) was significantly improved with the increase of dietary Met level in diet to 28.2 g kg<sup>-1</sup> protein (P<0.05). Results of the second experiment showed that optimal growth rate and protein efficiency ratio were found in diet containing 73.1 g Lys kg<sup>-1</sup> protein and there were significant differences in those parameters between diet treatment containing 73.1 g Lys kg<sup>-1</sup> protein and other diets containing lower Lys levels. The hepatosomatic index, protein and fat content in whole-body fish were significantly affected by dietary Lys levels. The FCR was significantly improved by increasing dietary Lys concentration to approximately 77.9 g Lys kg<sup>-1</sup> protein. Fish survival rate were not significant differences among treatments in both experiments. Broken-line analysis on the basis of optimal growth rate showed that the dietary Met requirement was 11.9 g Met kg<sup>-1</sup> diet (28.4 g kg<sup>-1</sup> protein) and the dietary Lys requirement of snakehead was 30.7 g Lys kg<sup>-1</sup> diet (73.1 g kg<sup>-1</sup> protein).

**Keywords:** methionine requirements, lysine, snakehead, *Channa striata*

## I. INTRODUCTION

Protein, especially when derived from fish meal, is the most expensive nutrient in the dietary formulation for aquatic

organisms. Therefore, it is important to incorporate inexpensive protein ingredients in the formulation of fish feed by taking care of essential amino acids (EAA) balances (Sardar *et al.*, 2009). By doing this, lysine (Lys) and methionine (Met) are known as the most limiting amino acids in feed ingredients used in diets for fish (Small and Soares, 2000), especial, when plant protein sources are used to replace fish meal (Abimorad *et al.*, 2009; Sardar *et al.*, 2009, Mai *et al.*, 2006).

Of all essential amino acids, Lys is one of special concern because it helps to absorb the calcium, maintain healthy blood vessels, and produce antibodies, enzymes, and collagen and repair tissues. Dietary Lys supplementation is related to advantages on weight gain feed conversion, nitrogen retention and reduction in body lipid contents (Santiago and Lovell, 1988) estimated dietary requirement of 14.3 g Lys kg<sup>-1</sup> diet (51 g kg<sup>-1</sup> protein) for Nile tilapia fingerlings. Wang *et al.* (2005) evaluated the digestible Lys requirement of grass carp fry and estimated a 20.7 g kg<sup>-1</sup> diet level for maximum growth, corresponding to 55.5 g kg<sup>-1</sup> of dietary protein. Furuya *et al.* (2006) determined the digestible Lys requirement of Nile tilapia juveniles to be 14.4 g kg<sup>-1</sup> diet for highest weight gain, which corresponded to 17.2 g kg<sup>-1</sup> diet crude Lys in the dry diet and 52.3 g kg<sup>-1</sup> in the protein fraction. For striped catfish (*Pangasianodon hypophthalmus*), the demand for Lys and Met was 20.7 g kg<sup>-1</sup> diet (53.5 g kg<sup>-1</sup> protein) and 10.1 g kg<sup>-1</sup> diet (26.7 g kg<sup>-1</sup> protein) respectively, with protein content of 38% (Hien *et al.*, 2009a; 2009b).

Besides Lys, Met is also limiting amino acid in some plant protein sources when the fish meal is replaced (Mai *et al.*, 2006; Sardar *et al.*, 2009). Met deficiency results in slow growth and reduced feed efficiency in Atlantic salmon (*Salmo salar L.*) (Opstvedt *et al.*, 2003), juvenile cobia (*Rachycentron canadum*) (Zhou *et al.*, 2006), juvenile rockfish (*Sebastes schlegeli*) (Yan *et al.*, 2007). The dietary Met supplementation has been applied mainly in soybean-protein based diets, which have Met as the first limiting amino acid for carnivorous fish. Met requirements have been reported varying from 2% to 3.75% of dietary protein in different fish species (Ahemd *et al.*, 2003; Mai *et al.*, 2006; Jia *et al.*, 2013).

As a carnivorous species, snakehead, a valuable commercial fish species culture in Asian countries, requires a high protein level in the diet (Samantary and Mohanty, 1997). As a result,

feed cost covered more than 80% of the total snakehead production cost (Hien *et al.*, 2018). Reducing cost, fish meal protein could be replacement by defatted soybean meal 40% with adding Met, Lys and phytase enzyme (Hien *et al.*, 2015). However, there is no published information on dietary Met and Lys requirements for snakehead to formulate the Lys and Met-balanced practical feeds. This study was aimed at determining optimum dietary Lys and Met requirements for optimizing growth, feed conversion, and body composition of snakehead (*Channa striata*) fingerlings.

## II. MATERIALS AND METHODS

### 2.1 Experimental diets

#### Experiment 1: Dietary Met requirement for snakehead

The experiment included 6 diets with the iso-protein level of 42% and iso-energy of 20.3 KJ.g<sup>-1</sup>. The control treatment without Met supplement contained a Met level available in feed of 7.3g.kg<sup>-1</sup> diet (corresponding to 17.5 g.kg<sup>-1</sup>protein). Met was added to the experimental diets from 0 to 7.5 g.kg<sup>-1</sup> diet (increase of 1.5g.kg<sup>-1</sup> diet), at a constant dietary level cysteine of 2.66 g.kg<sup>-1</sup> diet were formulated. The fish meal, wheat gluten and gelatin were used as main protein sources, and all diets were supplemented with crystalline amino acids mixture (Table 1) without Met to meet the requirements of other EAA according to the whole body amino acids profiles of snakehead.

#### Experiment 2: Dietary Lys requirement

The experiment was conducted with 7 diets with the same protein level of 42% and energy of 20.3 KJ.g<sup>-1</sup>. The control treatment was without Lys supplementation, where Lys content of 12.6 g.kg<sup>-1</sup> diet (corresponding to 30.1 g.kg<sup>-1</sup> protein) is available in feed. Lys was added to the experimental diets from 0 to 24 g.kg<sup>-1</sup> diet (an increase of 4 g.kg<sup>-1</sup> diet). The fish meal, wheat gluten and gelatin were used as main protein sources, and all diets were supplemented with crystalline amino acids mixture (Table 2) without Lys to meet the requirements of other EAA according to the whole body amino acids profiles of snakehead. except Met level was added 28.4 g.kg<sup>-1</sup> protein. All ingredients were mixed mechanically with water for 30 minutes and the dough was then passed through an extruder to obtain pellets of 2-mm diameter. Diets were dried in the oven at 60°C for 6 h, then cooled at room temperature for 30 minutes, and finally stored in airtight plastic bags in the freezer -20°C until use throughout the experiment (i.e., all diets were made at one time only). Proximate composition of diets was analyzed using methods of AOAC (2000).

### 2.2 Fish and experimental condition

Snakehead fingerlings used in the experiments were bought from a hatchery in An Giang province. Before starting each experiment, fish were acclimated in a 2,000-L circular tank and fed on a commercial diet for 15 days. The average initial weight per fish was 2-3 g. At the start of the experiments, fingerlings were randomly distributed into 18 composite tanks for Met experiment and 21 tanks for Lys experiment (120-L capacity, filled with 100 L of water) at a stocking density of 30 fish.tank<sup>-1</sup>.

Each tank was provided with continuous aeration and flow-through water supply with 30% water exchange d<sup>-1</sup>. Fish were fed twice a day (0900 and 1500) to satiation. The amount of consumed feed and uneaten feed in each tank was recorded daily (uneaten feed was siphoned out 30 min after feeding began, dried and weighed). Any fish mortality was recorded daily and dead fish were removed and weighed immediately. Each experiment lasted for 8 weeks. Water parameters were recorded. Temperature ranged from 26.7-28.8 °C, dissolved oxygen from 5.4 to 5.7 mg L<sup>-1</sup>, pH from 7.4 to 7.7, NO<sub>2</sub> < 0.1 mg L<sup>-1</sup> and NH<sub>3</sub><0.1 mg L<sup>-1</sup>, so the water quality parameters in all treatments were in a suitable range for the normal growth and development of this species. At the end of the experiments, the survival rate and fish weight was determined by counting and weighing all fish in each tank. Each specimen was kept in the freezer at -20°C for the chemical compositions analysis of the fish according to the method of AOAC (2000).

### 2.3. Data collection and calculations

Growth rate was calculated and expressed as weight gain (WG), daily weight gain (DWG), specific growth rate (SGR) according to the following equations: WG(g) = W<sub>f</sub> – W<sub>i</sub>, DWG (g/day) = WG/t, SGR (%/day) = ((ln (W<sub>f</sub>) - ln (W<sub>i</sub>))/t) x 100. The survival rate of the fish in each tank was measured using the following formula: survival rate (%): SR = (the number of the fish after 8 weeks per the number fish at commencement) x 100. Feed conversion ratio (FCR) and protein efficiency rate (PER) were calculated by the following equations: FCR = consumed feed (dry weight (g))/weight gain of fish (g), PER = (W<sub>f</sub> - W<sub>i</sub>)/protein intake. NPU = (the amount of fish body protein in the final fish – the amount of fish body protein in the initial fish)/the amount of protein intake. Where W<sub>i</sub> is the initial weight of fish (g), W<sub>f</sub> is the final weight of fish (g), t is the experimental period (day).

### 2.4 Statistical analysis

Mean differences in growth parameters and feed efficiency among treatments were tested by using ANOVA followed by DUNCAN tests at the significant level of 0.05. Statistical analyses were performed by using SPSS 16.0 software. Met and Lys requirements were calculated according to a model of broken line Zeitoun *et al.* (1976).

## III. RESULTS AND DISCUSSION

### 3.1 Dietary Met requirement

Growth out and survival rate of fish fed different dietary Met levels

The survival rate of snakehead fish was not significantly different among dietary Met treatments, ranging from 77.5% to 84.2%. Growth rate was increased with increasing dietary Met levels from 17.5 to 28.2 g.kg<sup>-1</sup> protein (P < 0.05), but decreased with dietary Met levels from 31.9 g.kg<sup>-1</sup> protein. At the highest Met level of 35.5 g.kg<sup>-1</sup> protein, the growth of fish was the lowest (6.81g fish<sup>-1</sup> and DWG 0.1 g fish<sup>-1</sup> day<sup>-1</sup>). Weight gain

(11.57 g) and DWG ( $0.21 \text{ g fish}^{-1} \text{ day}^{-1}$ ) of fish were the highest at the dietary Met level of  $28.2 \text{ g kg}^{-1}$  protein (Table 3).

The broken-line analysis of the relationship between the dietary Met levels and DWG (Figure 1) was given by two equations  $y = -0.0117x + 0.5388$  ( $R^2 = 0.9381$ ) and  $y = 0.0058x + 0.0424$  ( $R^2 = 0.8905$ ). The highest DWG at the broken - line was estimated at the optimal Met level of  $x = 28.4 \text{ g kg}^{-1}$  protein ( $11.9 \text{ g Met kg}^{-1}$  diet) with dietary protein level of 42%.

Feed utilization efficiency of fish fed different dietary Met levels

The fish had higher FI in diets containing Met levels from 24.8 to  $28.2 \text{ g kg}^{-1}$  protein compared to the fish in other treatments (Table 4). The FCR of the treatments tended to decrease when fish fed the dietary Met levels increased. The highest FCR (1.15) was found in the lowest dietary Met at  $17.5 \text{ g.kg}^{-1}$  protein and significantly different from the dietary Met treatment of  $28.2 \text{ g kg}^{-1}$  protein ( $P < 0.05$ ). When fish fed with higher dietary Met levels (from 31.9 to  $35.5 \text{ g kg}^{-1}$  protein, FCR of fish tended to increase but not significantly from the lowest one ( $P > 0.05$ ). The efficiency of protein utilization (PER) and net protein utilization (NPU) tended to increase (from 2.08 to 2.17) and (0.29 to 0.32) when fish fed dietary Met level increased from  $17.5$  to  $24.8 \text{ g kg}^{-1}$  protein, but remained relatively constant from  $28.2$  to  $35.5 \text{ g kg}^{-1}$  protein.

Body composition of fish in the dietary Met experiment

Levels of dietary Met had effects on body compositions and HSI of snakehead (Table 5). Crude protein and ash were significant differences among the dietary treatments ( $P > 0.05$ ). HSI content significantly increased with higher dietary Met levels ( $P < 0.05$ ), and highest HIS was observed at  $35.5 \text{ g.kg}^{-1}$  protein.

### 3.2 Dietary Lys requirement

Growth out and survival rate of fish fed different dietary Lys levels

The survival rates of snakehead fish were not significantly different among dietary Lys treatments, ranging from 72.5% to 82.5% ( $P > 0.05$ ). The growth of fish (DWG) increased with increasing dietary Lys levels from  $30.1$  to  $68.4 \text{ g.kg}^{-1}$  protein ( $P < 0.05$ ) but remained relatively constant from  $68.4$  to  $87.2 \text{ g kg}^{-1}$  protein (table 6).

The broken-line analysis of the relationship between the dietary Lys levels in the diet and the DWG (Figure 2) was based on two equations  $y = 0.0013x + 0.0697$  ( $R^2 = 0.9373$ ) and  $y = -0.00001x + 0.16583$ . The optimal Lys level estimated at the highest DWG was  $x = 73.1 \text{ g kg}^{-1}$  protein ( $30.7 \text{ g Lys kg}^{-1}$  diet) with protein level diet of 42%.

Feed utilization efficiency of fish fed different dietary Lys levels

The feed conversion ratio (FCR) of the treatments tended to decrease from 1.19 to 1.04 when fish fed increasing dietary Lys

levels from  $30.1$  to  $87.2 \text{ g kg}^{-1}$  protein (Table 7). The highest FCR was 1.19 at  $30.1 \text{ g kg}^{-1}$  protein treatment and significantly different from the remaining treatments ( $P < 0.05$ ). The efficiency of protein utilization (PER) and net protein utilization (NPU) tended to increase when the dietary Lys level increased from  $30.1$  to  $64.4 \text{ g kg}^{-1}$  protein, but remained relatively constant with higher dietary Lys levles. In this experiment, the NPU values increased from 0.28 to 0.36 when the fish fed Lys content of  $30.1$  to  $68.4 \text{ g kg}^{-1}$  protein. At high Lys levels from  $58.7$  to  $87.2 \text{ g.kg}^{-1}$  protein, there were no significant differences in NPU among treatments.

Fish body composition in dietary Lys treatments

Protein in the fish body tended to increase when fish fed increasing dietary Lys levels from  $30.1$  to  $87.2 \text{ g kg}^{-1}$  protein (Table 8). However, the difference was not significant among treatments with Lys content of  $30.1$  to  $68.4 \text{ g kg}^{-1}$  protein ( $P > 0.05$ ). Meanwhile, lipid levels in the fish body decreased when fish fed increasing dietary Lys levels from  $30.1$  to  $68.4 \text{ g kg}^{-1}$  protein. However, there were not significant difference in body lipid content of fish fed dietary Lys of  $39.6$  to  $87.2 \text{ g kg}^{-1}$  protein ( $P > 0.05$ ). The ash in fish body was not affected by the Lys levels in the feed. The HSI of snakehead fish increased (2.19 to 2.68) with the increase of dietary Lys levels. The lowest HSI of fish (2.19) was found at the lowest Lys content of  $30.1 \text{ g kg}^{-1}$  protein.

### 3.2 Discussion

The demand for EAA should be met the needs of aquatic animal health and growth Results from this study showed that growth rate of snakehead increased with increasing dietary levels of Met (the optimal level of  $28.8 \text{ g kg}^{-1}$  protein) and Lys (the optimal level of  $73.1 \text{ g kg}^{-1}$  protein). Final body weight, WG and SGR increased with increasing dietary Met level from  $17.5$  to  $28.2 \text{ g kg}^{-1}$  protein while FCR showed the adverse tendency. The growth of experimental snakehead declined insignificantly at higher Met level diets from  $31.9 \text{ g kg}^{-1}$  protein when compared with those fish fed optimal Met level diet as excessive level of Met. It could be the exceeded Met level leading to accumulate and oxidate of Met to ketones and other toxic metabolites thereby it occurred the reduction in the growth rate (Murthy & Varghese, 1998) and superfluous level of Met in fish body would result in extra energy expenditure towards deamination and excretion (Sveier *et al.*, 2001). Liou *et al.* (2014) reported that weight gain increased with increasing dietary Met level from  $11.5$  to  $36.5 \text{ g kg}^{-1}$  protein and then decreased insignificantly when dietary Met treached  $45.3 \text{ g kg}^{-1}$  protein, while FCR showed adverse tendency of *Megalobrama amblycephala*.

Comparing to other species, Met in feed for snakehead fish was similar to the Met requirement of *L. rohita*,  $28.8 \text{ g kg}^{-1}$  protein (Murthy and Varghese, 1998), Striped catfish (*P. hypophthalmus*)  $26.7 \text{ g kg}^{-1}$  protein (Hien *et al.*, 2009b), Chanel catfish (*Ictalury punctatus*)  $23.4 \text{ g kg}^{-1}$  protein (Harding, 1977); carp (*Carassius auratus gibeilo*)  $23 \text{ g kg}^{-1}$  protein (Wang *et al.*, 2016) and marine fish, i.e. *Sebastes schlegeli*  $28.0 \text{ g kg}^{-1}$  protein (Yan *et al.*, 2007); Seed germs  $25 \text{ g kg}^{-1}$  protein (Liao *et al.*, 2014). However, Met requirement for snakehead is lower than Chinese sucker (*Myxocyprinus asiaticus*)  $32.0 \text{ g kg}^{-1}$  protein (Chu

*et al.*, 2014); and marine fish, i.e. *Sparus macrocephalus* 45.3 g kg<sup>-1</sup> protein (Zhou *et al.*, 2011). Generally, the Met requirement for fish ranges from 20 to 40 g kg<sup>-1</sup> protein and according to species (Wilson *et al.*, 1989 ; Ahemd *et al.*, 2003; Mai *et al.*, 2006; Jia *et al.*, 2013). Results of previous studies on Met requirements in snakehead are consistent with this study. The FCR of snakehead of dietary Met treatments tended to decrease when fish fed the dietary Met levels increased. Yan *et al.* (2007) study on Rockfish (*S. schlegelii*) showed that FCR decreased when fish fed increased dietary Met levels in feed increased higher than growth demand FCR of fish was significant. Similar results were also observed in other fishes, juvenile Japanese flounder (Alam *et al.*, 2001), juvenile grouper *Epinephelus coioides* (Luo *et al.*, 2005), and Atlantic salmon (Espe *et al.*, 2008).

Relating to the fish body composition, many studies have shown that the Met levels in the diet affected the protein and lipid contents in fish body composition. In the present study, protein contents in whole body of snake head tended to increase with dietary Met level up to the near requirement level, beyond which it remained nearly unchanged, which is in agreement with other reports (Kim *et al.*, 1992 ; Ruchimat *et al.*, 1997 ; Alam *et al.*, 2000 ; Luo *et al.*, 2005). The results on snakehead was similar with the results of Luo *et al.* (2005), Yan *et al.* (2007), Zhou *et al.* (2011), Niu *et al.* (2013), Liao *et al.* (2014). These authors reported that protein in the fish body increased significantly with the increase of Met level in the diet and at the highest dietary Met level, the protein in the fish body slightly reduced. The lipid content in snakehead body slight increased (from 3.54 to 3.68%) with the increase in Met level in the diet (from 17.5 to 35.5 g kg<sup>-1</sup> protein). There are various reports showed similar results as that of current study, i.e. Wang *et al.* (2016), Niu *et al.* (2013), the lipid content in the fish body increasing with the increase levels of dietary Met but Met in the diet exceeding the requirement, slightly increased lipid content in the fish body found. This might be because of better utilization of protein with reduced deposition of lipid in the presence of Met resulting lean growth of fish (Sardar *et al.*, 2009). This study results also were consistent with Kim *et al.* (1992) and Schwarz *et al.* (1998), but in contrast with the study in grouper (Luo *et al.*, 2005). The liver is the organ that performs the highest Methylation reaction as well as the sulfur metabolic reaction (Mato *et al.*, 2002). The present study showed that liver weight was significantly increased with dietary Met supplementation. Similar results were observed in juvenile Jian carp, *Cyprinus carpio* (Tang *et al.*, 2009), juvenile rockfish (Yan *et al.*, 2007) and Atlantic salmon (Espe *et al.*, 2008). Wang *et al.* (2016) showed that fish HSI increased with the increase in Met level in feed. An increased HSI was also observed when Atlantic salmon was fed too low levels of Lys (Espe *et al.*, 2007) or Met (Espe, *et al.*,

2008).

Apart from Met, the results from the second experiment showed that growth rates of snakehead increased and FCR decreased with increasing dietary Lys level from 30.1 to 68.4 g kg<sup>-1</sup> protein. Higher levels of dietary Lys (77.9 g kg<sup>-1</sup> protein) influenced negatively on growth and FCR of snakehead. Depressed growth and lower feed conversion were more commonly noted in *H. fossilis* receiving dietary Lys below and above 52.9 g kg<sup>-1</sup> protein (20 g kg<sup>-1</sup> diet). Studies by Dupree and Halver (1970) also demonstrated that Lys-deficient diets when fed to chinook salmon and channel catfish caused poor growth.

The Lys requirement for optimal growth of snakehead was greater than that of other freshwater fish species such as 41.3 g kg<sup>-1</sup> protein for *S. quinquerediata* (Ruchimat *et al.*, 2001); 31.4 g kg<sup>-1</sup> protein for freshwater mantle *M. nemurus* (Tantikitti and Chimsung, 2001); 59.6 g .kg<sup>-1</sup> protein for grass carp *Bidyanus bidyanus* (Wang *et al.*, 2005); 50.4 g kg<sup>-1</sup> protein for *S. aurata* (Marcouli, 2006); 53.5 g kg<sup>-1</sup> protein for striped catfish (Hien *et al.*, 2009a); 57 g kg<sup>-1</sup> protein for common carp *Cyprinus carpio* (Nose, 1979). In contrast, the Lys demand for snakehead was lower than the Lys requirement of *Sparus macrocephalus* 86.4 g kg<sup>-1</sup>protein (Zhou *et al.*, 2010); or Goldfish (*Pelteobagrus fulvidraco*) 83.2 g kg<sup>-1</sup> protein (Cao *et al.*, 2012). The different results for determining the Lys requirement for fish species may be due to differences in methodology, protein sources in feed, protein content in diet, amino acid compositions in formula, culture conditions and species (Forster and Ogata, 1998 ; Kim *et al.*, 1992). The feed conversion ratio (FCR) of the treatments tended to decrease when the fish were fed increasing dietary Lys levels while PER showed the adverse tendency. Lin *et al.* (2013) when studied on Chinese sucker (*Myxocyprinus asiaticus*), FCR decreased significantly with increasing dietary Lys from 28.3 to 54.9g.kg<sup>-1</sup> protein and then showed no significant difference as the Lys level increases from 54.9 to 96.19g kg<sup>-1</sup> protein, while the highest FCR was observed for fish fed with the diet containing 28.3 kg<sup>-1</sup> protein. The studies of Cao *et al.* (2012) on the goldfish (*Pelteobagrus fulvidraco*), Lin *et al.* (2013) on chinese sucker (*Myxocyprinus asiaticus*) and Abimorad *et al.* (2010) on pacu juveniles showed that the PER increased with the increase of Lys level in the diet and the highest PER was reached when the diet contained the highest Lys content.

The protein content in the fish body tended to increase when the fish fed increasing dietary Lys levels from 30.1 to 87.2 g kg<sup>-1</sup> protein. This result is similar to some study's results Zhou *et al.* (2010), Cao *et al.* (2012), Lin *et al.* (2013) and Wang *et al.* (2016). In this study, when snakehead fed high dietary Lys levels showed an increase in protein content in the body but lipid content decreased. This trend of increase in protein deposition and muscle gain, and reduction in carcass fat in response to required dietary Lys intake has also been reported for various other cultivable fish species (Luo *et al.*, 2006). Highest whole-

body lipid was noted in fish fed lowest level of Lys at 30.1g kg<sup>-1</sup> protein of the diet which was found to decrease with increasing dietary Lys levels. This finding is in line with the trend in other studies reporting that Lys supplementation leads to increased protein content and decreased lipid content in fish (Zarate and Lovell, 1997; Mai *et al.*, 2006; Zhang *et al.*, 2008). Lys is active in promoting the transport of long-chain fatty acids across the inner mitochondrial membrane, resulting in extra energy from b-oxidation (Tanphaichitr, Horneand Broquist, 1971). However, dietary Lys deficiency suppresses the oxidation of these fatty acids, thereby increasing their availability or esterification to triacylglycerol and deposition in the various lipid storage tissues. Therefore, fish fed the lowest level of dietary Lys accumulated highest body fat. The HSI of snakehead fish increased (2.19 to 2.68) with the increase of dietary Lys levels. Wang *et al.* (2005) when studying the Lys demand of grass carp (*Ctenopharyngodon idella*) was reported: HSI increased from 2.2 to 2.6% when the fish fed Lys increased from 1.87 to 8,32 g kg<sup>-1</sup> protein (P<0.05). the study of Lin *et al.* (2013) on Chinese sucker (*Myxocyprinus asiaticus*) also showed that HSI increased from 1.54 to 1.85% when fish fed Lys increased feed. The differences in HSI findings as well as chemical compositions in fish can be attributed to the ability of each species to absorb amino acids, amino acid changes in the body, amino acid sources in the diet and methods processing, but most probably due to species differences (Lou and Liu, 2006).

#### IV. CONCLUSION

In conclusion, the optimum requirements of dietary Met and Lys for snakehead were 11.9 g Met kg<sup>-1</sup> diet (28.4 g kg<sup>-1</sup> protein) and 30.7g Lys kg<sup>-1</sup> diet (73.1 g kg<sup>-1</sup> protein) based on the broken-line regression analysis of daily weight gain versus different dietary Met and Lys levels. At these dietary levels of Met and Lys, the experimental fish expressed the best growth, the lowest feed conversion ratio (FCR) and the highest protein utilization (PER). Moreover, the increase of dietary levels of both Met and Lys tended to increase the protein content in the fish body. Especially, the supplementation of Lys in the diet helped to reduce the lipid content in the fish body and the liver weight (hepasomatic index – HIS) of fish.

#### Acknowledgments

This research was funded by the AquaFish Innovation Lab under USAID CA/LWA No. EPP-A-00-06-00012-00 and by US and Host Country partners. The AquaFish accession number is 1470. The opinions expressed herein are those of the author(s) and do not necessarily reflect the views of the AquaFish Innovation Lab or the U.S. Agency for International Development.

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**Table 1. Formulation and proximate composition of the Met experimental diets (dry matter basis)**

Ingredients (g kg <sup>-1</sup> )	Treatment diets					
	M 17.5	M 20.9	M 24.8	M 28.2	M 31.9	M 35.5
Fish meal	120	120	120	120	120	120
Wheat gluten	150	150	150	150	150	150
Dextrin	275	275	275	275	275	275
Gelatin	100	100	100	100	100	100
Cassava meal	150	150	150	150	150	150
MCP	10	10	10	10	10	10
Guar gum	0.5	0.5	0.5	0.5	0.5	0.5
Essential amino acids (EAA)	48.8	48.8	48.8	48.8	48.8	48.8
Nonessentials AA mixture	63.7	62.2	60.7	59.2	57.7	56.2
L – Methionine	<b>0</b>	<b>1.5</b>	<b>3</b>	<b>4.5</b>	<b>6</b>	<b>7.5</b>
Fish Oil	52	52	52	52	52	52
Mineral and vitamin premix*	30	30	30	30	30	30
Total	1000	1000	1000	1000	1000	1000
<b>Chemical composition (%)</b>						
Crude Protein	41.8	42.3	41.7	41.9	41.8	41.7
Crude fat	6.44	6.48	6.43	6.42	6.48	6.47
Ash	6.66	6.65	6.66	6.65	6.66	6.65
Gross energy (MJ kg <sup>-1</sup> )	20.2	20.3	20.2	20.4	20.3	20.1
<b>Methionine</b>						
Met g kg <sup>-1</sup> diet	7.3	8.8	10.3	11.8	13.3	14.8
Met g kg <sup>-1</sup> protein	17.5	20.9	24.8	28.2	31.9	35.5

*Premix mineral and vitamin (unit.kg<sup>-1</sup>): Vitamin A 2,000,000 IU; Vitamin D 400,000 IU; Vitamin E 6g; Vitamin B<sub>1</sub> 800mg; Vitamin B<sub>2</sub> 800mg; Vitamin B<sub>12</sub> 2mg; Calcium D Pantothenate 2g; Folic acid 160mg; Choline Chloride 100g; Iron (Fe<sup>2+</sup>) 1g; Zinc (Zn<sup>2+</sup>) 3g; Manganese (Mn<sup>2+</sup>) 2g; Copper (Cu<sup>2+</sup>) 100mg; Iodine (I) 20mg; Cobalt (Co<sup>2+</sup>) 10mg.*

**Table 2. Formulation and proximate composition of the Lys experimental diets (dry matter basis)**

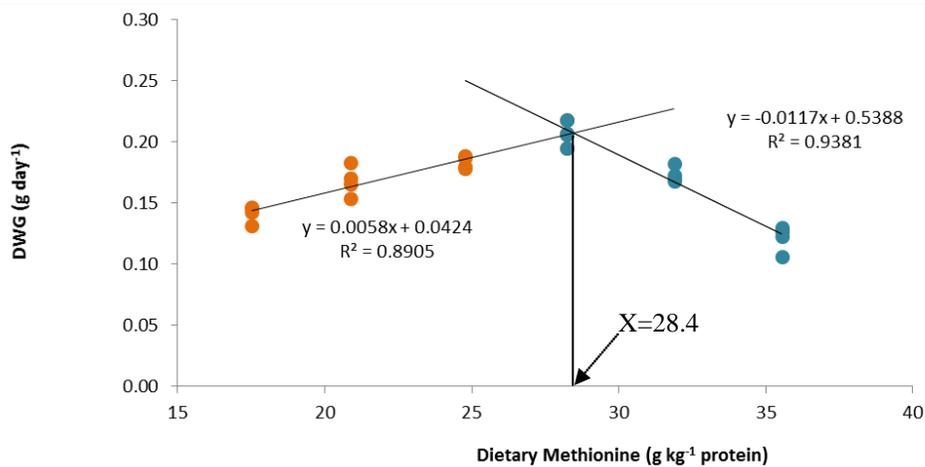
Ingredients (g kg <sup>-1</sup> )	Treatment diets						
	L30.1	L39.6	L49.1	L58.7	L68.4	L77.9	L87.2
Fish meal	120	120	120	120	120	120	120
Wheat gluten	150	150	150	150	150	150	150
Dextrin	275	275	275	275	275	275	275
Gelatin	100	100	100	100	100	100	100
Cassava meal	150	150	150	150	150	150	150
MCP	10	10	10	10	10	10	10
Guar gum	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Essential amino acids (EAA)	33.6	33.6	33.6	33.6	33.6	33.6	33.6
Nonessentials AA mixture	78.9	74.9	70.9	66.9	62.9	58.9	54.9
L – Lys	0	4	8	12	16	20	24
Fish Oil	52	52	52	52	52	52	52
Mineral and vitamin premix	30	30	30	30	30	30	30
Total	1000	1000	1000	1000	1000	1000	1000
<b>Chemical composition (%)</b>							
Crude Protein	41.5	42.1	41.9	41.9	41.7	41.8	41.9
Crude fat	6.47	6.45	6.45	6.47	6.47	6.47	6.49
Ash	6.70	6.63	6.66	6.65	6.65	6.66	6.66
Gross energy (MJ kg <sup>-1</sup> )	20.3	20.3	20.2	20.2	20.0	20.3	20.3
<b>Lys</b>							
Lys g kg <sup>-1</sup> feed	12.6	16.6	20.6	24.6	28.6	32.6	36.6
Lys g kg <sup>-1</sup> protein	30.1	39.6	49.1	58.7	68.4	77.9	87.2

*Premix mineral and vitamin (unit.kg<sup>-1</sup>): Vitamin A 2,000,000 IU; Vitamin D 400,000 IU; Vitamin E 6g; Vitamin B<sub>1</sub> 800mg; Vitamin B<sub>2</sub> 800mg; Vitamin B<sub>12</sub> 2mg; Calcium D Pantothenate 2g; Folic acid 160mg; Choline Chloride 100g; Iron (Fe<sup>2+</sup>) 1g; Zinc (Zn<sup>2+</sup>) 3g; Manganese (Mn<sup>2+</sup>) 2g; Copper (Cu<sup>2+</sup>) 100mg; Iodine (I) 20mg; Cobalt (Co<sup>2+</sup>) 10mg.*

**Table 3. Growth out and survival rate of snakehead fed with six dietary Met levels for 8 weeks**

Met (g kg <sup>-1</sup> protein)	Wi (g fish <sup>-1</sup> )	Wf (g fish <sup>-1</sup> )	WG (g fish <sup>-1</sup> )	DWG (g day <sup>-1</sup> )	SGR (% day <sup>-1</sup> )	SR (%)
17.5	2.95±0.02 <sup>a</sup>	10.87±0.3 <sup>d</sup>	7.93±0.39 <sup>d</sup>	0.14±0.01 <sup>d</sup>	2.51±0.08 <sup>d</sup>	77.5±6.87
20.9	2.92±0.03 <sup>a</sup>	12.36±0.70 <sup>c</sup>	9.44±0.68 <sup>c</sup>	0.17±0.01 <sup>c</sup>	2.77±0.10 <sup>c</sup>	80.84±4.19
24.8	2.88±0.10 <sup>a</sup>	13.17±0.22 <sup>b</sup>	10.28±0.29 <sup>b</sup>	0.19±0.01 <sup>b</sup>	2.92±0.09 <sup>b</sup>	84.17±11.02
28.2	2.95±0.02 <sup>a</sup>	14.52±0.5 <sup>a</sup>	11.57±0.52 <sup>a</sup>	0.21±0.01 <sup>a</sup>	3.07±0.07 <sup>a</sup>	82.50±05
31.9	2.95±0.03 <sup>a</sup>	12.67±0.36 <sup>bc</sup>	9.72±0.35 <sup>bc</sup>	0.17±0.01 <sup>bc</sup>	2.80±0.05 <sup>bc</sup>	80.83±1.67
35.5	2.88±0.07 <sup>a</sup>	9.70±0.56 <sup>e</sup>	6.81±0.61 <sup>e</sup>	0.12±0.01 <sup>e</sup>	2.33±0.15 <sup>e</sup>	79.17±6.94

Values (mean ± SD) in a column followed by the same superscript letter are not significantly different ( $P>0.05$ ).



**Figure 1. The relationship between Daily weight gain (DWG) and dietary Met levels (g kg<sup>-1</sup> protein of snaked fed with the experimental diets for 8 weeks.**

**Table 4. Feed intake (FI), feed conversion ratio (FCR), protein efficiency (PER) and net protein utilization (NPU) of snakehead fed with six dietary Met levels for 8 weeks**

Met (g kg <sup>-1</sup> protein)	FI (% BW)	FCR	PER	NPU
17.5	2.50±0.20 <sup>bc</sup>	1.15±0.04 <sup>a</sup>	2.08±0.07 <sup>b</sup>	0.29±0.01 <sup>b</sup>
20.9	2.69±0.08 <sup>ab</sup>	1.13±0.01 <sup>ab</sup>	2.09±0.01 <sup>b</sup>	0.29±0.01 <sup>b</sup>
24.8	2.87±0.18 <sup>a</sup>	1.14±0.01 <sup>ab</sup>	2.11±0.02 <sup>ab</sup>	0.32±0.01 <sup>a</sup>
28.2	2.90±0.13 <sup>a</sup>	1.10±0.01 <sup>b</sup>	2.17±0.03 <sup>a</sup>	0.33±0.014 <sup>a</sup>
31.9	2.71±0.05 <sup>ab</sup>	1.11±0.02 <sup>ab</sup>	2.15±0.04 <sup>ab</sup>	0.32±0.01 <sup>a</sup>
35.5	2.39±0.17 <sup>c</sup>	1.13±0.03 <sup>ab</sup>	2.12±0.05 <sup>ab</sup>	0.32±0.01 <sup>a</sup>

Values (mean ± SD) in a column followed by the same superscript letter are not significantly different ( $P>0.05$ ).

**Table 5. Effect of dietary Met levels on body composition (g kg<sup>-1</sup>) of snakehead fed with the dietary Met levels for 8 week**

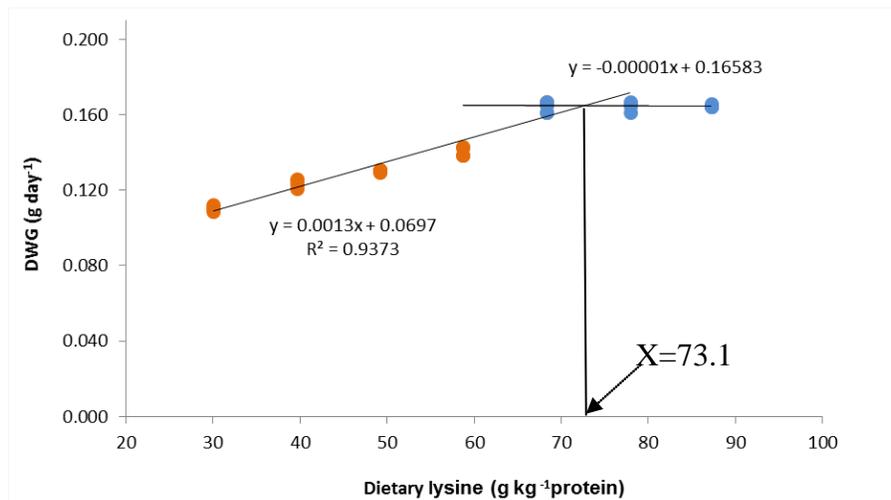
Met (g kg <sup>-1</sup> ) protein	Moisture (%)	Crude protein (%)	Crude fat (%)	Ash (%)	HSI
17.5	73.91±0.22 <sup>a</sup>	14.01±0.63 <sup>b</sup>	3.54±0.17 <sup>a</sup>	4.48±0.21 <sup>a</sup>	2.58±0.04 <sup>b</sup>
20.9	74.06±0.91 <sup>a</sup>	14.06±0.45 <sup>b</sup>	3.54±0.14 <sup>a</sup>	4.27±0.22 <sup>a</sup>	2.98±0.23 <sup>ab</sup>
24.8	73.34±0.74 <sup>a</sup>	15.05±0.37 <sup>a</sup>	3.63±0.12 <sup>a</sup>	4.43±0.14 <sup>a</sup>	2.86±0.04 <sup>ab</sup>
28.2	73.20±0.65 <sup>a</sup>	15.21±0.40 <sup>a</sup>	3.64±0.07 <sup>a</sup>	4.47±0.14 <sup>a</sup>	2.95±0.08 <sup>ab</sup>
31.9	73.08±0.38 <sup>a</sup>	15.20±0.25 <sup>a</sup>	3.67±0.06 <sup>a</sup>	4.41±0.6 <sup>a</sup>	2.89±0.08 <sup>ab</sup>
35.5	73.39±0.94 <sup>a</sup>	15.26±0.08 <sup>a</sup>	3.68±0.14 <sup>a</sup>	4.38±0.12 <sup>a</sup>	3.32±0.09 <sup>a</sup>

Values (mean ± SD) in a column followed by the same superscript letter are not significantly different (P>0.05).

**Table 6. Growth rate and survival rate of snakehead fed with seven dietary Lys levels for 8 weeks**

Lys (g kg <sup>-1</sup> ) protein	Wi (g fish <sup>-1</sup> )	Wf (g fish <sup>-1</sup> )	WG (g fish <sup>-1</sup> )	DWG (g day <sup>-1</sup> )	SGR (% day <sup>-1</sup> )	SR (%)
30.1	2.36±0.05 <sup>a</sup>	8.56±0.06 <sup>c</sup>	6.20±0.09 <sup>e</sup>	0.11±0.001 <sup>d</sup>	2.48±0.05 <sup>e</sup>	72.50±8.77
39.6	2.36±0.05 <sup>a</sup>	9.30±0.16 <sup>d</sup>	6.94±0.12 <sup>d</sup>	0.13±0.006 <sup>c</sup>	2.64±0.03 <sup>d</sup>	75.84±6.87
49.2	2.36±0.04 <sup>a</sup>	9.67±0.05 <sup>c</sup>	7.31±0.04 <sup>c</sup>	0.13±0.001 <sup>c</sup>	2.71±0.03 <sup>c</sup>	78.33±3.34
58.7	2.35±0.05 <sup>a</sup>	10.23±0.10 <sup>b</sup>	7.88±0.14 <sup>b</sup>	0.14±0.001 <sup>b</sup>	2.83±0.06 <sup>d</sup>	71.67±8.39
68.4	2.38±0.04 <sup>a</sup>	11.63±0.12 <sup>a</sup>	9.25±0.14 <sup>a</sup>	0.17±0.005 <sup>a</sup>	3.04±0.04 <sup>a</sup>	70.84±11.35
77.9	2.37±0.05 <sup>a</sup>	11.58±0.10 <sup>a</sup>	9.21±0.13 <sup>a</sup>	0.17±0.006 <sup>a</sup>	3.05±0.02 <sup>a</sup>	79.17±11.01
87.2	2.34±0.05 <sup>a</sup>	11.57±0.09 <sup>a</sup>	9.23±0.05 <sup>a</sup>	0.16±0.005 <sup>a</sup>	3.07±0.02 <sup>a</sup>	82.50±5.0

Values (mean ± SD) in a column followed by the same superscript letter are not significantly different (P>0.05).



**Figure 2. The relationship between DWG and dietary Lys levels (g kg<sup>-1</sup>) protein of snakehead fed with the experimental diets for 8 weeks.**

**Table 7. Feed intake (FI), feed conversion ratio (FCR), protein efficiency (PER) and net protein utilization (NPU) of snakehead fed with seven dietary Lys levels for 8 weeks**

Lys (g kg <sup>-1</sup> protein)	FI (% BW)	FCR	PER	NPU
30.1	1.83±0.12 <sup>a</sup>	1.19±0.04 <sup>a</sup>	2.01±0.07 <sup>c</sup>	0.28±0.02 <sup>c</sup>
39.6	1.84±0.08 <sup>a</sup>	1.15±0.02 <sup>ab</sup>	2.08±0.02 <sup>bc</sup>	0.30±0.001 <sup>bc</sup>
49.2	1.90±0.16 <sup>a</sup>	1.11±0.01 <sup>b</sup>	2.16±0.02 <sup>b</sup>	0.31±0.03 <sup>bc</sup>
58.7	1.80±0.06 <sup>a</sup>	1.10±0.03 <sup>b</sup>	2.16±0.05 <sup>b</sup>	0.32±0.01 <sup>ab</sup>
68.4	1.78±0.22 <sup>a</sup>	1.05±0.04 <sup>c</sup>	2.29±0.09 <sup>a</sup>	0.36±0.05 <sup>a</sup>
77.9	1.96±0.21 <sup>a</sup>	1.02±0.03 <sup>c</sup>	2.35±0.08 <sup>a</sup>	0.34±0.03 <sup>ab</sup>
87.2	1.94±0.18 <sup>a</sup>	1.04±0.04 <sup>c</sup>	2.30±0.09 <sup>a</sup>	0.33±0.03 <sup>ab</sup>

Values (mean ± SD) in a column followed by the same superscript letter are not significantly different ( $P>0.05$ ).

**Table 8. Body composition of snakehead fed with the dietary Lys levels for 8 weeks**

NT Lys (g kg <sup>-1</sup> protein)	Moisture (%)	Crude protein (%)	Crude fat (%)	Ash (%)	HSI
30.1	72.43±0.29 <sup>a</sup>	14.67±0.15 <sup>b</sup>	4.69±0.16 <sup>a</sup>	6.14±0.23 <sup>a</sup>	2.19±0.07 <sup>b</sup>
39.6	72.17±0.18 <sup>a</sup>	14.73±0.19 <sup>b</sup>	4.54±0.21 <sup>ab</sup>	6.18±0.22 <sup>a</sup>	2.50±0.29 <sup>ab</sup>
49.2	72.14±0.59 <sup>a</sup>	15.03±0.31 <sup>b</sup>	4.50±0.08 <sup>ab</sup>	6.04±0.16 <sup>a</sup>	2.49±0.46 <sup>ab</sup>
58.7	72.75±0.14 <sup>a</sup>	15.01±0.01 <sup>b</sup>	4.42±0.05 <sup>b</sup>	6.00±0.04 <sup>a</sup>	2.55±0.19 <sup>ab</sup>
68.4	73.12±0.47 <sup>a</sup>	15.07±0.18 <sup>ab</sup>	4.37±0.15 <sup>b</sup>	5.90±0.26 <sup>a</sup>	2.53±0.05 <sup>ab</sup>
77.9	71.83±0.82 <sup>a</sup>	15.47±0.56 <sup>a</sup>	4.38±0.13 <sup>b</sup>	5.95±0.18 <sup>a</sup>	2.62±0.25 <sup>ab</sup>
87.2	72.84±0.41 <sup>a</sup>	14.99±0.16 <sup>b</sup>	4.42±0.05 <sup>b</sup>	6.10±0.47 <sup>a</sup>	2.69±0.10 <sup>a</sup>

Values (mean ± SD) in a column followed by the same superscript letter are not significantly different ( $P>0.05$ ).

# Significant Reduction in the Recurrence of Urinary Tract Infection (UTI) Symptoms with Cystikare developed by Composition of Cranberry Prophylactic Adjuvant with D-Mannose

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DOI: 10.29322/IJSRP.8.8.2018.p80101

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80101>

**ABSTRACT** *The market of nutritional supplements for women care is proliferating these days. Urinary tract infections (UTIs) have always been and still continue to be a major health concern to women. UTI stands as the most prevalent bacterial infection suffered by women. Cranberry has been used in preventive and treatment medicines for UTI, since decades now. Most UTIs are acute uncomplicated cystitis caused by Escherichia coli (86%). Women with recurrent UTIs are the group to whom most recommendations regarding cranberry consumption is directed, inclusion of other groups in the efficacy assessment could influence clinical practice quality.*

*To be able to provide effective treatment for urinary health and many other related issues, these plant based compositions should not only have correct balance of antioxidants but also should be upgraded time to time, in accordance to latest clinical findings or developments.*

## UTIs (Urinary Tract Infections)

Due to women's anatomy, UTIs are especially problematic for them, and up to one-third of all women will experience a UTI at some point during their lifetimes. Appropriate treatment of a UTI requires accurate classification that includes infection site, complexity of the infection, and the likelihood of recurrence.

It has been calculated that about one-third of adult women have experienced an episode of symptomatic cystitis at least once. It is also common for these episodes to recur. If predisposing factors are not identified and removed, UTI can lead to more serious consequences, in particular kidney damage and renal failure. The aim of this review was to analyze the factors more commonly correlated with UTI in women, and to see what possible solutions are currently used in general practice and specialized areas, as well as those still under investigation. In a prospective study by Haylen et al 1140 women aged 18–98 years were examined for recurrent UTI in different physiologic and pathologic conditions.<sup>1</sup>

Also, the incidence of UTI in women increases with age. Bacteriuria occurs in about 10%–15% of women aged 65–70 years and in 20%–50% of women aged over 80 years.

**Table 1: Factors linked to an increased risk of Catheter-Associated UTIs (CAUTIs). (in alphabetical order)\***

Advanced age
Anatomic anomalies of the urinary tract
Comorbidities
Concurrent debilitating illness, including ICU admission
Distant coexisting infection
Faecal incontinence
Female sex and pregnancy
Immobility
Immunocompromised status (HIV/AIDS, prolonged steroid use, uncontrolled diabetes)
Institutionalisation or long term care facility residence
Long term catheters
Longer hospital stay
Poor nutritional status
Previous recurrent or difficult to treat UTI
Urological procedures

\*Modified from: American Urology Associations "Best Practice Policy Statement on Urologic Surgery Antimicrobial Prophylaxis (2008).

### Uncomplicated versus Complicated UTIs

A complicated UTI is an infection associated with a condition, such as a structural or functional abnormality of the genitourinary tract, or the presence of an underlying disease; this increases the risk of the outcome of a UTI being more serious than expected, as compared to its occurrence in individuals without any identified risk factors (i.e. uncomplicated UTI).

#### Classification based on clinical presentation of urinary tract infection (UTI) and risk factors (RFs)

Type	Category of RF	Example
O	No known/associated RF	Healthy premenopausal women
R	Recurrent UTI RF, but no risk of severe outcome	Sexual behaviour and contraceptive devices Hormonal deficiency postmenopause Secretory type of certain blood groups Controlled diabetes mellitus
E	Extra-urogenital RF, with risk of more severe outcome	Pregnancy Male gender Badly controlled diabetes mellitus Relevant immunosuppression* Connective tissue diseases* Prematurity, newborn
N	Nephropathic disease, with risk of more severe outcome	Relevant renal insufficiency* Polycystic nephropathy
U	Urological RF, with risk of more severe outcome, which can be resolved during therapy	Ureteral obstruction (i.e. stone, stricture) Transient short-term urinary tract catheter Asymptomatic bacteriuria† Controlled neurogenic bladder Urological surgery
C	Permanent urinary catheter and non-resolvable urological RF, with risk of more severe outcome	Long-term urinary tract catheter treatment Non-resolvable urinary obstruction Badly controlled neurogenic bladder

\*Not well defined. †Usually in combination with other RFs (e.g. pregnancy or urological intervention).

Notably, **Uncomplicated UTIs** included all patients who visited the polyclinic with a diagnosis code for UTI but did not correlate this with the actual symptoms. Since patients who were recently discharged from hospitals could have been included as well, nosocomial and community-acquired UTIs were also not accurately differentiated.

Hospitalization is often required in **Complicated UTIs** and therapy should be guided by urine cultures whenever possible to avoid the emergence of resistant strains. Patients can also be treated as outpatients by confident family physicians; treatment for 7–14 days is generally recommended in Complicated UTIs, but the duration should be closely related to the treatment of the underlying abnormality<sup>2</sup>.

### Effectiveness of Cranberry in treating Urinary Tract Infections

At the top of UTI “myth list” is the widely held belief that drinking cranberry juice or taking cranberry supplements can prevent and treat UTIs. “There is an active ingredient in cranberries that can prevent adherence of bacteria to the bladder wall, particularly *E. coli*,” says urologist Courtenay Moore, MD.

The active ingredient in cranberries -- A-type proanthocyanidins (PACs) -- is effective against UTI-causing bacteria, but is found only in cranberry capsules, not in cranberry juice, Boone said.

Cranberries have historically been associated with urinary tract health, particularly among women with recurrent UTIs (rUTIs). Results from several clinical studies have suggested that cranberries may decrease rUTIs in healthy women. In addition, in vitro and ex vivo research has suggested that cranberry-derived compounds such as A-type proanthocyanidins and other polyphenols may interfere with adhesion of bacteria (including multidrug-resistant *Escherichia coli*) to epithelial cells of the urinary tract, attenuate the development of uropathogen reservoirs (i.e., in the gastrointestinal tract and intracellular pods within the urothelium), and suppress inflammatory cascades. These observations have indicated that cranberries may provide an option for prophylaxis in certain populations<sup>3</sup>.

Cranberries and UTIs have been evaluated in evidence-based systematic reviews and meta-analyses, but instead of providing clarity on the efficacy of the cranberry for prevention of UTIs, these systematic reviews have resulted in conflicting conclusions<sup>3</sup>.

Cranberry appears to work by inhibiting the adhesion of type I and P-fimbriated uro-pathogens (e.g. uropathogenic *E. coli*) to the uroepithelium, thus impairing colonization and subsequent infection. The isolation of the component(s) of cranberry with this activity has been a daunting task, considering the hundreds of compounds found in the fruit and its juice derivatives. Reasonable evidence suggests that the anthocyanidin/proanthocyanidin moieties are potent antiadhesion compounds<sup>4</sup>.

#### **D-Mannose: Promising support for UTIs in women**

It appears that D-Mannose works best if taken preventively or at the very first signs of infection.

The downsides of long-term antibiotic prophylaxis are possible adverse reactions (although rare), costs and increasing bacterial resistance to antibiotics; therefore, alternative prophylactic agents, such as cranberry juice and probiotics have been extensively studied. One such agent is D-mannose, which is normally present in human metabolism and has an important role, especially in the glycosylation of certain proteins. The supposed mechanism of action is inhibition of bacterial adherence to urothelial cells. D-mannose acts as a competitive inhibitor of bacterial adherence. It is important to note that the anti-adhesive effect of mannose depends on the configuration of the molecule. Only D-isomer and  $\alpha$ -anomer ( $\alpha$ -D-mannose) can bind and block the FimH adhesin. Other carbohydrates have little or no anti-adhesive effect<sup>5</sup>.

In fact, there is in vitro evidence that mannose can inhibit macrophage activity, which could theoretically retard bacterial clearance from the urinary tract. Additionally, d- mannose may not be effective against certain strains of UPEC or other uropathogenic bacteria that do not express type 1 pili and FimH<sup>6</sup>.

#### **Conclusion**

The process in our understanding of UTI pathogenesis over the past decade has been truly remarkable. The long-term ability of an association of cranberry and D-mannose, an innovative gelling complex, with lactobacillus strains tested to significantly improve the uncomfortable symptoms reported by women with acute cystitis and Urinary Tract Infections.

Also it has been reviewed, it's extremely effective when causative bacteria is *E. coli*. Whenever *E. coli* infect urinary bladder, D-mannose being a simple sugar attaches at fimbriae of *E. coli* and prevents its motion. Cranberry then acidify the urine & reducing bacterial adhesion to UTI. If the combination (cranberry & D-Mannose) does not show significant improvement in 24~ 48 hrs. It is likely that causative organism is not *E. coli*. In such cases a different approach by bacteria analytical examination is required.

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# Efficacy of Alimentary Components in an Oral Supplement for the Treatment of Insulin Resistance and Boosting Progesterone levels for Female Poly Cystic treatment.

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DOI: 10.29322/IJSRP.8.8.2018.p80102

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80102>

**Abstract-** Resveratrol is nutraceutical with many beneficial therapeutic effects. They're thought to act like antioxidants, protecting the body against damage that can put you at higher risk for things like cancer and heart disease. It has been found that for neurological disorders, cardiovascular diseases, and diabetes, the current clinical trials show that resveratrol is well tolerated and beneficially influenced disease biomarkers. Resveratrol and Alpha-lipoic Acid which appears to act on adiponectin, which is produced by our fat cells and helps us lose fat by improving our insulin sensitivity. Similarly Myo inositol and D-chiro inositol are potent insulin sensitizers which are especially used to treat PCOS. In this review we highlight the issues associated with increased fertility rate in females and symptoms like acne, pimples and aging related problems in PCOS that can be cured with oral supplementation of MI/DCI combination and systemic management of Resveratrol in Insulin resistance and other skin disorders.

Key Words: PCOS, Resveratrol, insulin sensitivity, fertilization, inflammation, Prediabetes, Overweight, AMPK

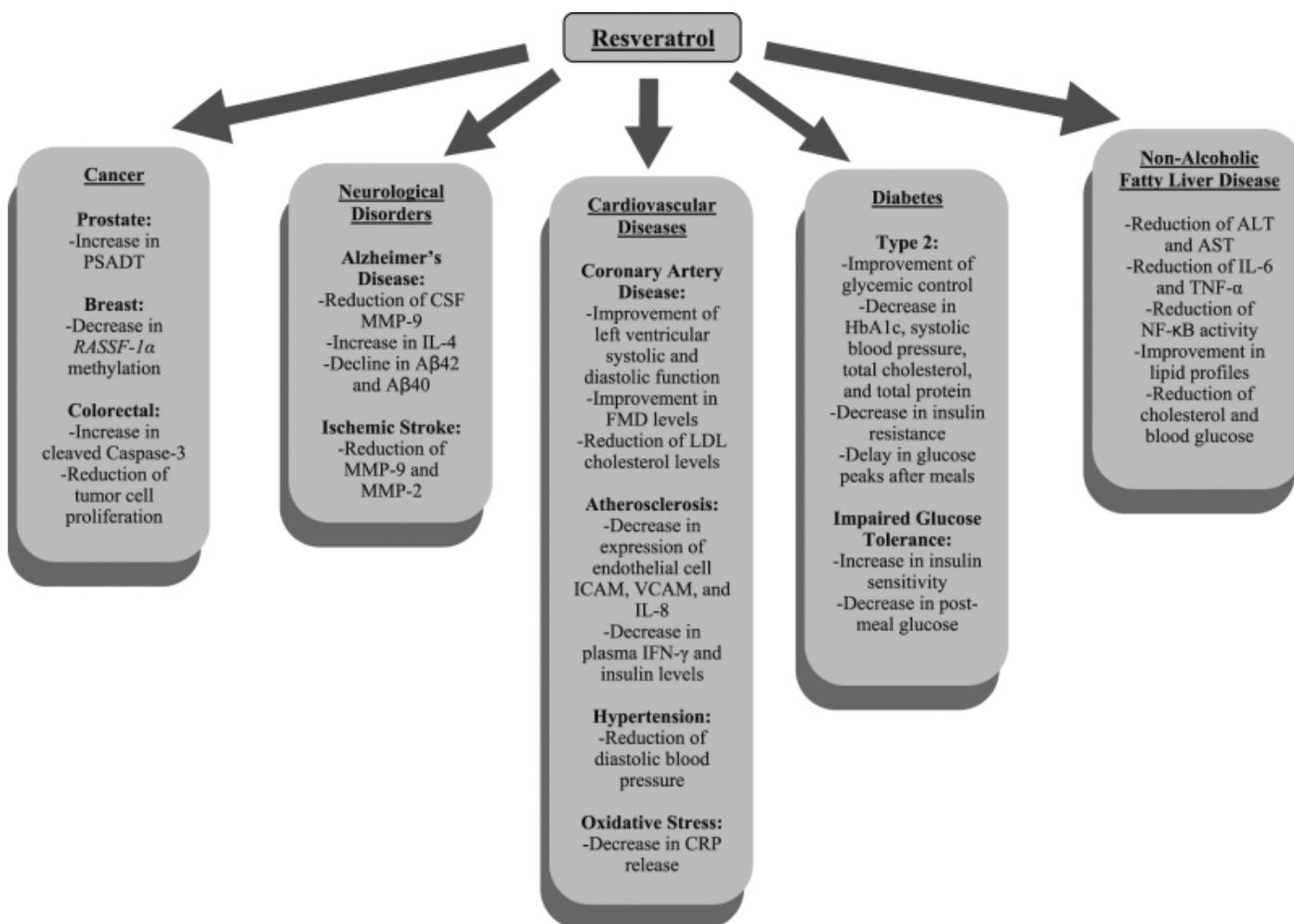
## INTRODUCTION

Resveratrol (trans-3,4',5-trihydroxystilbene), a natural polyphenolic, non-flavonoid antioxidant, is a phytoalexin found in many plants including grapes, nuts and berries, has recently attracted a lot of research attention due to its exciting pharmacological potential. Early research showed that resveratrol was present in large quantities in injured, infected, and ultraviolet-treated leaves. Processed plants products also contain a significant amount of resveratrol; its presence in red wine (concentrations of 0.1–14.3 mg/L) has been suggested as a solution to the “French paradox,” the observation of an unexpectedly low rate of heart disease among Southern French people who consume a lot of red wine, despite their diets being high in saturated fat.<sup>1</sup>

Resveratrol occurs in two isoforms cis and trans – resveratrol, but trans- resveratrol is more biologically active than its cis isoform.<sup>2</sup> Resveratrol alters gut microbiota and influences stem cell proliferation and differentiation. These pleiotropic actions of resveratrol may explain the multitude of its actions and benefits.<sup>3</sup>

Resveratrol is an activator of SIRT1, one of the mammalian forms of the sirtuin family of proteins. SIRT1 deacetylates histones and non-histone proteins including transcription factors. The SIRT1-regulated pathway affects metabolism, stress resistance, cell survival, cellular senescence, inflammation-immune function, endothelial functions, and circadian rhythms.<sup>1</sup>

A study by Bhatt et al. showed that daily resveratrol treatment for 3 months decreased HbA1c levels, systolic blood pressure, total cholesterol, and total protein, improving glycemic control. This suggests that resveratrol could be a possible adjuvant for diabetes treatment.



Dosage with biomarker changes due to resveratrol

Disease Type	Resveratrol dosage	Biomarker Changes
Multiple myeloma	5.0 g	Activate Sirtuin subtype 1 (SIRT-1)
Coronary Artery Disease	10 mg daily	Improved left ventricular function, Lowered LDL Level.
Hypertension	60 mg	Reduced diastolic pressure
Type 2 Diabetes	50 mg twice daily	Decrease insulin resistance, blood glucose, urinary ortho tyrosine excretion.

**Resveratrol in Insulin Resistance**

Diabetes affects 422 million people worldwide, with type 2 diabetes comprising 90% of those cases.<sup>4</sup> Despite increased understanding of this disease and advancements in treatment in recent years, its frequency continues to increase globally, with the WHO projecting that diabetes will be the seventh leading cause of death in 2030. Resveratrol consumption significantly reduced fasting glucose, insulin, glycated haemoglobin, and insulin resistance (measured by using the homeostatic model assessment) levels in individuals with diabetes.<sup>5</sup> A large body of evidence supports the beneficial effects of RSV in the management and treatment of IR, type 2 diabetes, and related complications through a multitude of mechanisms. This review article focuses on the mechanisms of action of RES, the mechanisms leading to improved insulin sensitivity, and its clinical role in the management and treatment of type 2 diabetes.<sup>6</sup>

RSV has anti-hyperglycemic effects in diabetic, which is associated with its stimulatory action on intracellular glucose transport.<sup>7</sup> Recently, it has been demonstrated that RSV enhances adiponectin cellular levels and multimolecularization by upregulation of DsbA-L, which in turn is mediated by the FOXO1 and AMPK signaling pathways.<sup>8</sup>

Study has been conducted among sixty-two patients with type 2 diabetes who received either oral hypoglycemic agents alone or oral hypoglycemic drugs plus RSV 250 mg/d for three months. Those receiving RSV showed an improvement in HbA1c after the completion of three months, suggesting an improvement of glycemic control among patients with type 2 diabetes after supplementation with RSV.<sup>9</sup> Another clinical trial enrolling nineteen patients with type 2 diabetes receiving RSV 2 x 5 mg for four weeks versus placebo, showed a decrease in insulin resistance via a RSV-induced amelioration of oxidative stress<sup>10</sup>

### **Resveratrol in anti-ageing**

Resveratrol has been a subject of intense interest in recent years due to range of unique anti-aging properties including lowered levels of oxidized low density lipoprotein, cyclooxygenase inhibition and most importantly sirtuin activation, which is believed to be involved in the caloric restriction-longevity effect. Several reports suggested that incorporation of resveratrol into dietary supplements or foods be a powerful therapeutic option for anti-aging. Recently, it has been demonstrated that resveratrol extends the lifespan through significantly increasing SIRT1 activity, resulting in the increase of SIRT1 affinity for both NAD<sup>+</sup> and the acetylated substrate<sup>11</sup>

Recently, it has been reported that resveratrol inhibits  $\alpha$ -melanocyte-stimulating hormone signaling, viability, and migration in melanoma cells. According to histological data by the study, resveratrol inhibits melanin synthesis via a reduction in tyrosinase-related protein 2 among the melanogenic enzymes. Notably, resveratrol inhibits mRNA expression of tyrosinase, TRP-1, MITF, and DCT in human melanocytes<sup>12</sup>. The anti-aging effect of CR (Calorie Restriction) has been strongly associated with an increased level and activation of members of the sirtuin family, and also related to other molecular signaling pathways, including peroxisome proliferator activated receptor G coactivator-1 $\alpha$  (PGC-1 $\alpha$ ), adenosine monophosphate activated protein kinase (AMPK), insulin/insulin growth factor-1.<sup>13</sup>

An instrumental study was performed in 50 subjects (25 treated with supplements and 25 with placebo) to identify clinical features induced by chronoaging or photoaging. Product efficacy was evaluated after 60 days of treatment in terms of in vivo and in situ skin hydration, elasticity, and skin roughness levels, systemic oxidative stress levels by plasmatic derivatives of reactive oxygen metabolites and oxyadsorbent tests, and extent of the skin antioxidant pool. After 60 days of treatment, values for systemic oxidative stress, plasmatic antioxidant capacity, and skin antioxidant power had increased significantly. Additionally, skin moisturization and elasticity had improved, while skin roughness and depth of wrinkles had diminished. Intensity of age spots had significantly decreased, as evidenced by improvement in the individual typological angle.<sup>14</sup>

### **EFFECTIVENESS OF MYO INOSITOL IN INSULIN RESISTANCE AND PCOD**

PCOS (Polycystic ovary syndrome) is a complex and debilitating disorder with several health complications including hirsutism, acne, infertility, miscarriage and menstrual dysfunction in which insulin resistance is another common feature of PCOS in both overweight and lean women, and it is often treated with insulin sensitizers like metformin. Currently 1 in 15 women are affected, however, numbers are expected to soar, alongside rising obesity rates.

#### **Natural support to PCOS**

- Weight management
- Blood sugar balance and insulin function normalization
- Hormone balance
- Ovarian health support

Over the last decade, low levels of Myo-inositol, an isomerized and dephosphorylated precursor of glucose-6-phosphate, found in the patients suffering with PCOS which can further led to PMDD (severe form of PMS) has been used more and more as a natural insulin sensitizer.

### Clinical evidence

In a 2009 double blind clinical trial, 42 women with PCOS received Myo-inositol (4 grams daily plus 400mcg folic acid) or placebo (folic acid alone). Results showed that Myo-inositol increased insulin sensitivity, improved glucose tolerance and decreased glucose-stimulated insulin release. In addition, the researchers noted a positive effect on ovulation - 16 out of 23 women in the Myo-inositol group ovulated, compared to 4 out of 19 women in the placebo group. In these women, there was also a 66% reduction of serum total testosterone and a 73% reduction of serum free testosterone concentrations. Cardiovascular markers, systolic and diastolic blood pressures, plasma triglycerides and total cholesterol concentrations also decreased in the myo-inositol group.<sup>15</sup>

Metformin resulted to be the most used and studied drug, even if this molecule is predominantly associated with gastrointestinal discomforts consisting of bloating, nausea, and diarrhea. Interesting and promising results have been obtained focusing on two inositol stereoisomers, such as Myo-inositol (MI) and D-chiro-inositol (DCI), acting like insulin mediators.<sup>16</sup>

### Chromium Polynicotinate in skin pigmentation: Promises and Prospects

Food	Chromium (mcg)
Broccoli, ½ cup	11
Grape juice, 1 cup	8
English muffin, whole wheat, 1	4
Potatoes, mashed, 1 cup	3
Garlic, dried, 1 teaspoon	3
Basil, dried, 1 tablespoon	2
Orange juice, 1 cup	2
Banana, 1 medium	1

Several studies have now demonstrated that chromium supplements enhance the metabolic action of insulin and lower some of the risk factors for cardiovascular disease, particularly in overweight individuals. Chromium picolinate, specifically, has been shown to reduce insulin resistance and to help reduce the risk of cardiovascular disease and type 2 diabetes.<sup>17</sup> Recent study that has been reported (which was presented in 1995 at the annual meeting of the American College of Nutrition) showed dramatic improvements in blood sugar using less than one milligram of supplemental chromium picolinate in a group of women who developed gestational diabetes (that is, they showed symptoms and signs of diabetes only during their pregnancies).

### Conclusion

Our understanding of the pathogenesis of insulin resistance has grown significantly over the past decade. The long-term ability of an association of Resveratrol, a polyphenolic non- flavonoid, tested to significantly improve the undesirable symptoms reported by people with insulin resistance and other skin disorders. We can now hope to reduce the use of metformin and also for the metformin intolerant patients, Resveratrol & its availability in various combinations is proved to be safe & well tolerated option. Initial use for 15 days, in doses of 1 tablet twice a day after that for next 15 days 1 tablet once a day has shown Within 30 days a reduction in serum insulin levels especially PP insulin levels. If combined with other dietary precautions then the response is even better.

Finding also suggests when Resveratrol is combined with other ingredients like ALA, Vitamin B1, B6, B12, folic acid & Chromium Polynicotinate, it works even better at the level of insulin resistance, metabolic balance and bringing homocysteine level in check, whereas Myo-inositol and D chiro inositol on the other hand balances excess androgen prolactin and sex hormone binding globulins (SHBG), it's found both these molecules are very effective in treating PCOD and for both, insulin dependent and non-insulin dependent patients. The benefits demonstrated by clinical research so far have involved myo-inositol in supplemental form rather than from food sources; it is also unlikely that food sources can supply high enough levels to achieve a therapeutic effect.

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# Comparison for Level Control of a Coupled-Tank using PI, PI-plus-Feedforward, and IMC Controllers

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DOI: 10.29322/IJSRP.8.8.2018.p80103

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80103>

**Abstract-** This paper investigates the performance of various control schemes for level control of a coupled tank process. The nonlinear dynamic model of the system was derived using the analytical and empirical approaches. To investigate the performance of the controllers, proportional plus integral control, proportional plus integral plus feedforward control and internal model control (IMC) have been proposed. The PI gains were determined using pole placement, Ciancone correlation, and Cohen-Coon tuning techniques. Time response specification and mean absolute error (MAE) are used to assess the level control performance of the designed controllers. Comparative MATLAB simulation assessments have shown that IMC with the least MAE value and fastest settling time has the best tracking performance as compared to other controllers.

**Index Terms-** coupled-tanks, Ciancone, Cohen-Coon, IMC, feedforward.

## I. INTRODUCTION

Liquid level control is an integral aspect of many industrial processes. Some of the notable areas where the level control is essential include petrochemical industries, power generation, water treatment plants and food processing among others. A typical level control can be seen in a storage tank, where the desired level of water or other products is controlled at a specific set point. The liquids are processed by mixing or chemical treatment in the tanks. In many cases, the tanks are often coupled together such that an interaction between the levels and flows exist. In addition, various sensors exist for measuring these levels such as capacitive type sensor, float sensor and differential pressure sensor [1-2].

For safety, cost implication and other issues, simulation of the open loop and closed loop response is designed and analyzed before implementing on the real system. However, a reliable model which represents the system behavior must be derived using either the analytical approach or the empirical method before conducting the simulation. Depending on the system, empirical approach is employed where the system is difficult to model. Though, some dynamics of the system are ignored using this approach [3-4].

Interestingly, many researchers have employed different control schemes, mainly feedback techniques for level control of a nonlinear coupled tanks system. These includes comparative study of various tuning methods [5-6] and PI controller [3-4]. However, due to its highly nonlinear behavior, single feedback control is not sufficient to achieve good performance. Hence, modified or advanced control techniques have been introduced such as hybrid genetic-immune PI tuning [1], sliding mode control [2], nonlinear backstepping control [7], feedforward plus sliding mode control [8], internal model control [9] etc.

In this paper, a comparison for pole placement, Cohen Coon and Ciancone based proportional plus integral (PI) control, PI-plus-feedforward control and internal model control (IMC) is presented. A coupled tank system is considered. The nonlinear dynamic model of the coupled tanks is derived using analytical and empirical approaches. The designed controllers were simulated in the MATLAB environment. The performances of the designed controllers are investigated in time domain based on the mean absolute error and time response specifications. These results will provide useful information for the selection of appropriate control strategy for efficient control of liquid level.

The paper is organized into seven sections. These are:

- 1) Abstract
- 2) Introduction
- 3) Description of the coupled-tank system
- 4) Mathematical modeling of the coupled-tank
- 5) Design of controllers
- 6) Implementation and discussions of results
- 7) Conclusions.

## II. THE COUPLED TANK SYSTEM

A lab scale coupled tank is one of the commonly used systems for control research and education at various institutions. Fig. 1 shows the schematic diagram of the coupled tanks considered for this study. As shown, it consists of a two-tank module with a pump connected to a water basin. The two tanks are configured such that the upper tank (tank 1) flows through an orifice outlet located at the bottom of the tank into the lower tank (tank 2). The outflow of the lower tank flows into the main water reservoir. The pump thrusts water upwards to the orifice “out1” before entering tank 1. The two tanks have identical parameters which are: tanks inside diameters ( $D_{t1} = D_{t2} = 4.445$  cm), orifice diameters ( $D_{o1} = D_{o2} = 0.47625$  cm), cross sectional areas ( $A_{t1} = A_{t2} = 15.5197$  cm<sup>2</sup>), outlet hole cross sectional areas ( $A_{o1} = A_{o2} = 0.1781$  cm<sup>2</sup>), pump constant ( $K_p = 3.3$  cm<sup>3</sup>/s/V), gravity ( $g = 981$  cm/s<sup>2</sup>), pump input voltage ( $V_p$ ) and water level in tanks ( $L_1$  and  $L_2$ ) in cm.

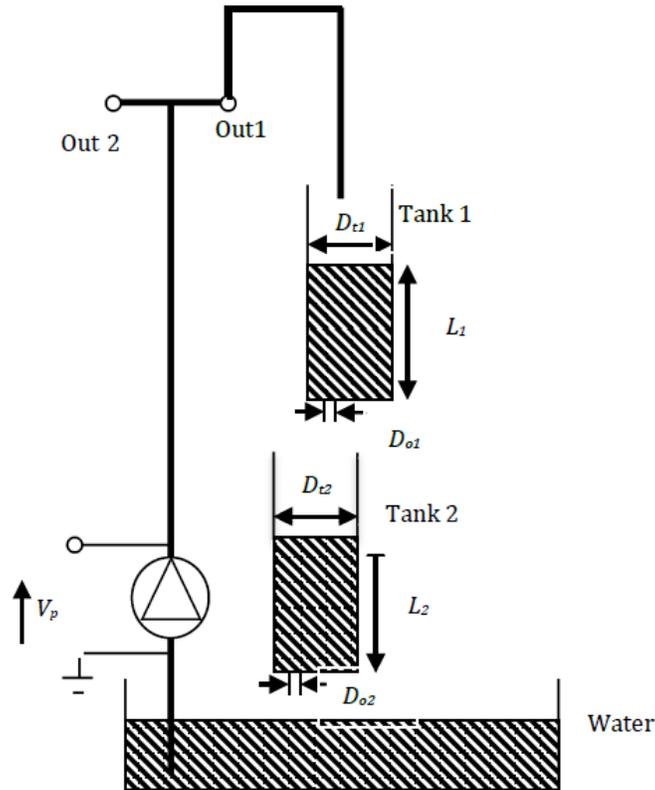


Fig. 1. Schematic diagram of coupled-tanks process.

## III. MODELING OF THE COUPLED TANKS

In this section, the modeling of the coupled tanks is presented using analytical and empirical methods. The pump voltage and the level in tank 2 are the input and output of the system respectively. The main target is to maintain the level of tank 2 at a particular set point. The nonlinear model of the coupled tanks is expressed based on the defined parameters of section II.

### A. The Analytical Model

By using the mass balanced law, the rate of change of the level in each tank can be obtained. The inflow to tank 1 can be expressed in Eq. 1 and by applying Bernouli’s law for flow through the orifice at the bottom of tank 1, the outflow rate is given in Eq. 2.

$$Q_1^{in}(t) = K_p V_p \quad (1)$$

$$Q_1^{out}(t) = A_{o1} \sqrt{2gL_1} \quad (2)$$

Similarly, the inflow flow to tank 2 is the same as the outflow from tank 1 as given in Eq. 3. Therefore, the dynamic model for the coupled tanks can be written in Eq. 4 and Eq. 5.

$$Q_2^{in}(t) = Q_1^{out}(t) \quad (3)$$

$$\frac{\partial L_1}{\partial t} = -\frac{A_{o1}}{A_{t1}} \sqrt{2gL_1} + \frac{K_p}{A_{t1}} V_p \quad (4)$$

$$\frac{\partial L_2}{\partial t} = \frac{A_{o1}}{A_{t2}} \sqrt{2gL_1} - \frac{A_{o2}}{A_{t2}} \sqrt{2gL_2} \quad (5)$$

where the cross-sectional area of tank 1 and its outlet hole (similar representation as tank 2) are given as in Eq. 6.

$$A_{o1} = \frac{1}{4} \pi D_{o1}^2 ; A_{t1} = \frac{1}{4} \pi D_{o1}^2 \quad (6)$$

Due to the square roots function of  $L_1$  and  $L_2$  of Eq. 4 and 5, the two first order equations are nonlinear. In order to design a linear controller, the equations should be linearized about an operating point. A Taylor's series approximation is utilized for the linearization as in Eq. 7. The approximate square root of  $L_1$  about an operating point ( $L_{10}$ ) of tank 1 and  $L_{20}$  for tank 2 can be obtained as in Eq. 8. Thus, the nonlinear models of Eq. 4 and 5 can be linearized into Eq. 9 and Eq. 10.

$$f(x) = f(x_0) + (x - x_0) f'(x_0) + \dots \quad (7)$$

$$\sqrt{L_1} = L_{10} + \frac{1}{2} L_{10}^{-1/2} (L_1 - L_{10}) ; \sqrt{L_2} = L_{20} + \frac{1}{2} L_{20}^{-1/2} (L_2 - L_{20}) \quad (8)$$

$$\frac{\partial \tilde{L}_1}{\partial t} = -\frac{A_{o1}}{A_{t1}} \sqrt{\frac{g}{2L_{10}}} \tilde{L}_1 + \frac{K_p}{A_{t1}} \tilde{V}_p \quad (9)$$

$$\frac{\partial \tilde{L}_2}{\partial t} = \frac{A_{o1}}{A_{t2}} \sqrt{\frac{g}{2L_{10}}} \tilde{L}_1 - \frac{A_{o2}}{A_{t2}} \sqrt{\frac{g}{2L_{20}}} \tilde{L}_2 \quad (10)$$

$$\tilde{L}_1 = L_1 - L_{10} ; \tilde{L}_2 = L_2 - L_{20} ; \tilde{V}_p = V_p - V_{pss} \quad (11)$$

Since the parameters of tank 1 and tank 2 are the same,  $L_{10} = L_{20}$ . In this study, the operating level is assumed to be 15 cm. To determine the steady state pump voltage ( $V_{pss}$ ) that yields a steady state level ( $L_{10}$ ) in tank 1, the left-hand side of Eq. (9) is set to zero as obtained in Eq. 12.

$$\tilde{V}_{pss} = \frac{A_{o1}}{K_p} \sqrt{2gL_{10}} = 9.26V \quad (12)$$

The state space representation for the system and the transfer function of tank 1 and tank 2 of the system with respect to the input voltage using the system parameters can be respectively obtained Eq. 13 and Eq. 14.

$$A = \begin{bmatrix} -0.0656 & 0 \\ 0.0656 & -0.0656 \end{bmatrix} ; B = \begin{bmatrix} 0.2127 \\ 0 \end{bmatrix} ; C = [0 \ 1] ; D = [0] \quad (13)$$

$$G_1(s) = \frac{\tilde{L}_1}{\tilde{V}_p} = \frac{3.24}{15.24s + 1} ; G_2(s) = \frac{\tilde{L}_2}{\tilde{L}_1} = \frac{1}{15.24s + 1} \quad (14)$$

### B. The Empirical model

To obtain the dynamic model using the empirical approach, a steady state pump voltage is applied to the nonlinear dynamic models represented in Fig. 2. The output response of level in tank 2 is monitored. Note that before applying the empirical analysis, the following steps should be followed.

- 1) The process must be at steady state initially,
- 2) A step change is applied to the process as an input set point,
- 3) Finally, the process must attain a steady state for the applied set point input.

The empirical model is generally represented as first order system expressed in Eq. 15, where  $\tau$  is the time constant,  $\theta$  is the dead time and  $K_p$  is the process gain represented in Eq. 16.

$$G_p(s) = \frac{K_p e^{-\theta s}}{\tau s + 1} \quad (15)$$

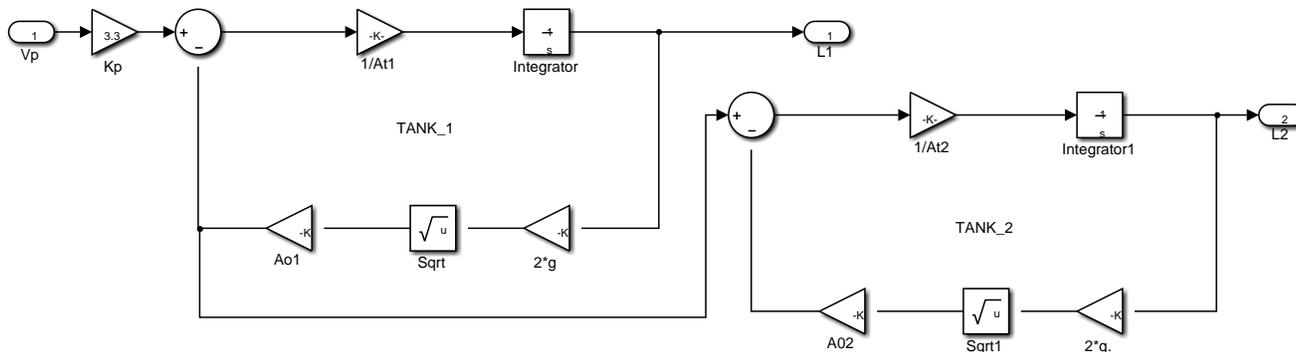


Fig. 2. Simulink block for the nonlinear coupled tank model.

$$K_p = \frac{\Delta L_2}{\Delta V_p} ; \tau = 1.5(t_{63\%} - t_{28\%}) ; \theta = t_{63\%} - \tau \tag{16}$$

where  $\Delta L_2$  is the change of output level in tank 2,  $\Delta V_p$  is the change of input voltage,  $t_{63\%}$  and  $t_{28\%}$  are the time taken by the response to reach 63% and 28% of the final settled value respectively. By using the output response of the tanks, the parameters of Eq. 16 can be obtained and hence, Eq. 15 can express as the empirical model of the coupled tanks as in Eq. 17.

$$G_p(s) = \frac{1.62e^{-2.2s}}{22.82s + 1} \tag{17}$$

#### IV. CONTROL DESIGN

In this section, various control strategies are presented. These include pole placement based proportional plus integral (PI) control, PI-plus-feedforward control and internal IMC control. To design a control scheme, the system must be controllable. To check for the controllability of the system, the determinant of the controllability matrix ( $G^c$ ) must be nonsingular [10]. Thus, using Eq. 13, the controllability can be obtained as in Eq. 18.

$$G^c = [B \ AB] = \begin{bmatrix} 0.2127 & -0.0139 \\ 0 & 0.0139 \end{bmatrix} \Rightarrow |G^c| \neq 0 \tag{18}$$

Therefore, the system is controllable and the proposed controllers can be designed. To simplify the control design, a constant flow is assumed from tank 1, thus, the steady state level of tank 1 is considered as the set point to tank 2.

##### A. Pole placement-based PI controller

The PID control families are most widely used control techniques in the industries due to their design simplicity and applicability to many processes. The proportional gain increases the system responses and improved the closed loop stability. However, it leaves a trace of an offset error and large proportional gain lead to instability of the system. The integral gain clears the steady state offset but larger integral time delayed the settling time of the process. In the presence of overshoots, the derivative gain is added to control. Though, it amplifies noise for noisy systems. Therefore, appropriate selection of the control depends on the system dynamics. For any of the PID controls, the error value is calculated by taking the difference between the set-point and the measured controlled variable. The control tries to make the as close to zero as possible.

To design pole placement control for tank 2, certain design specifications must be outline. In this work, percentage overshoot (PO) of 10% and settling time (ts) of 20 s are considered. Consider a standard feedback characteristics equation with negligible sensor and valve dynamics given in Eq. 19, where  $G_p(s)$  is the plant transfer function and  $G_c(s)$  is controller given in Eq. 20.

$$1 + G_c(s)G_p(s) \tag{19}$$

$$G_c(s) = K_c + \frac{K_i}{s} \tag{20}$$

where  $K_c$  is the proportional gain and  $K_i$  is the integral gain. Thus, substituting for Eq. 14 and Eq. 20 in Eq. 19 yields the characteristics equation in Eq. 21.

$$s^2 + \frac{(1 + K_p K_c)}{\tau} s + \frac{K_i K_p}{\tau} \tag{21}$$

In addition, consider the standard second order characteristic equation given in Eq. 22, where  $\zeta$  is the damping ratio and  $\omega_n$  is the natural frequency of the plant as in /

$$s^2 + 2\zeta\omega_n s + \omega_n^2 \tag{22}$$

$$\zeta = \frac{\left| \ln \frac{1}{100} PO \right|}{\sqrt{\left( \ln \frac{1}{100} PO \right)^2 + \pi^2}} ; \omega_n = \frac{4}{\zeta \tau_s} \tag{23}$$

Finally, comparing Eq. 21 and Eq. 22 yields the PI control gains in Eq. 24 and by substituting the design specifications in Eq. 23 and solving for Eq. 24 gives the control gains as in Eq. 25.

$$K_c = \frac{(2\zeta\omega_n\tau - 1)}{K_p} ; K_i = \frac{\omega_n^2\tau}{K_p} \tag{24}$$

$$K_c = 5.1 ; K_i = 1.7 \tag{25}$$

**B. Cohen-Coon PID Tuning**

In this type of control gains tuning, an open loop response is considered. As an empirical approach, similar procedures as outline above are followed. The Cohen – Coon formulations requires process with dead time as shown in Table I [11]. In this work, PI gains are considered and based on the open loop response of Eq. 17 and using the Table I formulations, the PI control gains are obtained as in Eq. 26.

TABLE I. COHEN COON TUNING FORMULATIONS

Type	$K_c$	$K_i$	$K_d$
P	$\left( \frac{\tau}{K_p\theta} \right) \left( 1 + \frac{\theta}{3\tau} \right)$	-	-
PI	$\left( \frac{\tau}{K_p\theta} \right) \left( 0.9 + \frac{\theta}{12\tau} \right)$	$\theta \left( \frac{30 + \frac{3\theta}{\tau}}{9 + \frac{20\theta}{\tau}} \right)$	-
PID	$\left( \frac{\tau}{K_p\theta} \right) \left( \frac{4}{3} + \frac{\theta}{4\tau} \right)$	$\theta \left( \frac{32 + \frac{6\theta}{\tau}}{13 + \frac{8\theta}{\tau}} \right)$	$\theta \left( \frac{4}{11 + \frac{2\theta}{\tau}} \right)$

$$K_c = 4.06 ; K_i = 7.75 \tag{26}$$

**C. Ciancone correlation-based PI controller**

Ciancone based tuning is also an empirical method and it is applied to processes with dead time using the Ciancone correlation graph. The aforementioned steps for the empirical model analysis are also followed for this tuning as well. By using the parameters of Eq. 17, the fraction dead time is obtained as in Eq. 27 and by tracing the value of Eq. 27 on the Ciancone correlation graph yields the PI control gains as in Eq. 28.

$$\frac{\theta}{(\theta + \tau)} \tag{27}$$

$$K_c = 0.9259 ; K_i = 18.51 \tag{28}$$

**D. PI plus Feedforward control**

Feedback plus feedforward technique is one of the advance control schemes commonly used in the process industries. This scheme significantly improves the performance of a process in the presence of a measured disturbance. The feedback control takes care of the measured variable with respect to the set point while the feedforward eliminates the effect of external disturbance to the process. In this study, the out flow from tank 1 is considered as the disturbance to tank 2. Thus, the feedforward control can be obtained by solving tank 2 nonlinear model of Eq. 10 at static equilibrium. Hence, the feedforward control gain can be obtained as in Eq. 29.

$$K_{ff}(s) = \frac{A_{o2}}{A_{o1}} = 1 \tag{29}$$

*E. Internal Model Controller (IMC)*

The main idea of IMC scheme is to obtain a good closed loop response from the open loop dynamic model. The internal model law states that acceptable control can be achieved if and only if the closed loop control encapsulates some dynamics of the process. Thus, the controller depends on the accuracy of the derived model, because the controller would have the inverse dynamics of the plant in order to perfectly track the reference input [12]. Fig. 3 shows the general block diagram of an IMC scheme. The IMC design is in two phases. First, the process model ( $G_m$ ) is factored into the invertible part ( $G_{m-}$ ) and the non-invertible part ( $G_{m+}$ ). The  $G_{m+}$  contains the time delays and the right half plane zeros. The controller ( $G_c$ ) is given in Eq. 29, where  $G_f$  is a low pass filter with the general form shown in Eq. 30 for  $N$  represents the order of the model in order to get a perfect poles zero cancellation,  $\tau_c$  is the controller time constant which is the critical design parameter of IMC scheme. Depending upon the system, the filter time constant can have the value of the dead time of the system. After block reduction technique, the closed loop controller ( $G_{cc}$ ) can be expressed in Eq. 31 with negligible valve dynamics ( $G_v \approx 0$ ).

$$G_c(s) = \frac{G_f(s)}{G_{m-}} \tag{29}$$

$$G_f(s) = \frac{1}{(\tau_c s + 1)^N} \tag{30}$$

$$G_{cc}(s) = \frac{G_c(s)}{1 - G_c(s)G_m(s)} \tag{31}$$

By applying Pade approximation of the dead time, Eq. 17 can express in terms of PID control gains known as IMC-PID based tuning as shown in Table II.

TABLE II. IMC-PID BASED TUNING RULES

Type	$K_p K_c$	$K_i$	$K_d$
PI	$\frac{\tau}{\tau_c}$	$\tau$	-

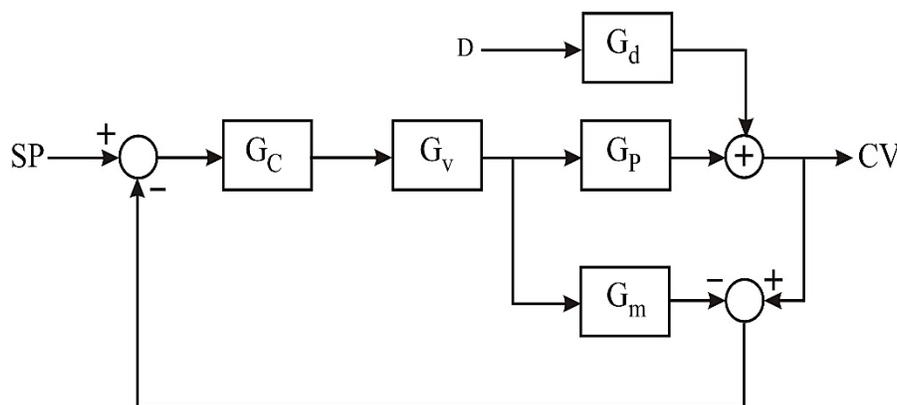


Fig. 3. Block diagram of IMC scheme

V. IMPLEMENTATION OF RESULTS AND DISCUSSIONS

In this section, MATLAB simulation analysis of the results from the designed controllers on a coupled tank process is presented. A reference level starting from zero position to settle at 15 cm and then decrease to 10 cm is used as the tracking indices for the controllers. Fig. 4(a) shows the comparison of the nonlinear model, empirical and linearized model subjected to an input voltage. It can be observed that the empirical model represents the system more closely. Fig. 4(b) shows the set-point tracking performance for

the PI controller tuned using pole placement, Ciancone correlation and Cohen-Coon methods. It can be seen that Cohen-Coon correlation gives the best performance in terms of least maximum overshoot and fast settling time while Pole placement demonstrated faster response and settling time but with higher overshoot. However, Ciancone has the poorest performance in terms of response time. In addition, comparing the best feedback control with the PI plus feedforward based on Cohen-Coon shows that adding the feedforward action improves the tracking performance of the of the single PI control as shown in Fig. 5(a). Also, Fig. 6(b) shows the comparison of IMC-PI based on the PI plus feedforward control schemes. The summary of the time response specifications and MAE values for all the controllers are shown in Table III. The smaller the MAE value, the better the controller, it is noted that IMC as the advance technique gives the best tacking performance as compared to the remaining designed controllers.

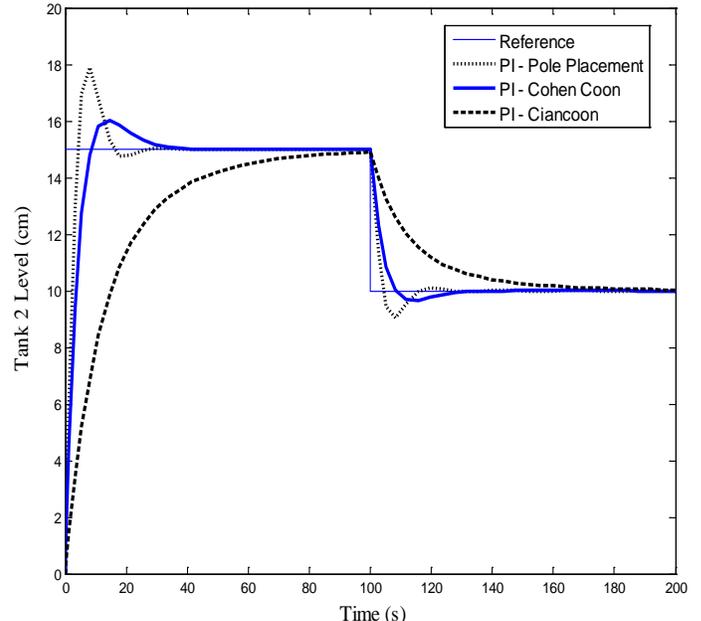
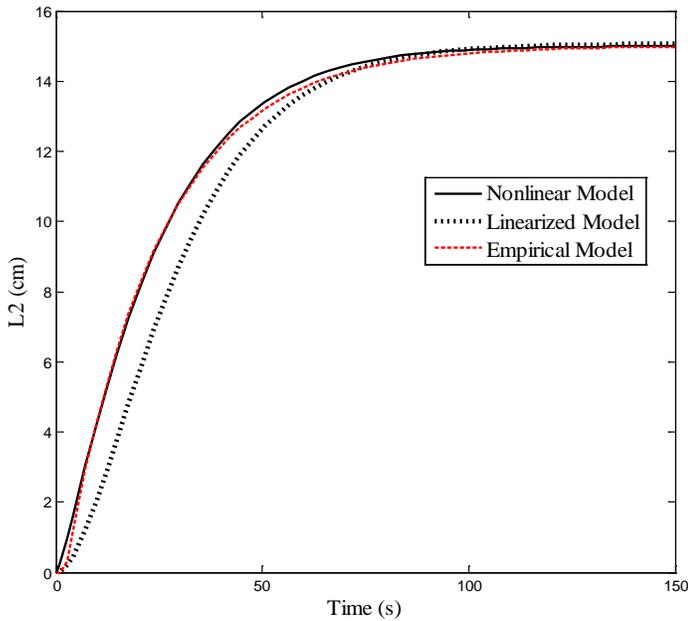


Fig. 4: (a) Open loop response of the tank 2 level (b) Comparison for PI level control using Pole placement, Cohen Coon and Ciancone tunings

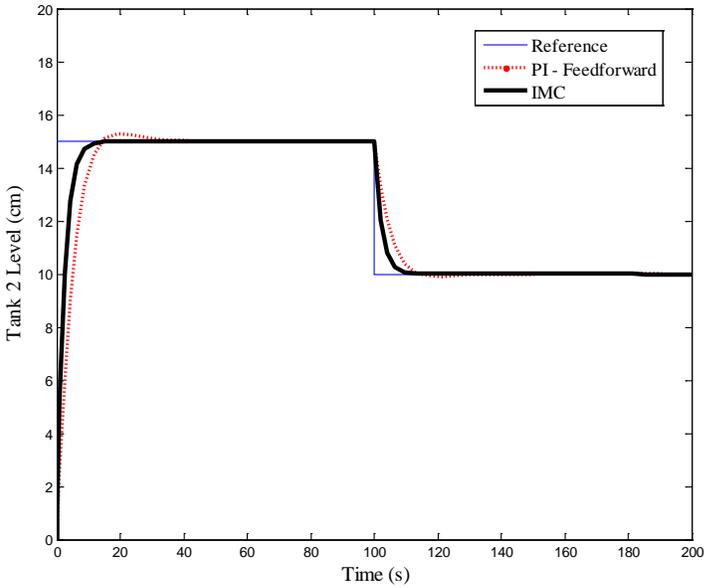
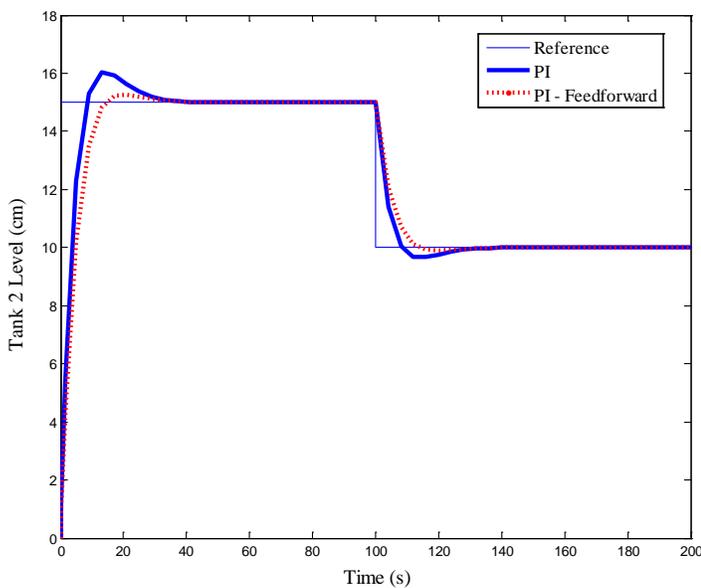


Fig. 5: (a) Comparison for PI and PI plus feedforward level controllers (b) Comparison for PI plus feedforward with IMC scheme for level control

TABLE III. PERFORMANCE ANALYSIS OF THE CONTROLLERS

Controller	Settling Time (s)	Max. Overshoot (%)	MAE Value
PI-Pole Placement	30	20%	2.50
PI-Ciancone	100	0	3.65
PI-Cohen Coon	33	7%	2.70
PI plus Feedforward	29	3%	2.61
IMC	12	0	2.40

## VI. CONCLUSION

Investigations into level control techniques for a coupled tank process using the PI controller, PI plus feedforward and IMC scheme have been presented. The nonlinear dynamic model of the system was derived using the analytical and empirical approaches. Simulations of the dynamic model of a coupled tank have been performed to study the effectiveness of the controllers. The results of the proposed controllers showed a significant tracking performance using all the controllers. The performances of the controllers demonstrated that IMC scheme provides the best level tracking followed by PI plus feedforward control as compared to the single PI controller.

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# Investigation on the Anti-diabetic Activity of *Sphenostylis stenocarpa* Seed Milk Extract in Alloxan-induced Diabetes Rats

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DOI: 10.29322/IJSRP.8.8.2018.p80104

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80104>

**Abstract-** Diabetes mellitus is a chronic metabolic disease that is associated with abnormal metabolism of carbohydrates, proteins and fat. It is usually associated with excretion of excess sweet urine known as glycosuria. This study investigated the anti-diabetic activity of seed milk extract in Alloxan-induced diabetic rats. The seed milk extract at a concentration of 100, 200, 300 and 400 mg/kg body weight were orally administered to alloxan-induced diabetic rats for a period of fifteen (15) days. The oral glucose tolerance test was also carried out using animal experimental method. The phytochemical analysis of the milk extract revealed the presence of flavonoids, isoflavones, saponin, tannin, phytosterol, lignin and anthocyanidine at moderate concentrations. The acute toxicity test showed no lethality *Sphenostylis stenocarpa* seed milk up to a concentration of 5000 kg/body weight. In oral glucose tolerant test, the *S. Stenocarpa* seed milk extract exerted the highest response, similar to glibenclamide after 15 minutes and 30 minutes of administration compared with the control. The *S. Stenocarpa* seed milk extract recorded the highest blood glucose-lowering effect after day 15 of treatment ( $p < 0.05$ ) compared with the diabetic rats that were administered normal saline and 0.3 mg/kg body weight of glibenclamide. The seed milk extract of *S. Stenocarpa* possessed anti-diabetic activity like the reference drug glibenclamide, and the results of this study revealed that the graded doses of the seed milk extract have blood glucose-lowering effect in a time and concentration-dependent manner.

**Index Terms-** glycosuria, diabetes, phytochemicals, metabolism, phytosterol, alloxan

## I. INTRODUCTION

Diabetes mellitus is a metabolic disorder which is associated excess sweet urine known as glycosuria. The nature of diabetes attack and how it predisposes the body system to the attacks of other diseases made it to be known in medical parlance as “gate opener”. The world health organisation (WHO 2008) estimates that about 171 million people worldwide are suffering from diabetes mellitus and that this Figure will double

by the year 2030. Diabetes mellitus is characterized by recurrent/persistent hyperglycaemia (Suzanne *et al.*, 2010). Chemotherapy remained the only resort of diabetes control. However, most anti-diabetes drugs are not just costly, but always go with high levels of drug toxicity. The phobia generated by chemotherapeutic toxicity has paved way for alternative drugs of plant origin. Hence, the choice of *Sphenostylis stenocarpa* seed milk for anti-diabetes study. African yam bean (AYB) *Sphenostylis stenocarpa* is a tropical grain legume that Originated in Ethiopia, East Africa – (GRIN, 2009). Both the wild and cultivated types now occur in tropical Africa as far as Zimbabwe, throughout West Africa as from Guinea to Southern Nigeria. African yam bean is grown in West Africa particularly in Cameroun, Cote’d Ivore, Ghana, Nigeria and Togo (Potter, 1992). However, extensive cultivation of this legume has been reported in the Eastern Southern, and Western Nigeria (Abbey and Berezi, 1998; Ojiakor, *et al.*, 2010). African yam bean is an underutilized/orphan tropical climbing, vine-like tuberous legume (Obatule *et al.*, 2001), which has attracted research in recent times. This study was therefore designed to investigate the anti-diabetic effects of the seed milk extract of *Sphenostylis stenocarpa* and glibenclamide treatment on alloxan-induced diabetic rats.

## II. MATERIALS AND METHODS

### Seed Collection, Identification and Preparation

The harvested seeds of *Sphenostylis stenocarpa* (African yam bean) were purchased from Ogige Market, Nsukka Enugu State, Eastern Nigeria. The seeds were identified and authenticated by Mr. Alfred Ozioko and Prof. M.I. Uguru, both of Centre for Ethnomedicine Drug Development (BDGP) and Crop Agronomy Department of the University of Nigeria Nsukka respectively. The seeds were washed with normal saline and oven-dried. They were roasted at 30- 50°C, de-shelled for milk-making extraction.

### Extraction of AYB Seed milk

Five hundred grammes (500 g) seeds of AYB was roasted using frying pan for 50 minutes at 30-50°C and were de-shelled when hot. The seed cotyledons were ground and sieved with fine-pored silk, and made in to milk by mixing and homogenizing in the ratio of 1:5 v/v of the flour/ de-ionized water. The prepared milk was used immediately for its storage always result to contamination and auto-oxidation of the labile substances.

The physicochemical properties of the milk were determined using both the sensory method and the use of instruments (AOAC, 2006). The colour and aroma of the oil were sensorily determined as described by Ihekoronye and Ngoddy, 1985. Chemical Properties

### Physicochemical analysis of the Milk

Twenty panellists invited from the Department of Food Science and Technology, University of Nigeria, Nsukka conducted the sensory analysis of the extract. The chemical properties was conducted by titration for acid value, and pH with pH metre (Jenway, 3505) and the presence of minerals was carried out using Atomic absorption spectrometer (AAS)(NARICT, Zaria) Nigeria.

### Proximate Analysis of the Milk

The crude lipid was extracted using petroleum ether as solvent in a soxhlet apparatus and ash content (gravimetric by AOAC. The total carbohydrate was calculated by the difference method (sum of crude protein, ash, moisture and crude fat petroleum ether extract) minus the sum from 100). The moisture contents of the milk were determined after drying at 105 °C. The microkjeldahl method was also used to determine the total nitrogen and crude protein (m x 5.95). Nitrogen free extract (NEF) was calculated by difference as NFE total (CHO)<sub>n</sub> – crude fibre.

### Animal Protocol

#### Purchase of Animals

Thirty five (35) male albino rats weighing 100 – 180 g were used for the study, the rats were obtained from the College of Veterinary Medicine, University of Nigeria, Nsukka, Enugu state, Nigeria. They were acclimatized for Fourteen days in the animal house of Department of Biochemistry, and were given regular feed (grower' mash) Vital Feeds Nigeria Ltd, Jos, Nigeria and water *ad libitum*. This occurred under standard environmental conditions with a 12- hour light/dark cycle maintained.

### Experimental Design

Thirty five (35) male albino rats weighing 180-220 grammes were used for the study; the rats were obtained from the faculty of Veterinary Medicine, University of Nigeria, Nsukka, Nigeria. The rats were divided into seven groups with five animals per group, and different treatments administered to each group; Group I: Non- diabetic control (not induced).

Group II: Alloxan- induced diabetic rats administered 0.3 ml of normal saline.

Group III: Alloxan-induced diabetic rats administered with 0.3 mg/kg body weight of glibenclamide.

Group IV: Alloxan-induced diabetic rats administered 100 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract.

Group V: Alloxan-induced diabetic rats administered 200 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract.

Group VI: Alloxan-induced diabetic rats administered 300 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract.

Group VII: Alloxan-induced diabetic rats administered 400 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract.

### Drug Preparation

Glibenclamide (Hovid, Ipoh Malaysia, Batch No. VUDIA 11 – 0, 5mg) was purchased from a pharmaceutical shop in Nsukka, Enugu State, Nigeria. The Tablets were finely powdered, suspended in a normal saline and was filtered using a Buchner funnel and whatman no 1 filter paper at a concentration of 5mg/ml and was administered at 50mg/kg body weight.

### Induction of Diabetes

Alloxan diabetic rat were prepared by adopting the method of Saidu *et al.*, (2011). All rats, except the Normal control group were intraperitoneally injected with 120 mg/kg body weight of the prepared Alloxan. After 6 hours of alloxan administration, rats in their cages were then allowed 10% glucose solution for the next 24 hours in order to prevent alloxan-induced hypoglycaemia. The animals were observed for polydipsia, polyuria, polyphagia as well as general reduction of body weight. Seventy two hours after the alloxan administration, the animals were fasted overnight and diabetes was confirmed by measuring fasting blood glucose level with the aid of a Glucometer (ACCU – Check, Active Roche Diagnostics). Only rats that have fasting blood glucose level > 7.0 mmol/l (126 mg/dl) were considered and included in the study (Saidu *et al.*, 2011).

### Animal Treatment

The experimental animals were treated in four different groups for 15 days. Group 111 was treated with the standard drug (Glibenclamide) while groups 1V, V, VI and VII were treated with African yam bean milk of 100 mg/kg b.w, 200 mg/kg b.w, 300 mg/kg b.w, and 400 mg/kg b.w. dosage respectively, twice daily. The mean blood glucose levels in the animals were measured 72 hours after the drug administration by tail tapping using Glucometer (ACCU–Check, Active Roche Diagnostics).the experimental animals were treated with the standard drugs and the AYB milk by oral administration for 15 days and their mean blood sugar were recorded group- wise.

### Glucose Level Determination

#### Procedure

- The coding chip of the corresponding test strips to be used was inserted into the Accu–check glucometer.
- The area of the tail to be pricked was cleaned with swab containing methylated spirit and then pricked with a lancet.
- The next step is the insertion of the test strip in to the glucometer.
- A time, 2 – 4 minutes should be used for the activation of the strip in the glucometer after which, the blood sample was then dropped on the test area of the strip and the result displayed on the glucometer screen was recorded.

### Glucose Profile Study

Glucose profile studies were conducted with alloxan-induced diabetic rats using the method of Atangwho *et al.*, (2013) with modification.

### Oral Glucose Tolerance Test

The method, dosage of extract and the glibenclamide and animal groupings in this study were as described in the experimental design. Also, the rats had glucose administered orally at a concentration of (2 g/kg body weight) 30 minutes after dosing, and blood samples were obtained by tail puncture at time zero (0) before glucose dosing and at 15, 30, 45, 60, 90, and 120 minutes after glucose administration to measure the glucose level.

### Acute Anti-hyperglycaemic Study

Glucose profile studies were conducted with diabetic rats, in the study, six groups of alloxan-induced diabetic rats were treated as follows: group 2 received 0.3 ml normal saline, group 3 received 0.3 mg/kg body weight of glibenclamide, group 3 received 100 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract, group 4 received 200 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract, group 5 received 300 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract, group 6 received 400 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract, and group 1 served as the normal control group. The normal saline and glibenclamide were administered in doses per day during the period of the study. Fasting blood glucose was measured on day 0 (baseline), 3, 6, 9, 12, and 15<sup>th</sup> day. At the end of the study, the animals were sacrificed and buried. The ACCU – Check, Active Roche Diagnostics glucometer was used to measure the glucose level with compatible strip.

### III. RESULTS

The Seed milk extract of *Sphenostylis stenocarpa* was homogenized with de-ionized water in an electric blender (Nakai-462) China and used. The extract yield was observed to be 1.0 kg (33.3%).

In the experiment, there was no lethality or behavioural changes in the three groups of the mice that received 10, 100, and 1000 mg/kg body weight of the extract at the end of the first experiment. Based on this result, further increased doses of 1900, 2600 and 5000 mg/kg body weight of the extract showed that no death case was observed within 72 hours of administration. This result showed that the extract was safe at dose above 5000 kg body weight.

Physical Properties of African Yam Bean (AYB) Seed Milk (Table 1) shows that AYB was milk coloured, aroma 5.8 and overall acceptability was 6.8. Chemical Properties of AYB Seed Milk (Table 2) showed that AYB had a Titrable acidity of 25.24 and a pH of 4.76. The result of proximate analysis of AYB seed milk revealed the following: fibre (9.24 ± 0.18), carbohydrates (60.26 ± 1.02%), moisture (5.02 ± 2.04%), ash (3.40 ± 0.04%), crude protein (19.24 ± 0.06%), and lipids (2.84 ± 0.14%) (Table 3).

The qualitative phytochemical analysis as observed in Table 4 showed moderate presence of compounds such as isoflavones, flavonoids and saponin, while anthocyanidines, phytosterol, lignin and tannins were low in the sample.

The results of the effect of *Sphenostylis stenocarpa* seed milk extract and glibenclamide on oral glucose tolerance in non-diabetic rat was shown in Figure 1. The measured fasting blood glucose level reached its peak at 15 minutes after oral

administration of glucose. Animals administered 2 g/kg body weight of glucose and 0.3 mg/kg body weight of glibenclamide had the highest significant (p < 0.05) reduction of fasting blood glucose concentration and sustained throughout all the measured time compared to the glucose level of other treatment groups. The animals administered 2 g/kg body weight of glucose and 100 mg/kg body weight of *Sphenostylis stenocarpa* seed milk extract showed significant (p < 0.05) decrease in blood glucose level 30 minutes from treatment compared to glucose level after 15 minutes of treatment, and also showed significant (p < 0.05) reduction in glucose after 45, 60, 90 and 120 minutes respectively compared to glucose level after 30 minutes of treatment. The animals administered 2 g/kg body weight of glucose and 0.03 ml of normal saline showed significant (p < 0.05) decrease in glucose level after 30 minutes compared to glucose level after 15 minutes and showed significant (p < 0.05) increase in glucose level after 60 minutes from treatment. The effect of *Sphenostylis stenocarpa* seed milk extract on glucose level of alloxan induced diabetic rats is shown in Figure 2. All animals induced with 150 mg/kg body weight of alloxan monohydrate showed significant (p < 0.05) increase in blood glucose level on day 0. Animals induced and treated with normal saline showed significant (p < 0.05) reduction in blood glucose level on day 3, 6, 9, 12, and 15 respectively.

**Table 1 Physical Properties of African Yam Bean (AYB) Seed Milk**

Colour	milk colour
Aroma	5.8
Taste	6.4
Mouth feel	6.2
Overall acceptability	6.8

**Table 2 Chemical Properties of AYB Seed Milk**

Parameters	Results
Titration acidity	25.24
pH	4.76
Ca	0.12605 ppm
Fe	0.05605 ppm
Cu	0.0009 ppm
Pb and Cd	Not Detected

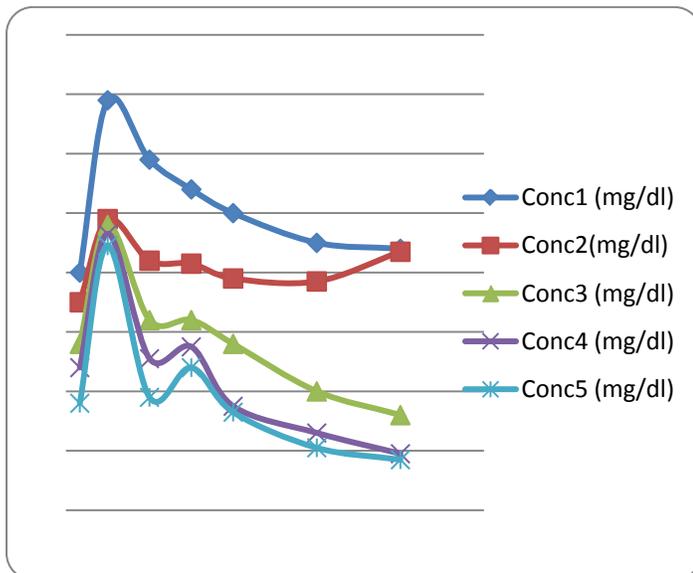
**Table 3 Proximate Composition of AYB Milk**

S/No.	Nutrient	Relative abundance (%)
1	Carbohydrates	60.26 ± 1.02
2	Crude Protein	19.94 ± 0.06
3	Lipids	2.84 ± 0.14
4	Crude Fibre	9.24 ± 0.18
5	Ash	3.0 ± 0.04

**Table 4 Phytochemical Analysis of AYB Milk**

Parameters	Relative abundance (mg/100ml)	abundance
Isoflavones	++	
Anthocyanides	+	
Flavonoids	++	
Saponins	++	
Phytosterol	+	
Lignin	+	
Tannins	+	

KEY: +: Low present: ++: moderate present.



Group 1 = Normal control  
 Group 2 = 0.3 ml of Normal saline  
 Group 3 = 0.3 mg/kg of Glibenclamide  
 Group 4 = 100 mg/kg b.w. of seed milk extract  
 Group 5 = 200 mg/kg b.w. of seed milk extract  
 Group 6 = 300 mg/kg b.w. of seed milk extract  
 Group 7 = 400 mg/kg b.w. of seed milk extract

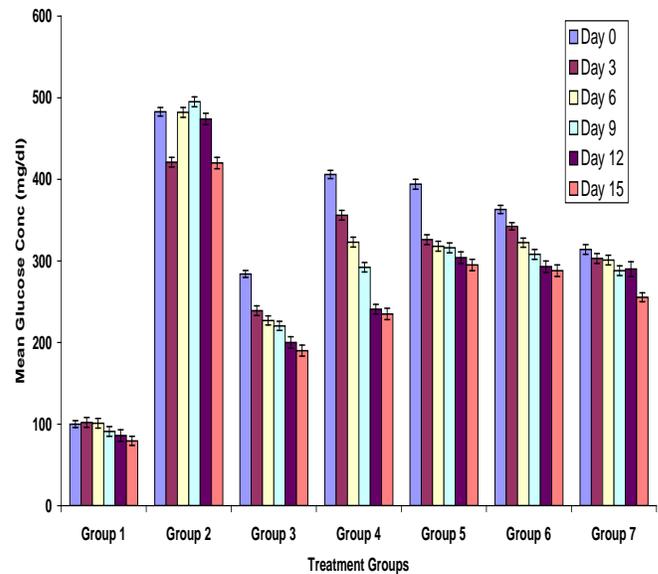


Fig 1: The effect of *Sphenostylis stenocarpa* milk extract on blood glucose concentration of alloxan-induced-diabetic rats

Group 1 = Normal control  
 Group 2 = 0.3 ml of Normal saline  
 Group 3 = 0.3 mg/kg of Glibenclamide  
 Group 4 = 100 mg/kg b.w. of seed milk extract  
 Group 5 = 200 mg/kg b.w. of seed milk extract  
 Group 6 = 300 mg/kg b.w. of seed milk extract  
 Group 7 = 400 mg/kg b.w. of seed milk extract

#### IV. DISCUSSION

The results of this study indicate that seed milk extract of *Sphenostylis stenocarpa* significantly reduced blood glucose levels in alloxan-induced diabetes animals. The physical properties showed that the colour was milk colour, and other parameters that were sensorily tested by 20 panelists invited from the Department of Food Science and Technology who scored the following; aroma- 5.80, taste -6.40, mouth feel-6.20 and overall acceptability-6.80. The results above was in agreement with work of Akubor, 1998, on physicochemical and sensory Characteristics of melon seed milk; Belewa, Belewa and Olatunji, 2005 on Soy- Coconut milk preparation; Mordi *et al.*, 2010 on physicochemical and sensory evaluation of Nigerian Tiger nuts and Nnam, 2003 who worked on the physicochemical properties of Tigernut-soy milk. Chemically, the titraTable acidity of the AYB milk is 25.244 and a pH of 4.76. These agree with the work of Nnam, 2003 who also worked on the physicochemical properties of Tigernut-Soy milk mixture. Also, the atomic absorption spectroscopy (AAS) gave us the results of Ca-0.1260 Ppm, Fe-0.05605 Ppm and Cu-0.0009 Ppm as the heavy metals Pb and Cd were not detected. Certainly, the above made the researchers convinced that the works of Uguru and Madukaife, 2001; Azeke *et al.*, 2005; Dhingra and Jood, 2005; as well as Uche, *et al.*, 2014 on the nutritional qualities of this legume seeds gave the seeds the novel properties that made the legume a potential but latent nutraceutical. The cultivation and uses of seeds and tubers of the African yam bean (AYB) was

worked on and reported by Klu *et al.*, 2001 ; Azeke, *et al.*, 2005; and Dhingra and Jood, 2005. Uguru and Madukaife, 2001 reported on the nutritional evaluation of AYB and proved it as a novel food. Abbey and Berezi, 1998 showed that if well processed, AYB's digestibility will become increased. The chemical composition of AYB were worked on and reported by Edem, Amugo and Eka, 1990, and by Ekpo, 2006, they collectively the abundance of novel amino acids, phytochemicals and good quality bioactive compounds. Also, Okigbo, (1973); Nwokolo, 1987 and Uguru and Madukaife, 2001, corroborated the work of Abbey and Berezi, 1998. Amoatey, 2001 reported on the processing of milk of AYB and in 2003, Nnam, reported that this legume is a good source of plant milk. The nutritional composition of AYB was also reported by Ene-Obong, in 1993, and in 2014, Uche *et al.*, reported the nutritional evaluation of this legume and suggested the prospect of using the legume to reduce the scourge of malnutrition in the Northern and Southern Nigeria, in some war-torn countries of sub-Saharan Africa and beyond. The rationale behind this is that *Sphenostylis stenocarpa* seed milk is anti-malnutrition. In Togo, Ghana and Nigeria, the lectin content of *Sphenostylis stenocarpa* seed is used as insecticide. The pastes made from the seeds are used as a cure for stomach ache/antacid. Also when this paste has water added to it, it becomes an anti-alcohol abuse (antabuse) which is natural unlike the drug disulfiram with its adverse drug reaction antecedents. (Asuzu, 1986). Enwere, 1998; Farinde and Omole, 2006 reported the use of *Sphenostylis stenocarpa* seed milk in the management of chronic diseases like diabetes mellitus, hypertension and other cardiovascular diseases because its dietary fibre content. Nwankwo and Ekeanyanwu, 2011 reported that the phytochemicals contained also in the *Sphenostylis stenocarpa* seed milk such as flavonoids, isoflavones, anthocyanides, saponins, phytosterols, and lignin have the potential health benefits functioning as anti-cancer, and heart disease, lower blood cholesterol, reduce risk of heart disease, anti-hypertensive, anti-diabetic, anti-osteoporosis as well as anti-inflammatory agent. Since *Sphenostylis stenocarpa* seed is a continental orphan legume which has the West Africans preferring the seeds to tubers, and the Easterners and Southerners relishing the tubers especially among the Bandudus, the Shabas and the tribe of Kinshasa in Democratic Republic of Congo. The FAO/WHO, (1991) have also reported the AYB amino acid profile to be higher than those in other legumes including soybean, and affirmed that this same amino acid profile compares favourably with whole hen's egg and met the organisations daily requirement of food. However, previous studies have shown that the phytochemicals like, polyphenols, flavonoids and tannins present in *Sphenostylis stenocarpa* seed milk are anti-diabetic Nwankwo and Ekeanyanwu, 2011. The result of this present study revealed that *Sphenostylis stenocarpa* seed milk has low glycaemic index, and may be the attribute that suggests its use in the management of diabetes mellitus.

#### V. Conclusion

The present study revealed that *Sphenostylis stenocarpa* seed milk has low glycaemic index, and may be the attribute that suggests its use in the management of diabetes mellitus.

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# Analysis on Guidance Laws Implementation based on Parallel Navigation Time Domain Scheme

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DOI: 10.29322/IJSRP.8.8.2018.p80105

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80105>

**Abstract**— How to develop a novel missile guidance law that can act effectively against very high speed incoming targets, such as ballistic missiles, has been a major concern in the defense technique. On the basis of this requirement, a new integrated proportional navigation guidance is developed in this research against very high-speed maneuverable targets on three-dimensional space. Proportional navigation (PN) has attracted a considerable amount of interest in the literature related to missile guidance and continues to be a benchmark for new missile guidance laws. The detailed analytical study of this empirical guidance law for nonmaneuvering and maneuvering targets was undertaken. Analysis of PN guidance for the homing stage was usually undertaken for nonmaneuvering targets assuming a constant closing velocity. The so-called augmented PN law and other modifications of the proportional navigation law were obtained based mostly on the relationships established for nonmaneuvering targets. However, any optimal guidance law assumes that the trajectory of a maneuvering target, as well as time-to-go and the intercept point, is known. In practice, such information is unknown and can only be evaluated approximately. The accuracy of prediction significantly influences the accuracy of the intercept. Taking into account that the PN law is a widely accepted guidance law and has been tested in practice, it is of interest to consider the possibility of its improvement.

**Keywords**—Guidance Law, Missile, MATLAB, Control System, Stability.

## INTRODUCTION

THE engagement of hypersonic ballistic targets has been the new challenges in the world. When a ballistic target reenters the atmosphere after having traveled a long distance, its speed is high and remaining time to ground impact is relatively short. It has been a known design philosophy that the best trajectory for a defense missile to intercept a

hypersonic target is called the nearly head-on [1, 2]. Under this setting, the interceptor can ultimately hit the target without resorting to huge lateral acceleration.

In the past, the guidance laws based on the above fundamental requirement were found to be efficient for the targets that are non-maneuverable, and an acceptable miss distance can be obtained. However, more and more new generation attacking targets possess higher speed and maneuverability. Under these situations, it is hard to track these targets by using classical guidance designs [3], since system performance sensitivity was rarely considered in the design procedure that usually caused an unacceptable miss distance. In addition, the missile-target dynamics are theoretically highly nonlinear partly because the equations of motion are best described in an inertial system, while aerodynamic forces and moments are represented in missile and target body axis system. Besides, un-modeled dynamics or parametric perturbations are usually remained in the plant modeling procedure, because of complexity of the nonlinear guidance design problem, prior approximations or simplifications were usually required before deriving the analytical guidance gains. Therefore, one does not know exactly what the true missile model is, and the missile behavior may change in unpredictable ways. Consequently, optimality of the resulting design cannot be ensured any more.

Several guidance design techniques such as linear quadratic regulator (LQR) [4], explicit guidance [5], modified proportional guidance [6] and geometric controls [7] have been previously proposed for the implementation of optimal midcourse or terminal guidance. In particular, linear quadratic regulator [2], modified explicit guidance [8] and neural networks [8, 9] have recently been applied to treat the ATBM

guidance design problem. However, solving the LQR problem or training the neural network in real time is often infeasible. Traditionally, midcourse guidance was often formulated as an optimal control problem to shape the trajectory to maximize the terminal energy or to minimize the flight time. However, the implementation of the optimal control midcourse guidance is very difficult since a nonlinear

two-point boundary value problem has to be solved to obtain the optimal trajectory [4]. The neural network guidance might also be unreliable in practice; if the network was not well trained, it usually sensibly interpolates input data that are new to the network [8, 9].

It is well known that fuzzy systems have the ability to make use of knowledge expressed in the form of linguistic rules without completely resorting to the precise plant models. In control applications, fuzzy logic approaches using if-then rules can solve complex and practical problems. In recent years, researchers have also attempted to apply it on missile guidance designs [10-12]. However, only a few results were presented to support feasibility and performance of their proposed approaches. Although many applications of fuzzy logic theory on missile guidance and control have appeared with growing interest, no application to the three-dimensional (3D) midcourse and terminal guidance problem has been attempted. The parallel navigation guidance approach is extended in this work to deal with the problem. An integrated midcourse and terminal guidance law of an aerodynamically controlled missile system to intercept a maneuvering target is developed. The principle aim to the guidance law is to cope with the complex interactions between a missile system and its changing environment to achieve excellent tracking performance. The design procedure is systematically and orderly. The parallel navigation strategy is robust to the changes of environments and is closer to the ideal thought of guidance law designers. Simulation studies are well performed to verify engagement performance, performance sensitivity and to estimate the defensible volumes under various operating environments.

#### PROPORTIONAL NAVIGATION FOR MISSILE SYSTEMS IN THE TIME DOMAIN

It is well known that investigation of processes and phenomena is linked, first of all, with the construction of mathematical models describing these processes and phenomena using mathematical language. The model is characterized by some parameters, including input variables or control actions, as they are called, or simply controls, output variables or output coordinates, or controlled variables, and also intermediate variables, the so-called state variables. In most cases processes are not considered in isolation but in direct connection with other processes and phenomena. The influence of external conditions—environment—is characterized by the so-called disturbing influences or, simply, disturbances.

As a matter of fact, the mathematical model is nothing but the analytical expression of an interconnection of the specified parameters. The parameters chosen are determined by the problem under consideration. The control theory approach was used to obtain the proportional navigation (PN) guidance law. The line-of-sight (LOS) rate was considered as the system output; the PN law, the commanded missile acceleration, was considered as control, or input; and the target acceleration was considered as disturbance.

The miss distance, the parameter that characterizes the missile guidance system performance, is the system output.

The missile and target accelerations are control and disturbance, respectively. In control theory analytical tools were developed for describing the characteristics of control systems based on the concept of the system error. The goal of control is to reduce the error to the smallest feasible amount. The ability to adjust the transient and steady-state response of a control system to meet certain performance requirements is the main goal of its design. To analyze systems their performance criterion should be defined. Then, based on the desired performance, the parameters of the system and its structure should be adjusted to provide the desired response. Because the actual input signals are usually unknown, a standard test input signal is normally chosen. The time-domain analysis is usually based on the so-called step input.

The miss distance in guidance system analysis and design is, to a certain degree, analogous to the error in conventional control systems. The goal of guidance is to reduce the miss distance to the smallest feasible amount. Target maneuvering plays a major role in determining missile system performance. The miss distance due to a step target maneuver is the miss step response, similar to the well-known time-domain characteristic in control theory. Below we obtain analytical expressions of miss distance for simple models of PN guidance systems. Unfortunately, in the time domain the closed-form solutions cannot be obtained for high-order models realistically reflecting autopilot and airframe dynamics. Nevertheless, the models under consideration enable us to establish some properties of linear models of PN missile systems.

#### PROPORTIONAL NAVIGATION AS A CONTROL PROBLEM

The basic philosophy behind PN guidance, which implements parallel navigation, is that missile acceleration should nullify the LOS rate. However, the realization of this philosophy was based on physical intuition: when the LOS rate differs from zero, an acceleration command proportional to the deviation from zero is created to eliminate this deviation. Below we will consider the PN as a control problem that realizes the parallel navigation rule. First, the linearized planar model of engagement is considered [see Fig.1]. By differentiating equation can be rewritten in the form

$$\begin{aligned} \dot{\lambda}(t) &= \frac{\dot{y}(t)r(t)-y(t)\dot{r}(t)}{r^2(t)} - \frac{\dot{y}(t)}{r(t)} - \frac{\lambda(t)\dot{r}(t)}{r(t)} \\ \ddot{\lambda}(t) &= \frac{\ddot{y}(t)r(t)-\dot{y}(t)\dot{r}(t)}{r^2(t)} - \frac{\left(\dot{\lambda}(t)\dot{r}(t)+\lambda(t)\ddot{r}(t)\right)r(t)-\lambda(t)r^2(t)}{r^2(t)} \\ \ddot{\lambda}(t) &= \frac{\ddot{y}(t)-\dot{\lambda}(t)\dot{r}(t)-\lambda(t)\ddot{r}(t)}{r(t)} - \frac{\dot{r}(t)}{r(t)} \frac{(\dot{y}(t)-\lambda(t)\dot{r}(t))}{r(t)} \\ \ddot{\lambda}(t) &= \frac{\ddot{y}(t)-\dot{\lambda}(t)\dot{r}(t)-\lambda(t)\ddot{r}(t)-\dot{\lambda}(t)\dot{r}(t)}{r(t)} \\ \ddot{\lambda}(t) &= \frac{\ddot{y}(t)-2\dot{\lambda}(t)\dot{r}(t)-\lambda(t)\ddot{r}(t)}{r(t)} \end{aligned}$$

and introducing the time-varying coefficients

$$\begin{aligned} a_1(t) &= \frac{\ddot{r}(t)}{r(t)} \\ a_2(t) &= \frac{2\dot{r}(t)}{r(t)} \\ b(t) &= 1/r(t) \end{aligned}$$

it can be presented in the form

$$\ddot{\lambda}(t) = -a_1(t)\lambda(t) - a_2(t)\dot{\lambda}(t) + b(t)\ddot{y}(t)$$

Taking into account that

$$\ddot{y}(t) = -a_M(t) + a_T(t)$$

it can be transformed in

$$\ddot{\lambda}(t) = -a_1(t)\lambda(t) - a_2(t)\dot{\lambda}(t) - b(t)a_M(t) + b(t)a_T(t)$$

Let  $x_1 = \lambda(t)$  and  $x_2 = \dot{\lambda}(t)$ . The missile-target engagement is described by the following system of first-order differential equations:

$$\dot{x}_1 = x_2$$

$$\dot{x}_2 = -a_1(t)x_1 - a_2(t)x_2 - b(t)u + b(t)f$$

where control  $u = a_M(t)$  and disturbance  $f = a_T(t)$ .

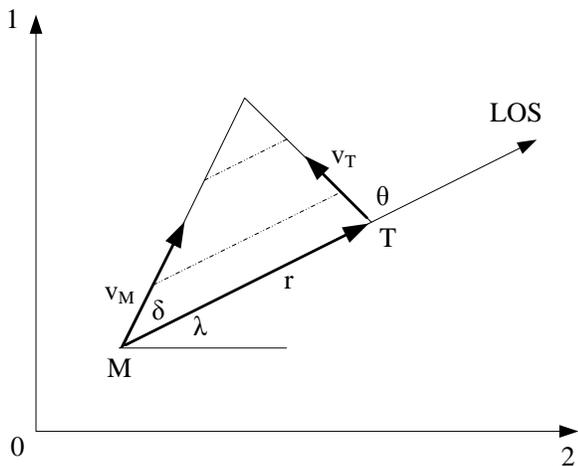


Fig.1. Geometry of Planar Engagement

First, let the case of a nonaccelerating target (i.e.,  $f = 0$ , the assumption that accompanies the main relations used in PN guidance). The asymptotic stability with respect to  $x_2$  (i.e.,  $\lim_{t \rightarrow \infty} x_2 \rightarrow 0$ , corresponds to the parallel navigation rule, so that the control law that satisfies this condition is the guidance law that implements parallel navigation).

The guidance problem can be formulated as the problem of choosing control  $u$  to guarantee the asymptotic stability of system with respect to  $x_2$ . It is important to mention that the guidance law is determined based on the partial stability of the system dynamics under consideration, only with respect to the LOS derivative. The approach for examining asymptotic stability is based on the Lyapunov method. For above equation, it is natural to choose the Lyapunov function  $Q$  as a square of the LOS derivative, i.e.,

$$Q = \frac{1}{2} c x_2^2$$

where  $c$  is a positive coefficient.

Its derivative along any trajectory of equation equals

$$\dot{Q} = c x_2 (-a_1(t)x_1 - a_2(t)x_2 - b(t)u)$$

The negative definiteness of above equation, that is, the asymptotic stability with respect to  $x_2$ , can be presented in the form

$$(-a_2(t) + c_1/c)x_2^2 - a_1(t)x_1 x_2 - b(t)x_2 u \leq 0$$

It follows that for  $a_1(t) = 0$  and  $c_1 \ll c$  the control

$$u = k x_2 = k \dot{\lambda}(t)$$

stabilizes system if  $k$  satisfies

$$k b(t) + a_2(t) > 0$$

$$k > -\frac{a_2(t)}{b(t)}$$

Introducing the closing velocity  $v_{cl} = -\dot{r}(t)$  and the effective navigation ratio  $N$ , expression can be written as  $k > 2v_{cl}$  and the control law can be presented as

$$u = N v_{cl} \dot{\lambda}(t), N > 2$$

which is the well-known property established for the PN guidance law. For the three-dimensional case and the Earth-based coordinate system, the LOS and its derivative are presented, so that analogous to

$$\ddot{\lambda}_s(t) = -a_1(t)\lambda_s(t) - a_2\dot{\lambda}_s(t) + b(t)(a_{Ts}(t) - u_s) \quad (s=1,2,3)$$

where  $(s = 1,2,3)$  are the LOS second derivative coordinates,  $a_{Ts}(t)$  ( $s = 1,2,3$ ) are the coordinates of the target acceleration vector, and  $u_s(t)$  are the coordinates of the missile acceleration vector, which are considered as controls. The Lyapunov function is chosen as the sum of squares of the LOS derivative components that corresponds to the nature of proportional navigation.

$$Q = \frac{1}{2} \sum_{s=1}^3 d_s \lambda_s^2$$

where  $d_s$  are positive coefficients.

Its derivative can be presented in the following form:

$$2\dot{Q} = \sum_{s=1}^3 d_s \dot{\lambda}_s \lambda_s$$

or

$$2\dot{Q} = \sum_{s=1}^3 d_s (a_1(t)\lambda_s(t)\dot{\lambda}_s - a_2\dot{\lambda}_s^2 + b(t)\dot{\lambda}_s (a_{Ts}(t) - u_s))$$

Analogous to the planar engagement, under the near-collision course assumption, the controls  $u_s(t)$  that guarantee  $\lim_{t \rightarrow \infty} \|\lambda\| \rightarrow 0$ , can be presented as

$$u_s = N v_{cl} \dot{\lambda}_s, N > 2 \quad (s=1,2,3)$$

#### SYSTEM FLOWCHART

The system flowchart for observer compensator design for high gain fast response control system for missile is illustrated in Fig.2.

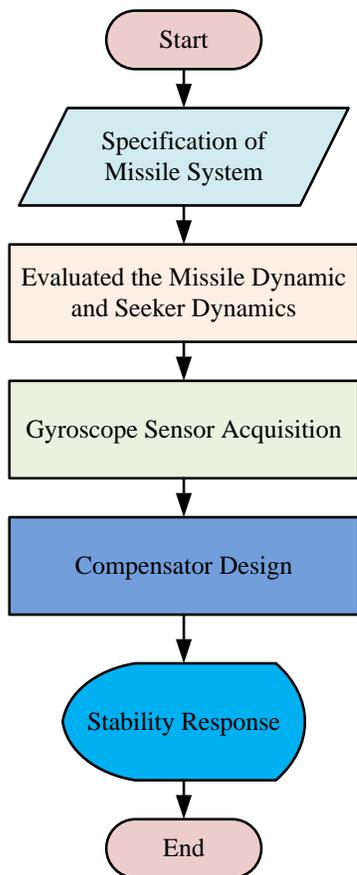


Fig.2. System Flowchart

The unguided missile model for stability analysis is developed by the typical missile system parameters. The missile dynamic and fin dynamic are evaluated from the specification of the typical missile system. The state observer design for missile system is also implemented according to the state space analysis. The lead compensators for missile system are evaluated consistent with the state observer design for missile stability analysis. There are at least two lead compensators design for state observer design techniques. Based on the advanced control system analysis, the missile is guided with stable condition by using missile analysis function and Bode analysis with the help of MATLAB and the observer design evaluation are based on the SIMULINK model of the unguided and guided missile system with stability response.

FLOWCHART OF MISS DISTANCE ANALYSIS

The generalized missile guidance model gives more accurate estimates of the miss distance. Target missile dynamics are presented by the time constant  $T_t$ , natural frequency  $\omega_t$ , damping  $\text{damp}_t$ , and airframe zero frequency  $\omega_z$ , respectively. Its amplitude characteristic  $GT(i,1)$  is written but is not used in the program. To use the generalized model program to determine the peak miss distance the symbol should be deleted from the lines where  $GT(i,1)$  is determined, and placed on the line  $GT(i,1) = 1$ . The MATLAB program is more powerful for the fourth-order model. Since the two time constants  $T_1$  and  $T_2$ , instead of the factor  $ac2(i,1)$  and the program also contains the expression for the phase

characteristic  $f(i,1)$ . As a result, the real  $RE(i,1)$  and imaginary  $IM(i,1)$  parts of the frequency response can be obtained. The expression of  $RE(i,1)$  is used to obtain the miss step response  $INT(j,1)$  based on the procedure described in Fig.3.

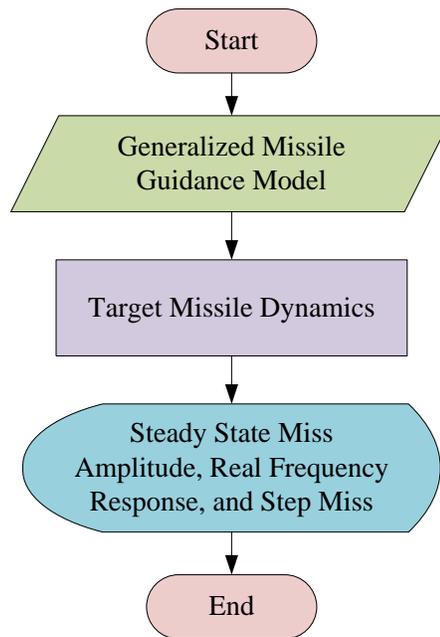


Fig.3. Flowchart of Miss Distance Analysis

SIMULATION RESULTS OF TYPICAL MISSILE SYSTEM

Based on the literature survey and background knowledge on the stability analysis of observer compensator for high gain fast response missile stability analysis is evaluated in this chapter. The simulation results of high gain fast response control system for missile system stability analysis are linked with the MATLAB GUI windows.

A. SIMULINK Model of Proposed System Design

The SIMULINK Model of observer compensator for high gain fast response control system for missile system is illustrated in Fig.4. In this figure, the main portion is high gain fast response missile and the state observer design. According to the state observer design the stability analysis is accomplished to the implementation of lead compensator for proposed system.

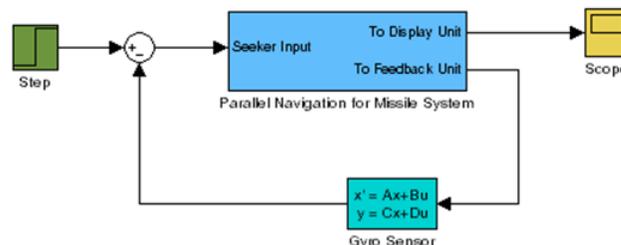


Fig.4. SIMULINK Model of the Proposed System

After debugging the SIMULINK model, the frequency response of typical control system for missile system is demonstrated in Fig.5. Based on the theoretical knowledge of the compensator design, the frequency response has a small

amount of the overshoot and it is the stable state of the missile analysis. The specifications are met with the desired situation.

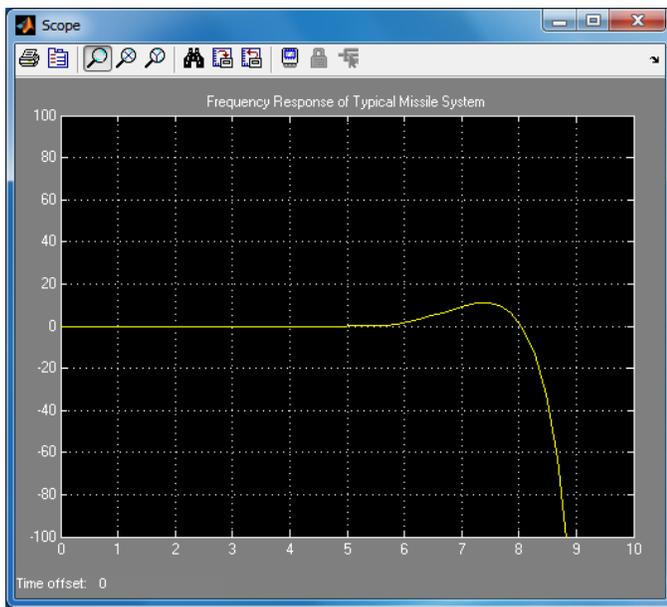


Fig.5. Frequency Response of Typical Control System for Missile System

**B. Miss Distance Analysis**

The steady-state miss amplitude between zero to five radian per second frequency range has the maximum values and the amplitude value approaches to zero after five radian per second. The imaginary values (IM) with respect to real values (RE) for missile trajectory are also mentioned in Fig.6.

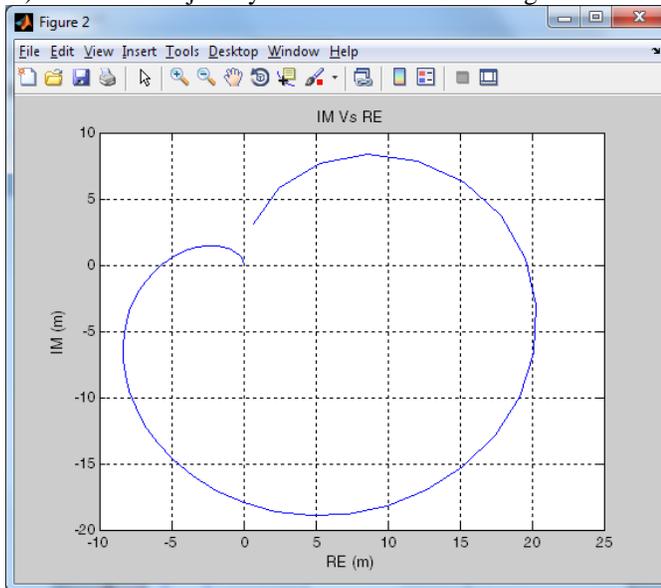


Fig.6. Plot of IM Vs RE

**C. Bode Plots and Frequency Response Plots**

The unguided condition and guided condition of high gain fast response missile system is given in Fig.7. The unguided condition is only stability analysis on the missile dynamic with fin dynamic. The guided condition means the missile dynamic with state observer design and lead compensator for stability analysis. The guided Bode plot meets with the specifications of the gain and phase margin for typical missile system.

The comparison plot of unguided and guided missile response with frequency domain analysis is also developed in Fig.8. After guiding the typical missile system, the overshoot of guided missile system is very less amount than the unguided missile system.

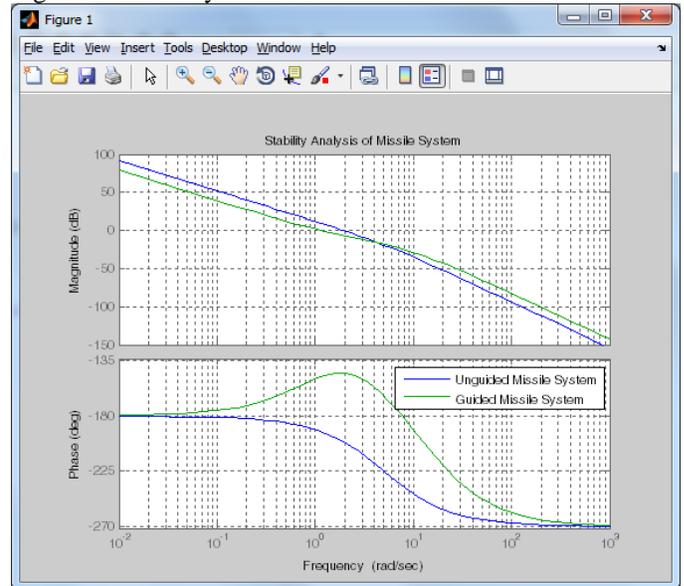


Fig.7. Plot of Stability Analysis of Missile System

**CONCLUSION**

Experimental results using guidance control system for missile system indicate that, the proposed guidance control is able to achieve higher tracking accuracy than the parallel navigation guidance without compensation, which verifies the effectiveness of the control algorithm. The guidance control method that can be used together with passivity-based controllers in order to enhance the guidance control system for missile system accuracy. The parallel navigation implementation, though similar to an integral action from the point of view of performance in free motion, has several advantages. First, it avoids saturation or overflow of the integrator in case of external disturbance torques (e.g. unexpected contacts). Second, only friction is compensated, instead of the sum of friction and external disturbance, so that it can be used also by impedance control in contact with the environment. Third, the design of the friction observer can be done independently of the MIMO controller design, whereas when adding an integrator all gains of the controllers have to be changed for good performance. Finally, this approach preserves the global asymptotic stability of the original MIMO controller even in the presence of friction. Experimental results validate the approach for the guidance control system for missile system.

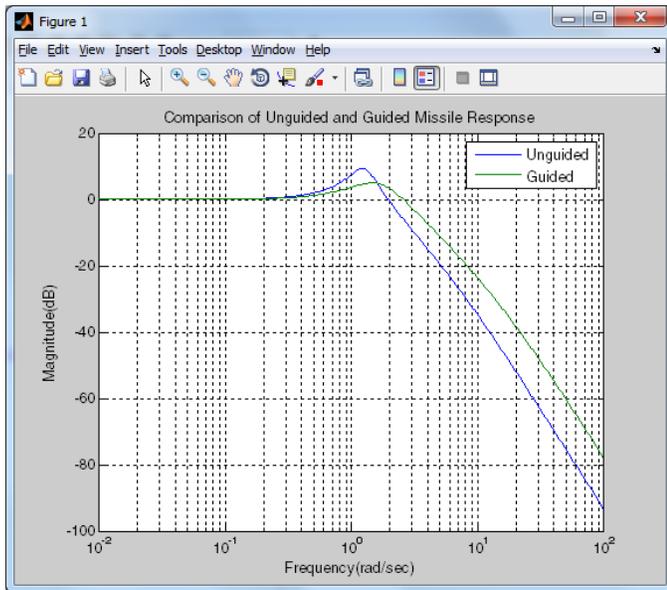


Fig.8. Comparison Plot of Unguided and Guided Missile Response

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# Implementation of Multi-rate Data Exchange System for Radar Signal Processing

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DOI: 10.29322/IJSRP.8.8.2018.p80106

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80106>

**Abstract**— On the basis of the characteristic analysis of data transmission and interconnection interface in complicated radar real-time signal processing system, a multi-rate data exchange system is designed. Then the structure and composition of this system are described in detail. The system has the characteristics of standardization, modularization and scalability. And through the implementation and application in an airborne SAR signal processing system, the universality and flexibility of this system were proved. The simulation results for multirate data exchange system are developed according to the literature survey on the RADAR signal processing. The RADAR signal processing analysis is accomplished with the help of MATLAB environments.

**Keywords**—Multi-rate Data Exchange, RADAR Signal Processing, MATLAB, SIMULINK, Performance Evaluation.

## INTRODUCTION

IN complicated radar real time signal processing systems, data communication or exchange is frequently required among various function modules in the process of signal handling. Furthermore, data from different function modules usually have different physical interface and transmission rate. So it is necessary to design a multi-rate data exchange system which is appropriate for data communication among each function module in signal processing system. As for conventional design method, each type of data electric interface and data interchanging function on the multi-rate data exchange system are usually implemented based on application specific integrated circuit (ASIC). Because the function of ASIC is fixed, the universality, expansibility and flexibility of system are undoubtedly limited.

This paper presents a design and realization of multi-rate data exchange system based on RADAR signal processing, which integrates with various data interface and is configurable according actual demand. And it provides flexible data interface and efficient data transmission rate for the entire radar signal processing system, and the performance of signal processing system would be improved greatly.

## RADAR SIGNAL PROCESSING TECHNIQUES

Signal processing is used in the radar receiver to extract information from the returned radar signal such as target detection, tracking, measurement, and signal processing to mitigate the effects of electronic countermeasures, including radar jamming. Additional signal processing techniques often employed include moving-target indication (MTI), pulse-Doppler, and synthetic-aperture radar (SAR) processing.

MTI is often used by terrestrial radar to separate moving targets of interest (e.g., aircraft) from background returns (e.g., from terrain and the ocean), called radar clutter. This is done using the Doppler-frequency shift of the received signals. The clutter has only small radial velocity components due to the motion of vegetation or waves, while moving targets are likely to have larger radial velocities. The MTI filters out the received signal frequencies that have low Doppler-frequency shift and correspond to the clutter. This is done by processing the phases of two or more successive pulses in a canceller.

Limitations of MTI processing result from the stability of the radar components and the velocity spread of the clutter. Targets traveling tangentially to the radar will have little or no radial-velocity component, and will be cancelled along with the clutter. MTI processors may be simply characterized by the minimum detectable target velocity (MDV), and the clutter cancellation ratio.

In pulse-Doppler radar, a coherent burst of pulses is transmitted. Coherency implies that the phases of the individual pulses are derived from a continuous stable signal, that is also used in processing the received signals. The returned signals are processed using a Fourier-transform-type algorithm to divide the received signal into a series of spectral bands. Those bands that correspond to the Doppler shift of clutter may be rejected, and those that correspond to potential targets may be examined for detections. The pulse-Doppler band in which a target is detected also gives a measure of its Doppler-frequency shift, and hence its radial velocity.

Pulse-Doppler processing is often used in airborne and space-based radar. With these moving platforms, the radar returns from terrestrial clutter may have a large Doppler frequency spread, due to the spread of angles at which the clutter is viewed, both in the main radar beam and through the

antenna sidelobes. Thus, cancellation of the clutter by MTI techniques is often not effective. Pulse-Doppler processing, however, allows rejection of bands having large clutter components, detection of targets in bands clear of clutter returns, and setting of detection thresholds over the clutter signal return in bands, where target returns may exceed clutter returns. Pulse-Doppler processing may be simply characterized by the velocity resolution corresponding to the processed Doppler frequency bands, and the suppression of clutter not in a band.

Synthetic-aperture radar (SAR) processing is used by moving radar (e.g., those on aircraft or satellite platforms), to produce high-resolution terrain maps and images of targets. Radar may achieve good range resolution by using short pulses or employing pulse compression. For example, a signal bandwidth of 100 MHz may provide a range resolution of 1.5m. However, with conventional (real-aperture) processing, the radar beamwidth is rarely small enough to provide cross-range target resolution useful for ground mapping. For example, with a beamwidth of 10 mR (0.57°), cross-range resolution at a range of 50 km is 500m.

With SAR, radar data taken while the radar travels a significant distance is processed to produce the effect of an aperture dimension equal to the distance traveled. For example, with an aircraft velocity of 250 m/s and a SAR processing time of 2 seconds, the synthetic aperture is 500m long. With an X-band wavelength of 0.03m, the cross-range resolution at 50 km range is 1.5m. An SAR radar processor may be simply characterized by the resolution it provides, 1.5m in the above example.

SAR processing is based on Fourier transforms, but corrections are made for factors such as changes in target range and platform path perturbations during the processing time. In a strip-mapping mode, a SAR collects and processes data at a fixed angle relative to the platform as it moves along its path. This technique, often referred to as side-looking radar, generates a continuous strip map. In a spotlight SAR, the radar beam is scanned relative to the platform to keep the desired target region in coverage. This allows increased processing time, and hence greater angular resolution for the region imaged.

SYSTEM ARCHITECTURE DESIGN

Based on the above characteristics of multi-rate data flow in radar real-time signal processing system, it is necessary to design a system that supports multiple rate data communication and exchange. And as the centre of data interchange, it provides a platform in which each module in signal processing system can communication each other efficiently. Eventually, a radar real-time signal processing system based on data exchange would be established and illustrated in Fig.1.

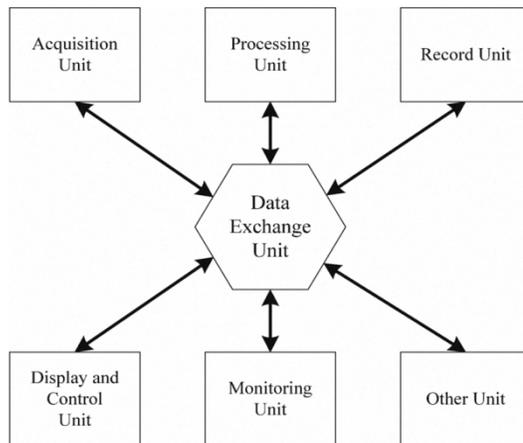


Fig.1. Block diagram of radar signal processing system based on data exchange

IMPLEMENTATION

The system flowchart for implemented multi-rate data exchange unit is illustrated in Fig.2. The specification of RADAR signal processing and target for data exchange analysis are specified by the input of data exchange unit. And then the noise, measurement and azimuth parameter are declared based on the signal processing stage. The range compression is calculated according to the declaration parameters. The azimuth compression result is displayed after implementing the data exchange processes.

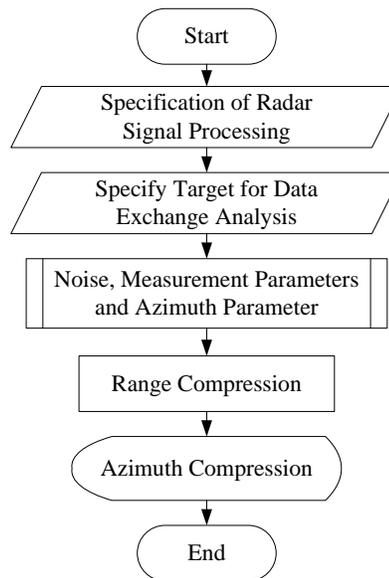


Fig.2. System Flowchart

The sub function for overall system flowchart is mentioned in Fig.3. The noise and linear azimuth FM rate are inputted to the evaluation of range samples and time array for data acquisition process.

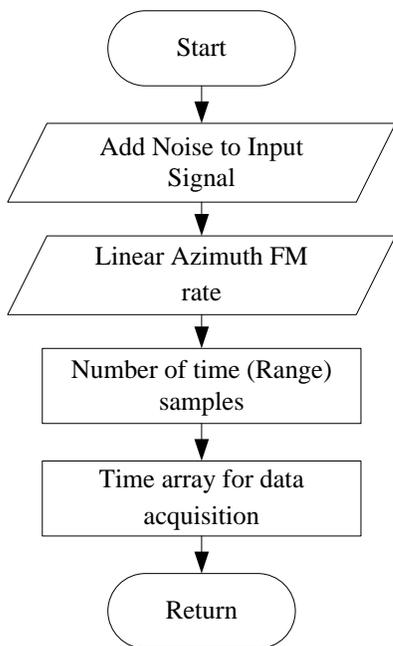


Fig.3. Sub Function of System Flowchart

**SIMULATION RESULTS**

The specified target for Multi Rate Data Exchange Analysis is only helicopter and the range is evaluated according to the specified parameters of the implementation. The Data Exchange Stage for RADAR Target is shown in Fig.4. It is only based on the azimuth samples for RADAR signal processing.

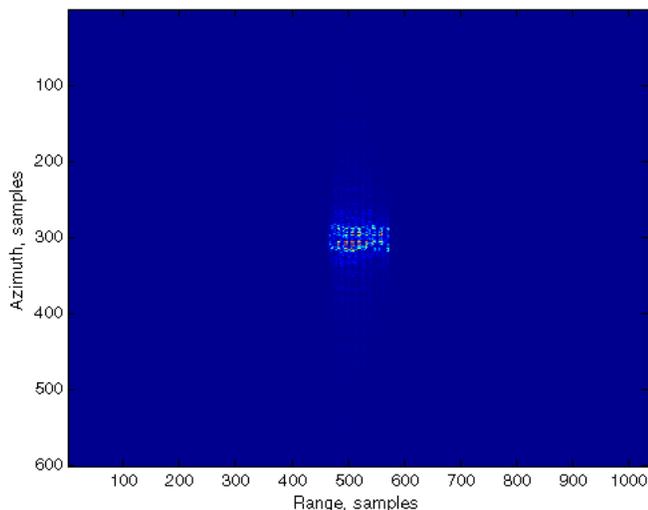


Fig.4. Data Exchange Stage for RADAR Target

The enlightenment of SIMULINK Model for Multi Rate Data Exchange Analysis is as follows. Input/Output are connected to Data Exchange Unit. Band limited white noise are acquired for acquisition unit. Delay unit is used for Display and Control unit. Output terminal is linked with Record unit. Error terminal is employed for Monitoring unit. Equalizer response and filter tap are utilized for processing unit.

SIMULINK model is accomplished to analyze the multi rate data exchange unit for SAR radar signal processing

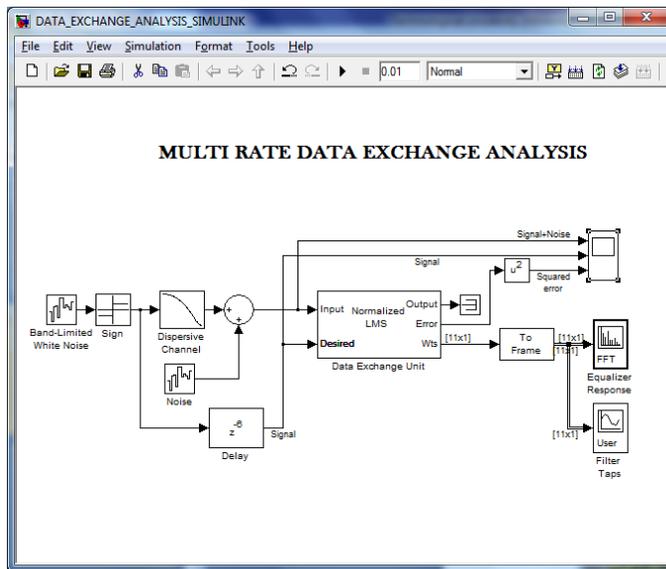


Fig.5. SIMULINK Model for Multi Rate Data Exchange Analysis

After debugging the SIMULINK Model for Multi Rate Data Exchange Analysis, there are three major responses for simulation results. Signal, Signal with Noise and Squared Error response are illustrated in Fig.6. According to this response, the noise level is approach to zero for data exchange process. Magnitude Response Vs Frequency is shown in Fig.7. This response says the magnitude values are gradually higher for increasing the frequency in kilohertz.

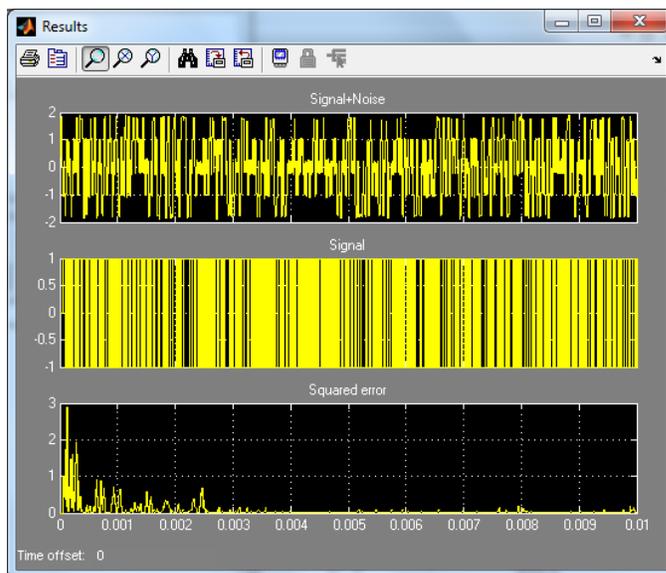


Fig.6. Signal, Signal with Noise and Squared Error

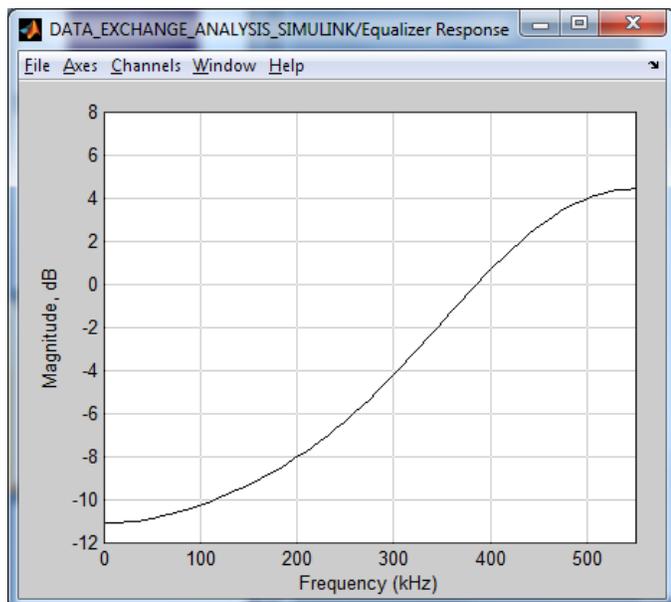


Fig.7. Magnitude Response Vs Frequency

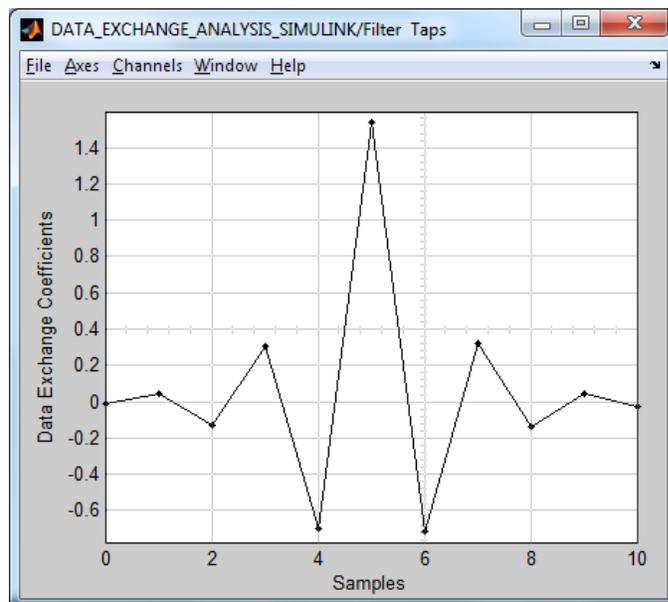


Fig.8. Data Exchange Coefficients

Data Exchange Coefficients response is illustrated in Fig.8. This response says the highest coefficients for data exchange is between four and six samples.

#### CONCLUSION

The multi-rate data exchange platform described above is used in a SAR real-time signal processing system which block diagram is shown in previous chapters. In this SAR signal processing system, data exchange platform receives the raw echo data from acquisition unit, and receives the radar carrier motion parameters from motion compensation unit simultaneously. The radar echo data and carrier motion parameters are packed and sent to the signal processing unit by means of LINK channel. Through the serial Rapid I/O interface, the packed data from data exchange platform can directly be sent to record unit for real-time storage. Accordingly, via the data exchange platform, data stored in record unit can also be transferred to the processing unit when necessary. Moreover, the working mode of the data exchange platform can also be determined by main control unit which can send command data to the platform by the PCI interface. Thereby, with the flexible interconnection function of the multi-rate data exchange platform, each function unit in the SAR signal processing system is effectively connected as a whole.

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# Assessment of Heavy Metal Concentration in Water, Soil and Vegetable in Ex-Mining Pond, Jos South L.G.A Plateau State, Nigeria.

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DOI: 10.29322/IJSRP.8.8.2018.p80107

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80107>

**Abstract-** This study assessed the effect of ex-mining pond water used for irrigation on the soil and two vegetable samples (Cabbage and Tomatoes) by assessing the concentration of some heavy metals (Cu, Cr, Mn, Cd, and Fe) present in the pond water and comparing with the concentration of the metals in the soil and the vegetables using AAS. In the mining water all the selected metals were detected except for cadmium and were within the WHO permissible limit. In the soil sample, all the selected heavy metals were detected and were within the range of 0.001-216.50ppm. Chromium was within the WHO limit for heavy metals in soil while Cu, Cd, Mn, Pb and Fe were above the WHO limit. In the tomatoes samples, the heavy metal concentration ranges from 0.131-3.299ppm. Chromium and cadmium were not detected and Mn, Pb and Fe were above WHO permissible limit. In Cabbage, all the heavy metals were detected except chromium and was within the range of 0.006-1.900ppm. Mn, Pb, Cd and Fe were above WHO permissible limit except for Cu. From this result the concentration of heavy metals in the soil was higher than the concentration of the heavy metals in the water. This could be due to the parent materials that make up the soil as well as the application of chemicals like herbicide and pesticide. Continuous use of the mining water for irrigating the farmland results in accumulation of the heavy metals in the soil as well as the plants.

**Index Terms-** AAS, Concentration, Ex-mining, Heavy metals, Pond.

## I. INTRODUCTION

Metal contamination in abandoned mines is a global environmental problem which various countries around the world are suffering from. This problem ranks among the most significant environmental challenges worldwide, which requires ongoing evaluation and urgent solution to overcoming this problem and its negative impacts (Kutty & Al-Mahaqeri, 2016). Uncontrolled mining activities and illegal mining in developing countries have generated a lot of environmental hazards and waste (Atafar et al, 2010). Metal mining is the second large source of heavy metal contamination in soil after sewage sludge (Gosh & Singh, 2005). In some cases, tailings present on steep slopes are unstable and prone to erosions. All these factors

contribute to pollution for the soil, ground and surface water. Metals are non degradable and therefore can persist for long period in aquatic as well as terrestrial environments (Nouri et al., 2012). These metals may be transported through soils to reach ground water or may be taken up by plants including agricultural crops (Atafar et al., 2010). Eating vegetables regularly in diet can have many health benefits by reducing diseases and used to convert fats and carbohydrates into energy (Mercola. 2014). Plants are capable of using metals through different ways such as complexing them in their sedentary nature, binding them into cell wall, and/or combining them to produce certain organic acid or proteins (Galfati et al, 2011). Therefore, plant species are considered as good bio-indicators in the early stages of heavy metal pollution. As a result of soil, water and atmosphere represents a growing environmental problem affecting food quality and human health. Heavy metals may enter food chain as a result of their uptake by edible plants, thus the determination of heavy metals in environmental samples is very important (Daniel, Chundusu & Chup, 2014). Heavy metals are natural components which cannot be degraded or destroyed biologically. The toxic heavy metals entering the ecosystem may lead to geo-accumulation and bioaccumulation (Lokeshappa, Kandarp & Anil, 2012). A heavy metal is defined as any dense metal or metalloid that is noted for its potential toxicity especially in the environmental context (Sirivastava & Goyal, 2010). The amount of metallic elements in plants is the measure of the level of the metal in the environment in which the plants grows over a period of time (Ahmed et al., 2012). This study assess the effect of mining activities on the concentration of the heavy metals (Cd, Cr, Cu, Mn, Fe, Pb) in the pond water, soil and vegetables (cabbage and tomatoes) using Atomic Absorption Spectrophotometer (AAS).

## II. MATERIALS AND METHOD

### STUDY AREA

The study site is located in Jos South Local Government area of Plateau state with latitudes 9°E to 10°N and longitude 8°30'E. It is situated at the north western part of the state with its headquarter at Bukuru which is about 15Km from the state capital Jos, with total land area of about 1,037Km<sup>2</sup> with a population of 301,096 at 2011 national population census. Samples were taken

from ex mining pond and farm land irrigated with water from the pond in Rayfield, Jos south L.G.A of plateau state. (Ishola et al., 2016)

### SAMPLING

100g of the soil sample was collected from the farm land irrigated with water from the ex-mining pond by using a plastic spoon within the depth of about 5 cm<sup>3</sup> and was put in a labeled polyethylene bag. The water from the ex-mining pond was sampled by using a 1 litre capacity plastic rubber that has been previously rinsed with distilled water and dilute nitric acid. The water was collected and labeled properly. The two vegetables; cabbage and tomatoes were sampled randomly in the farm land irrigated with water from the ex-mining pond using stainless knife and was put in a polyethylene bag and labeled properly.

### SAMPLE PRE TREATMENT

The soil sample was air dried in the laboratory, grounded with mortar and pestle and was sieved with a 2mm mesh and stored in a labeled polyethene bag prior to analysis. The water sample collected was taken to the laboratory for preservation after treatment with concentrated nitric acid (HNO<sub>3</sub>). While the harvested cabbage and tomatoes were washed with de-ionized water to remove soil particles and then cut with stainless steel knife and was oven dried at 70<sup>0</sup>C until stable weight was obtained. It was then grounded in a mortar and sieved and kept until needed.

### DETERMINATION OF WATER pH

About 50ml of the water sample was put in a 100ml beaker and the pH was measured by introducing a glass probe of the pH meter in to the water sample and the reading was recorded.

### DETERMINATION OF WATER TEMPERATURE

500ml capacity rubber previously raised with dilute HCl was dipped into the mining water and the cover was opened and the water sample was collected to the marked region. The water sample collected was left 10mins and the thermometer (mercury thermometer) was inserted and left for 30mins and the reading was taken.

### DETERMINATION OF SOIL TEMPERATURE

50g of the soil sample was weighed and put in a beaker. 100ml of distilled water was added and shaken thoroughly until it

dissolves completely and a thermometer was inserted and the reading was taken.

### DETERMINATION OF SOIL pH

1.0g of soil sample (passed 2mm sieve into a 50ml) was weighed and 20ml of distilled water was added, the suspension was stirred several times for 30mins with glass rod. The soil suspension was allowed to stand for 30mins. The electrode was calibrated by using buffer solution (standard buffer solution pH 7.0 and 4.0) the electrode of the pH was inserted into the partly settled suspension and the pH was measured. The electrode was not allowed to touch the bottom of the beaker and also the suspension was not stirred during measurement.

### DIGESTION OF THE SOIL SAMPLE

1.0g of the soil sample was digested with 12ml of aqua-regia (HNO<sub>3</sub>: HCl) to the ratio 3:1 in a pyrex beaker and heated on a hot plate at a temperature 110<sup>0</sup>C for 3hours and was evaporated to dryness. The digested sample was further diluted with 20ml of 2% HNO<sub>3</sub>, and was filtered using Whatman filter paper No.42 and was then transferred into a 50ml volumetric flask, the distilled water was added to mark up the mark and was kept until needed.

### DIGESTION OF THE VEGETABLE SAMPLES

About 1.0g of vegetable sample was digested with 24ml Of 80% aqua-regia and 5ml of 30% H<sub>2</sub>O<sub>2</sub> in a 100ml pyrex beaker and was digested at 80<sup>0</sup>C on a hot plate until a clear solution was obtained (Ang and Lee., 2005). After cooling, the digested samples were filtered using Whatman filter paper No.42 and diluted to 50ml with de-ionized water and kept until needed.

## III. RESULTS AND DISCUSSION

The result of the temperature of water, soil pH and water pH are given below and the result of the chemical analysis of the water sample, soil samples and vegetables sample are given in table, 2, 3, 4, 5, 6 and 7 respectively. The mining pond water recorded a temperature of 27<sup>0</sup>C and a pH of 7.47 while the soil sample recorded a temperature of 24<sup>0</sup>c and a pH of 8.43. The normal pH range for irrigation water is from 6.5 to 8.4. The average pH of 7.47 recorded in the work was within the permissible range.

**Table 1: Temperature and pH of Water and Soil Samples**

Samples	Temperature	pH
Water	27 <sup>0</sup> C	7.47
Soil	24 <sup>0</sup> C	8.43

**Table 2: Heavy Metal concentration in Water Sample**

METALS	CONCENTRATION (ppm)		
	Mean $\pm$ SD	Standard Error	WHO
Cu	0.023 $\pm$ 0.0014	.001	2
Cr	0.3755 $\pm$ 0.0145	.0145	0.87
Mn	0.0645 $\pm$ 0.0025	.0025	0.1
Cd	0.415 $\pm$ 0.0212	.015	0.3

ND= Not detected

Duplicates determination

**Table 3: Heavy Metal Concentration on Soil Sample**

METALS	CONCENTRATION (ppm)			WHO Permissible Limit
	Mean $\pm$ SD	Standard Error	WHO Permissible	
ND				
Not				
Cu	5.520 $\pm$ 0.0323	.020000		2
Cr	0.001 $\pm$ 0.0012	.000001		0.87
Mn	0.800 $\pm$ 0.0021	.020000		1
Cd	0.010 $\pm$ 0.0014	.000000	0.003	
Pb	0.187 $\pm$ 0.0112	.007000		0.05
Fe	216.5 $\pm$ 0.9892	3.500000		0.3

Detected, Duplicate determination

**Table 4: Heavy Metal Concentration in Cabbage Sample**

METALS	CONCENTRATION(ppm)			WHO Permissible Limit
	Mean $\pm$ SD	Standard Error	Limit	
Cu	0.2985 $\pm$ 0.0021	.001500	2	
Cr	ND -	0.87		
Mn	0.5165 $\pm$ 0.0233	.016500	0.1	
Cd.	0.0060 $\pm$ 0.0071	.005000	0.003	
Pb	0.2665 $\pm$ 0.0007	.000500	0.05	
Fe	1.900 $\pm$ 0.0424	.030000	0.3	

ND = Not Detected

Duplicate determination

**Table 5: Heavy Metal Concentration in Tomatoes Sample**

METALS	CONCENTRATION (ppm)		
	WHO Permissible	Mean±SD	Standard Error Limit
<b>Cu</b>	.213±.0098	.007000	2
<b>Cr</b>	-	-	0.87
<b>Mn</b>	.533±.1103	.078000	0.1
<b>Cd</b>	-	-	0.003
<b>Pb</b>	.131±.0028	.002000	0.05
<b>Fe</b>	3.299±1428	.101000	0.3

ND= Not Detected  
 Duplicate determination

**IV. DISCUSSION**

**Concentration of Heavy Metals**

**Copper (Cu)**

From the result of water sample and the soil sample shown in Table 1 and 2. Copper showed a concentration value of 0.024ppm in water and 5.51ppm in soil. The soil sample gave a higher concentration of copper than the water sample which may be attributed to the type of parent material that makes up the soil. It can be as a result of accumulation due to prolong use of the pond water for irrigation resulting in a significant level of copper in the soil. Similar work shows copper concentration in water to be 0.527ppm which is higher than the value reported in this work and the value of 0.605ppm for soil which is Far lower than the value of 5.54ppm reported in this work (Boamponsemetal., 2012). However the value for copper in water sample is within the WHO permissible limit. Cabbage in Table 3 showed a concentration value of 0.29850ppm while tomatoes in Table 4 showed a concentration value of 0.213001ppm. These concentration value were however lower than the concentration of copper in the soil, but higher than the concentration value of copper in the water sample. This expected as only a fraction will be bio-available for the plant uptake. The concentration value reported for cabbage in this work was however higher when compared to the concentration value of 0.145ppm reported for cabbage irrigated with mining pond water (Boamponsem et al., 2012). The value of 0.21300 reported for tomatoes in this study was lower than the value of 5.01ppm reported in the literature of tomatoes (miclean et al., 2009).

**Chromium (Cr)**

From the result of water sample and the soil sample shown in Tables 1 and 2, Cr shows a concentration value of 0.37550ppm in water and 0.001ppm in the soil sample. It is however higher in the water sample than in the soil sample this may be due to the mining activity that take place. Cr was however not detectable in the two plants sample (Cabbage and tomatoes). However, the concentration value of Cr in the water was within the WHO permissible limit. Similar work showed the concentration value of Cr in water to be 0.005ppm which is

lower than the concentration value recorded in this study. (Anita et al, 2010).

**Manganese (Mn)**

From the result of water sample and the soil sample shown in Table 1 and 2, Mn showed the concentration value of 0.06450ppm in water and 0.8000ppm in soil. This may be due to the parent material that makes up the soil indicating a significant level of Mn in the soil. Similar work shows Mn concentration in water to be 2.107ppm which is higher than the value reported in this work and the concentration of 5.465ppm for soil which is also higher than the concentration value reported in this work (Boamponsem, et al., 2012). However, the value for Mn in both water and soil sample were above the WHO permissible limit. Cabbage shows a concentration value of 0.5165ppm while tomatoes in Table 4 show a concentration value of 0.533ppm. the concentration value of Mn both in cabbage and tomatoes were higher than the concentration value of Mn in the mining water indicating that the Mn concentration of te vegetables is as a result of the concentration of the Mn in the soil and not from the water although the mining water used in irrigating the plants might have elevated the concentration of Mn in the soil.

**Cadmium (Cd)**

From the result of water analysis and the soil sample analysis shown in Tables 1 and 2, Cd was not detectable in the mining water. It may be present in the concentration that is below the detectable limit of the instrument while the soil sample recorded a concentration of 0.01ppm. The presence of Cd in the soil sample and absent in the water may be as a result of the parent material that make up the soil. Similar work shows Cd concentration in water to be 0.267ppm while in this work, Cd was not detectable (Boamponsem et al., 2012). The concentration value of Cd in soil in this work is above the WHO permissible limit of 0.01ppm. Cabbage recorded a concentration value 0.006ppm for Cd while it was not detected in tomatoes. The value of 0.006ppm reported for cabbage was lower when compared to the value of the 0.10ppm recorded for Cd in soil. The concentration value reported for cabbage in this work was however lower when compared to the concentration value of 0.001 reported for cabbage irrigated with mining pond water

(Boamponsem et al., 2012) and the concentration value of 0.21ppm reported for cabbage (Miclean et al., 2009).

### Lead (Pb)

From the result of water sample and soil sample shown in Tables 1 and 2, Pb shows a concentration value of 0.001ppm in water and 0.187ppm in soil. The soil sample gave higher concentration of Pb than the water sample, which may be attributed to the type of parent material that makes up the soil indicating a significant level of Lead in the soil. Similar work shows Pb concentration in water to be 15.508ppm which is higher than the value reported in this work and the value of 1.775ppm for soil which is far higher than that value of 0.187ppm reported. (Boamponsem et al., 2012). However, the value of Pb in water and soil sample is above WHO permissible limit. Cabbage in Table 3 shows a concentration value of 0.26650ppm while tomatoes in Table 4 show a concentration value of 0.1310ppm. These concentration values were however higher than the concentration of Pb in the water and lower in the soil sampled. The concentration value reported for cabbage in this work was however lower when compared to the concentration value of 1.300ppm reported for cabbage irrigated with mining pond water (Boamponsem et al., 2012). The value of 0.131ppm reported for tomatoes in this study was lower than the value of 3.24ppm reported for literature of tomatoes (Miclean, et al. 2009).

### Iron (Fe)

From the result of water sample and soil sample shown in Table 1 and 2, Fe shows a concentration value of 0.4150ppm in water and 216.500ppm in soil. The soil sample gave a higher concentration of Fe than in the water sample which may be attributed to the type of parent material that make up the soil indicating a significant level of Fe in the soil and Fe is one of the most abundant element in the earth crust. Similar work shows Fe concentration in water to be 15.508ppm which is higher than the value reported in this work and the value of 14.076ppm for soil which is lower than the value of 216.500ppm reported (Boamponsem et al., 2012). However, the value Fe in both water and soil sample were above WHO permissible limit. Cabbage in Table 3 shows a concentration value of 1.900ppm while tomatoes in Table 4 show a concentration value of 3.2990ppm. These concentration values were however lower than the concentration value of Fe in the soil. The concentration value reported for cabbage in this work is however lower when compared to the concentration value of 150ppm reported for cabbage irrigated with mining pond water. (Boamponsem et al., 2012).

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# Determination of Heavy Metals Concentration in Some Herbs Commonly Consume in JOS North And JOS South Local Government Area of Plateau State, Nigeria.

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DOI: 10.29322/IJSRP.8.8.2018.p80108

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80108>

**Abstract-** The effect of high concentration of heavy metals on human health and the environment has attracted considerable attention in recent years as plants are the main route in the transfer of heavy metals from contaminated soil to humans. The aim of this study is to assess the concentration of (Copper, Iron, Lead and Manganese) in some commonly consumed herbs (Mint Leaves, Bitter Leaves, Lemon Grass and Moringa Leaves) in Jos North and Jos South L.G.A. of Plateau state using AAS and compare the result of the heavy metals analysis with WHO Standard limits for heavy metals in plants. The results showed that all the heavy metals in the four herbal plant samples collected from different markets both in Jos North L.G.A and Jos South L.G.A of Plateau State were detected and were above the WHO permissible limit for heavy metals in plants except for Mn (10.87-122.67ppm) which was consistently within the WHO permissible limits of 200mg/kg in all the four herbal plants and also Cu (2.30ppm) which was within the WHO permissible limit of 10mg/kg in Lemon grass in Jos North L.G.A. Similar concentration trend was also observed in Jos South L.G.A with Mn concentration values (24.84-138.20ppm) for all the four herbal plants being within the WHO permissible limit and Cu (8.75ppm) concentration values for Mint and Lemon grass (0.46ppm) were also within the WHO permissible limit for heavy metals in plants.

**Index Terms-** AAS, Concentration, Herbs, Heavy metals, WHO.

## I. INTRODUCTION

Herbs are plants with savory or aromatic properties that are used for flavoring and [garnishing](#) food, in medicine, or as fragrances. It also refers to the [leafy](#) green or [flowering](#) parts of a plant either fresh or dried (Panda, 2015). Some plants contain [phytochemicals](#) that have effects on the body. There may be some effects when consumed in the small levels that typify culinary spicing, and some herbs are toxic in larger quantities (Arrowsmith, 2009). Herbal plants such as mint leaves, bitter leaves, lemon grass, moringa and so on represent an important class of various traditional medicine system. In recent years they are increasingly used in the primary health care intervention both in developed and developing countries. According to the World Health Organization, nearly 70-80% of the world population still

primarily relies on non-conventional medications mostly derived from herbal plants (Sahoo et al., 2010; WHO, 2005). Herbs are traditionally used for the treatment and prevention of ailments such as stomach pain, headache, diabetes, hypertension, rheumatism and many others. According to a recent study on the diversity and conservation states of plants, about 50% of plants species were found to possess medicinal properties (Albraik, 2008). The toxicity of herbal plants may be related to contaminants such as pesticides, microbes, heavy metals, chemical toxics and adulterants. (Rutter, 2008). The geography and geochemical soil characteristics contaminants in the soil, water, air and other growth transportation and strange conditions can significantly affect the properties and the quantity of the herbal plants and their formulation (Rania, 2015).

The toxicity of heavy metals to human health and the environment has attracted considerable attention in recent years. Plants are mainly linked in the transfer of heavy metals from the contaminated soil to humans (Rania et al. 2015). Heavy metals are naturally occurring metals having atomic number (Z) greater than 20 and an elemental density greater than 5g/cm<sup>3</sup> (Ali & Khan, 2017). Heavy metals are dangerous because they tend to bioaccumulate. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted (Wijayawardena, Megharaj & Naidu, 2016).

Metals such as zinc, copper, iron, manganese and chromium are essential nutrients, they are important for the physiological and biological function of the human body. However, an increase in their intake above certain permissible limit can become toxic (Saad et al, 2006). In general, a number of health problems were linked to excessive intake of dietary heavy metals including a decrease in immunological defence, cardiac dysfunction, fetal malformation, impaired psycho-social and neurological behavior, gastrointestinal cancer, and many others (Korfali et al., 2013). The aim of this study is to assess the concentration of (Copper, Iron, Lead and Manganese) in some commonly consumed herbs (Mint Leaves, Bitter Leaves, Lemon Grass and Moringa Leaves) in Jos North and Jos South LGA of Plateau state and compare the result of the heavy metals analysis with WHO Standard limits for heavy metals in plants.

## II. MATERIALS AND METHOD

### METHOD

#### COLLECTION AND PREPARATION OF HERBAL SAMPLES

A total of thirty two (32) herbal samples were purchased from four different shops (markets) in Jos North and Jos South L.G.A. of Plateau State, Nigeria. The fresh samples collected were washed with distilled water to remove dirt. The samples were air dried at room temperature for about four weeks. The dried herbal samples were pounded using mortar and pestle, sieved using 2mm mesh, labeled properly and kept until needed.

### DIGESTION OF THE SAMPLES

1.0g each of the powdered herbal sample was weighed and transferred into a 250cm<sup>3</sup> beaker and was digested with 10ml mixture of analytical grade acids HCl : HNO<sub>3</sub> in the ratio 3:1. The digestion was performed at a temperature of about 60°C for 30minutes in a fume cupboard until it's almost dried. Digested samples were allowed to cooled, filtered into a 100ml volumetric flask, and made up to the mark with deionized water. Atomic Absorption Spectrophotometer (AA-6800) was used to determine trace metals concentration in the samples. Duplicate determinations were made.

## III. RESULT AND DISCUSSION

### RESULTS

**TABLE 1:-** Heavy metal Concentration (ppm) in Plant Samples (herbs) Sampled from Jos North L. G. A. in ppm.

Elements\Plants	Moringa	Bitter leaves	Mint	Lemon grass	WHO Limit (mg/kg)
<b>Pb</b>	21.92 ± 0.01	24.66 ± 0.23	90.41 ± 0.01	27.40 ± 0.13	10
<b>Fe</b>	1083.33 ± 0.21	154.76 ± 0.03	1190.48 ± 0.07	95.24 ± 0.04	20
<b>Cu</b>	19.80 ± 0.31	15.19 ± 0.01	13.35 ± 0.11	2.30 ± 0.08	10
<b>Mn</b>	66.77 ± 0.31	68.32 ± 0.04	122.67 ± 0.05	10.87 ± 0.03	200

\* Duplicate determinations

**TABLE 2:-** Heavy Metal Concentration (ppm) in Plant Samples (herbs) Sampled from Jos South L. G. A. in ppm

Elements\Plants	Moringa	Bitter leaves	Mint	Lemon grass	WHO limit (mg/kg)
<b>Pb</b>	30.14 ± 0.01	19.18 ± 0.06	27.40 ± 0.13	19.18 ± 0.03	10
<b>Fe</b>	964.29 ± 0.18	178.57 ± 0.11	583.33 ± 0.01	107.14 ± 0.14	20
<b>Cu</b>	13.35 ± 0.23	15.19 ± 0.09	8.75 ± 0.31	0.46 ± 0.10	10
<b>Mn</b>	69.88 ± 0.03	66.77 ± 0.01	138.20 ± 0.05	24.84 ± 0.02	200

\* Duplicate determinations

#### IV. DISCUSSION

From the result of the heavy metal concentration from the herbal plant samples collected from four markets in Jos North L.G.A., it showed that all the heavy metals analyzed were detected in all the samples. For Moringa, Fe recorded the highest concentration value of 1083.33 ppm while Cu recorded the least. The value of 21.92 ppm for Pb was high when compared to WHO limits of 10 mg/kg in plants. The concentration value of Fe was also high as against the value of 20 mg/kg for Fe in plants. Cu recorded the value of 19.80 ppm in this study area and was also higher than the value of 10 mg/kg for Cu in plants. Mn recorded the value of 66.77 ppm. This concentration value was however within the WHO permissible limits of 200 mg/kg for Mn in medicinal plants.

Bitter leaves collected from the four sides in Jos North local Government Area recorded 24.66 ppm for Pb which is higher than the WHO permissible limits of 10 mg/kg for Pb in medicinal plants, 154.76 ppm for Fe as against 20 mg/kg for WHO limits in plants, Cu recorded a concentration value of 15.19 ppm and also exceeded the WHO limit and Mn recorded a concentration value of 68.32 ppm and was within the WHO permissible limit of 200 mg/kg.

Mint leaves from the four sample sites in Jos North L.G.A. showed higher concentration of Pb, 90.41 ppm, Fe, 1190.48 ppm, Cu, 13.35 ppm which were all above the WHO permissible limits except for Mn which had a value of 122.67 ppm and was within the WHO permissible limit but however higher than the concentration of Mn in Moringa, Bitter leaves and Lemon grass. Lemon grass from the four samples sites had concentration of Pb (27.40 ppm) above the WHO permissible limit of 10 mg/kg and 20 mg/kg for heavy metals in plants. Although the concentration value of Fe, Cu and Mn in Lemon grass are far lower than that of Moringa, Bitter leaves and mint. The concentration value of 2.30 ppm for Cu was however within the WHO limit of 10 mg/kg for Cu in plants. Mn concentration value of 10.87 ppm was also within the WHO limits for Mn in plants.

In Jos South, the concentration value of moringa, recorded for Pb showed higher concentration value of 30.14 ppm than Jos North and the value was also above the WHO permissible limits for Pb in plants. Fe in Moringa recorded a concentration value of 964.29 ppm and is lower than the concentration of Fe in Jos North and is also higher than the WHO permissible limits for Fe in plant. Cu concentration value of 13.35 ppm is lower than the Cu concentration value in Jos North but was not within the WHO permissible limit for Cu in plants. Mn recorded a concentration value of 69.88 ppm and is within the WHO permissible limits.

The concentration value of Bitter leaves for heavy metals in Jos South was within the same range as that of Jos North except for Pb which was a little bit low in concentration in Jos South. However, Pb, Fe and Cu were above the WHO permissible limit of heavy metals in plants except for Mn which was within the WHO permissible limit of 200 mg/kg in plants.

The concentration of heavy metals in Mint plants sample from the four sites in Jos South L.G.A. showed lower concentration value for Pb, Fe and Cu when compared to the concentration values recorded in Jos North L.G.A. for mint plants. Cu and Mn recorded the lowest concentration value of 8.75 ppm and 138.20 ppm respectively which were within the WHO permissible limit of Cu and Mn in plants.

Lemon grass in Jos South L.G.A. recorded lower value for Pb and Cu when compared to Jos North L.G.A. The concentration of Fe and Pb were above the WHO permissible limit for Fe and Pb in plant sample while Cu and Mn had concentration values that were within the WHO permissible limit for Cu and Mn in plant. Generally from the result obtained, it was observed that all of the four herbal plant sample studied, Lemongrass has a low affinity for heavy metal uptake while mint plant showed a high affinity for heavy metal uptake. This may be due to several factors like soil type, type of activities in the area, the atmospheric condition of the area, the type of plant etc. There is an increasing need for the herbal sellers to be educated on the effect of harvesting these plants in sites prone to heavy metal contamination as it poses serious health challenge to the consumer of these herbs in the long run.

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# On Sorting of Personal Management Schools and its Content Building

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DOI: 10.29322/IJSRP.8.8.2018.p80109

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80109>

**Abstract:** The research is based upon ‘The school of Personal Management thoughts’, on which ‘The building of Personal Management content’ as well as ‘The forecast about Personal Management development trend’ is explored. The 3<sup>rd</sup> section ‘The implication of Personal Management as well as Personal Management Science’, paves a way for the 4<sup>th</sup> section ‘The building of PM content’, making the whole research busy and convictive. The 5<sup>th</sup> section ‘The significance of studying PM’, replenishes the 4<sup>th</sup> section ‘The building of PM content’, also serves for the 6<sup>th</sup> section ‘The forecast PM development trend’. ‘The combing as well as summary of PM school’ makes a hub for the development of PM theory, joining the history, starting the future, as dredges people’s knowledge about PM theory, assisting people to make a bird eye prospect for the development of it. The research of ‘PM thoughts school’, ‘The building of PM content’, ‘The forecast of PM development theory’, is original effort.

**Key Words:** the school of PM thoughts; the building of PM content; the forecast of PM development trend.

## I. Introduction

Personal management, as a formal branch science, its development could only be a matter of late 20 years. If western self management theories taken into consideration, from self management thoughts of Peter Drucker(1909-2005), the time span would be more than half a century or so. While, personal management practice has been borne early along with the beginning of human history. [1] The King Tang (B.C1670-B.C1587) of Chinese Shang Dynasty took ‘no excessive entertainment, no indulgence’ as a principle to establish his kingdom, motto ‘if a new day, keep creative every day, more innovative next day’ carved in his basin as his self motivation. Similar methods to Tang’s strategy are adopted by vocational man in modern society. 13<sup>th</sup> century B.C, [2]the Jew prophet Moses stipulated ‘10 admonishments’ on their exodus to Egyptian, which were earlier personal management rules as well as organization management disciplines of western world.

## II. Schools of personal management thoughts

Data from baidu.com, the concept of personal management comes from the monograph *The Seven Habits Of Highly Effective People* by Stephen Covey in 1989. As a matter of fact, in spite of excellent guide for personal management practice in Covey’s book, it would belong to the science of success, no special discussion upon the theory of personal management connotation, research contents etc.. In 2003, Peter Drucker published his research *Personal Management*, which is the earliest monograph titled with Personal Management. Domestically, Luo Guicheng, Luo Rundong researched the system of Personal Management science, their paper *On Building of a Frontier Science, Personal Management* published [www.paper.edu.cn](http://www.paper.edu.cn) in 2008, which was an earlier systematic demonstration for the building of Personal Management (PM) science. Le Xiaotao published the monograph *Personal Management* in 2011. Extensive research for Personal Management sprouted domestically after 2008. Abroad, corresponding research would mainly be self management theories, involving time management theories, mental health management theories, students’ self management theories, employee self management theories for enterprise Human Resources management after science *Management Principles*. Currently, Chinese personal management research, originating from western world, has high potential outrun western world. Chinese personal management research assimilates, synthesizes time management theories, self management theories, mental health management theories, knowledge management

theories, system management thoughts from western world, Chinese ancestors' management wisdom anastomosed, the characteristics of contemporary environment combined, initiating a better PM science system.

Along the time line, PM thoughts could be sorted into, time management school, mental management school, organization management school, system school, knowledge management school, social school.

#### (I) Time Management School

Time management is an important branch of PM, also the earliest content of modern self management theories. The origin of time management could be tracked back to Zhang Shui, Liang Lingzan of Chinese Tang Dynasty in 8<sup>th</sup> century, they invented a machine clock for time management. 15<sup>th</sup> century, Germany lock artisan P•亨莱恩 invented a clock driven by spring. In succession, 17<sup>th</sup> century, C•Huygens invented a more accurate clock with a pendulum. Time management got popular in Industry Revolution in 19<sup>th</sup> century (Explore the History of Time Management , <http://www.brighthub.com/office/home/articles/76908.aspx>). The concept of time management should be attributed to U.S president Benjamin Franklin, time is money, time is life. 1954, in his speech on the 2<sup>nd</sup> Plenary Meeting of World Church Commission in Illinois, U.S president Dwight D. Eisenhower cited schedule methods of North-West University head Miller, which is still a popular time management classics of now days, Eisenhower Matrix.

[3]Zhu Shuai's summary(2004) is typical relatively, he related self management with time resources management, proposing that self management should be operated better at priority setting, goal setting, list making, schedule making.

#### (II) Mental Management School

After time management theories, came out mental health management theories. When human society got into industry era, working stress hiked up, social contact dropped down, fierce social competition resulted in psychological failure as well as physiological hurt upon salariat. On the other hand, because of fierce competition, pursuing professional success became important social demands, under this circumstances, mental management theories was born, to avail mental problem for patient or self incentive for vocational man.

Western success theories arose earlier than self management theories, Dale Carnegie(1888-1955) was a typical character on theories of success and social relationship management, whose work *How to Win Friends and Influence People* in 1936 is a classic of success theories. Stephen Covey(1932-2012)'s work *The Seven Habits Of Highly Effective People* (1989)appreciated by professional persons also belongs to success theories.

[4]J.Block(1950), J-H-Block(1951) proposed the concept 'self-adaptive capability 'in their doctor degree dissertation respectively. Three theories upon self mental health management are introduced on official homepage of Health Ministry of Austrilia, (1)self efficacy theories, (2)theories of change phase, (3)theories of dynamics for psychological education groups. Sun [5]Xiaomin, Xue Gang introduced the self management model for mental health from Albert Bandura's paper published in 1986: performance observation, self evaluation, self responding. Bandura's theories, personal activity is the function of cognition, behavior and environment, which is a typical representative for mental health self management, cited and interpreted enormously. Sun Xiaomin, Xue Gang offered a definition for self management, a process for object management upon thinking, emotion, behavior and environment after individual implementing his cognition and behavior strategy positively. [4]Wang Yiming, Jin Yu's(2002) definition, 'self management denotes that individual actively adjust psychological activity and behavior, controlling and overcoming unsuitable impulse, disadvantageous circumstances, pursuing development positively, attaining good mental quality.

Self management theories for mental health are widely adopted in different phases of education for students' growing up. [6]Yang Guoliang (2004) generalized five procedures for self management: (1) analyze self superiority, grasp self specialty; (2) highlight object for action, set developing direction; (3) determine implementing manner, manage action efficiency; (4) implement image test, beware of self constraint; (5) regulate the time line, attain substantial effects. [7]Jin Haiyan's (2005) achievements, the contents of self management involve: self recognition, self appraisal, self constraint, self incentive.

#### (III) PM Theories for Enterprise Organization: Organization Management School

These PM theories employ classic Management Principles upon employees' self management, to improve organization efficiency. [8]U.S experts Nigel A.L. Brooks' (2008) research, self management is the fundamental contracts employing managing factors, such as planning, organizing, implementing, measuring, appraisal, adjustment into personal activities, to improve personal capability for realizing personal expectation, purpose and controlling stress. As a result, personal professional capacity as well as

entrepreneurship is bettered. PM theories focusing on Object Management also belong to Organization Management School, for instance, *Start from the End* of Wang Weibin (2005).

In self management theories of Enterprise Organization School, the most influential, the earliest, the most cited is Peter Drucker's thoughts, three of his works contain more related arguments, *The Effective Executive* (1966, 1986, 2009), *Management Challenges for the 21<sup>st</sup> Century*, *Personal Management* (2003). [9]Peter Drucker summarized the content of self management into 9 aspects: (1) understand self superiority, (2) what should be dedicated by yourself, (3) how to perform or learn, and embody effectiveness, (4) know personal values for yourself, (5) know life adscription and life goal, (6) responsible for relationship, (7) manage later half of life as well as professional career, (8) time management, (9) innovation management.

#### (IV) Knowledge Management School

Just as time management, knowledge management is an important content of PM. The wide spread developing of knowledge management happened after globe society getting into knowledge economy as well as information economy from market economy. It originated from enterprises competitions and competitions of knowledge production capacity, developing later than time management, mental management. [10]The concept of knowledge management was proposed the first time on 'International Labor Conference of UN' in 1986. Another opinion, [11] knowledge management was brought out in Taylor's *The Principles of Scientific Management* in 1911. [12]David·A·Garin's (1993) viewpoints, a learning organization is an organization good at creating, securing, transmitting knowledge, and changing its behavior by new knowledge, new ideas. [13]Davenport's (1998) points, knowledge management, based upon fully admitting knowledge value to enterprises, creates an environment to let each employee access, share internal and external information of organization to establish personal knowledge, supporting, inspiring individual to implement, integrate knowledge into organization products or services, ultimately, enhancing management theories as well as practice of innovation capacity and reaction velocity for enterprises. Wikipedia.org's interpretation, personal knowledge management (PKM) is a process, in which an individual collect, sort, store, search, share knowledge in his daily life(Grundspenkis 2007), also involving various manners underpinning work activity(Wright 2005); is a reaction to the increasing demand by knowledge employee for self development as well as learning (Smedley 2009); also a process of knowledge management for organization from top to bottom, just contrary to the traditional knowledge management process from bottom to top (Pollard 2008). Wikipedia.org's data, the concept of PKM could be tracked back to Frand and Hixon's work thesis (Frand & Hixon 1999). [14]Chinese Lai Chunsheng, Lu Zehui proposed the concept of PKM in 2000. [15]Zhou Jiuchang's (2006) research, PKM involves three important domains, personal inspiration knowledge management, personal knowledge project management, personal learning management.

#### (V) System School

This type of research employs system thoughts, information theories into personal management. [16]Chen Xinmin summarized Chinese modern educationist Wei Shusheng's (2001) personal management thoughts for students, Wei established three systems, planning system, supervising and checking system, feed-back system. [17]Ma Qiuli's research involves system thoughts (2005), she proposed management for dynamic system of personal development.

#### (VI) Personal Management Theories of Big Society Thoughts: Social School

This type of scholars or experts not only apply management theories, economics theories, education psychology theories into PM research, but also research personal management and development in the macro vision of social history, running PM research beyond pure commercial social order, taking the lead to combine PM tightly with the inner conflicts of human society, civilization progress. [18]Luo Guicheng, Tan Bin, Zheng Shiqiao's effort *Personal Quality Structure, Social Order and Long Term Curve of Personal Development* belongs to this category. In the eye of social school, society and individual are an integrated unity of a big field, individual should be studied when researching society, researching personal subsistence and development should not be isolated from social environment. Without various individuals, society would not be a society. Without society, individual can hardly advance an inch. Researching personal development is the research upon society, only smart research upon social development could avail personal subsistence and development.

Sorts above are a tongue from a particular person, only relative sorts, there are no absolute borders among different schools. Although earlier Taylor Rules from Frederick Winslow Taylor (1911) were outdated, standard operations were selected from the labor of excellent workers, as was a method saving time resources, also the accumulation and dissemination of knowledge. Now days, the research upon PKM system is very common, the process for organization knowledge management is also a process of

human-orientation management. Other than Time Management theories of early time, each school is a complex research with a perfect theory system comparatively, while having a different focus, a different characteristics respectively

Time Management (TM), Self Management are PM science born from western commercial society, the sharing point between them and Personal Management and Development (PMD), all have ties with Management Principles, their differences, PMD adds concern for personal subsistence and development under different social institution environment, or an environment with changing institution. PMD adds analysis upon institution of social environment, as well as mental management, at the same time, economics thoughts and methods integrated, such as long term equilibrium, short term equilibrium, whole equilibrium. In comparison with TM and self management, PMD pay more concern to big social vision, investigation into social environment, simple mathematics methods also employed, so PMD could be named as a management science of eastern people.

### III. Connotation of PM and PM Science

#### (I) The core issue of PM

On the basis of PM schools, our ideas, PM theories should tackle six core issues, (1) environment forecast, involving environment analysis and identification, (2) individual and family forecast, covering personal condition analysis, individual or family forecast, (3) the ensuring for personal quality or personal core competence, (4) life mission, or determination of long term, short term goals, (5) the plan for a road path to fulfill life mission, (6) a fence against uncertainty and risks.

In summary, PM is the solution upon personal subsistence and development in a changing environment. From this sense, it is the same as organization management. [19]Figure 1 (Luo Guicheng, Luo Rundong, 2008) unveils that, environment and individual, interacting with each other, are a system. Personal development could not be independent from the influence of environment. The interact between environment and individual would be positive or negative, which will be decided by real circumstances. So, (1) environment forecast, (2) individual and family forecast become core issue of PM respectively. Environment pressure and inner weakness decide it is not easy for individual's subsistence, which implies the demanding upon personal capacity. Personal quality and and core competence become the 3<sup>rd</sup> big issue of PM. A fruitful life career will be founded upon a life dream, which is the original dynamics of personal subsistence. The determination of personal long term or short term goal is the 4<sup>th</sup> issue of PM. An individual with normal quality, the fulfillment of life dream will need strategies or road map, 'taking action after perfect planning', so, the design for a road map of life dream is the 5<sup>th</sup> issue of PM. Success is rare matter, those lucky enough to catch a direct vehicle to success is few, the road to pursue dream is uneven, two reasons, personal limited wits and multiple changes of environment, which increase uncertainties or risks. From current complicated situation, an information era with massive population and fierce competition, the weight for the prevention against uncertainty and risks hikes up in daily management, which is the 6<sup>th</sup> issue of PM.

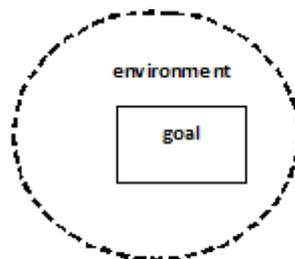


Fig 1 Goal and environment constraint

Aristotle had explained happiness, happiness is significant to life, of course also philosophy foundation for PM. Happiness is a mental state, a psychological perfectness. Success would not surely imply happiness, while, no success means the deficiency or defect of PM, which could not be regarded as happiness either. So, success could be the primary target of PM, happiness could be the dream of PM. In an earthly society, the most important thing of PM, the youth should put their life goal highly and with long term sight, standing for the big picture, eyeing for long run, to solve the relation between 'big ambition' and 'big wisdom', 'big ambition' often creates 'big wisdom'.

#### (II) Personal Management and Personal Management Science

Researches titled with 'PM' are not so many. [20]Wang Shuzhen's achievement (1999), PM of a postgraduate denotes how to manage himself, arranging his study, work, entertainment, daily life etc., and how to dispose of the relationship with others,

collectives, society. In a certain sense, PM of a postgraduate is personal self governance, self management, self constraint.

[19]Luo Guicheng, Luo Rundong's (2008) research, PM connotes, in a changing environment, a process of planning, organizing, controlling, coordination to fulfill life goal, grow personal utility. Personal Management Science is a science researching personal management.

[21]Zhou Zihui's sights (2009), ultimately, PM is the management upon value, personal value will decide life direction, which is just like an invisible force, influencing people's decision where to go or whom to follow all the time, determining their fate at last.

[22]Yue Xiaotao's research (2011), PM is an activity to realize personal made target by allocating personal resources suitably. PM science is a science systematically researching the basic law and general methods of PM activity.

Above points, the concept of PM, Luo Guicheng, Luo Rundong's achievement is better, the concept of PM science, Yue Xiaotao's research is more suitable.

<b>Life dream and personal strategic goals</b>				<b>PM forecast (1)</b>	<b>PM techniques</b>	<b>time resource allocation</b>
<b>Value management</b>	<b>Health management</b> mental health	<b>Knowledge and learning management</b>	<b>management for social relationship resources (1) analysis and forecast for social relationships (2)social crisis management</b>			
<b>endogenic quality</b>			<b>improvement for professional quality and other ability</b>	<b>ability of management field</b>		

**Fig.2 The relation among different personal management contents**

#### IV. Building for the content of PM Theory

Luo Guicheng etc.'s research, PM science contents involve, the connotation of PM and PM science, PM techniques, personal value management, personal management forecast, management for personal strategic target, management for personal resources of social relationship, management for personal time resource, knowledge management, mental health management, personal quality structure、social order and personal long term developing curve, management for wealth creating of individual and family, PM information system.

The structure of contents above (figure 2), life dream and personal strategic goals are the core, while endogenic quality, professional capacity, social capacity, other ability (such as art capability, medical ability of non professional person) are the foundation for the fulfillment of life strategic targets, abilities of management field are the engine for personal subsistence and development. For the weight of management forecast ability is hiking up, it is isolated from management techniques.

[18]Luo Guicheng etc. (2009) sorted personal quality into the endogenic quality and the learned quality. The endogenic quality includes,value, mental health, physiological health. The learned quality includes, professional capacity, social capacity, the ability of management field, other capabilities.

On the basis of psychological school and Peter Drucker's achievements, [9]Li Jialong (2009) sorted the content of self management into implicit factors and explicit factors. Implicit factors mainly denote mental qualities, covering self consciousness, self restraint, self adjustment, self incentive, value. Explicit factors involve long term or short term daily affairs, (long term or short term) object management, professional career, learning, time, superiority and efficacy, health.

By means of general capacity and professional capacity, [23]Zhang Xiaoyan (2014) researched the self management of pupils in high vocational colleges.

#### **V. Significance of researching PM science**

Fierce competition of contemporary society demands higher personal qualities. PM capacity structures the foundation and core of the common people. Ultimately, competitions among people would be attributed to the competition of PM capacity. Current world, generally, the gap between the poverty and the wealthy is paired along with the gap of personal qualities, in macro sense, for which the education could be blamed, while in micro sense, which should be attributed to PM capacity. We find out, even graduates from the same class, their fates vary astoundingly after graduation. If they received the course Personal Management and Development (PMD), it is surely that the gap between their development will be narrowed. So, to individual, learning PM is a necessary requirement adapting himself to fierce competition of modern society; to a country or an ethnic, it is a powerful instrument to improve civilians' quality. Many countries are pushing quality education to better nationals' quality, to which the initiation of a course PMD will be beneficial, reaping great social efficiency. From point of management theories, PMD expands traditional management theories, applying management theories and methods to every cell of the society—every individual. From the sense of economics, PMD concretes, theorizes the allocation and utilization of personal resources, guiding the sustainable development of single economy unity. In summary, PM science adds a powerful theoretical instrument to further social productive capability as well as the progress of social civilization.

#### **VI. Forecast for The Developing Trend of PM Theories**

Our opinion, religious capability, medical capacity, management capacity, net security will be new four skills of personal potential in future human society. PM capacity is one of new four skills. The perfection of PM theories is the necessary outcome of the globalization and information economy from market economy of human society. PM theory is in its adolescence in spite of the affluent content, not matured. PM theories will surely be affected by the development of globe society, with a sear mark of time, shouldering the responsibility to push forward human society civilization. Sustainable development has become a fundamental conception of international civilization progress. Xi Jinping (2016) pointed out profoundly, human society has a sharing fate with the nature, philosophy conception of sustainability will surely be melted into PM theories. The connotation of sustainability involves not only the relation between human being and nature, but also the relationship among people, among organizations, among nations, e.g. 'to build clean water and green mountains for the political environment.' The compatibility of one social system's development with another will be the perpetual issue of globe civilization, which is also an inevitable item of PM theories, so, PM theories will certainly be melted deeply into sociology, history, politics, ethics. Social school of PM will act a significant role in PM theories for very long time. Cloud computing, big data theory and methods have become a fashion of the globe society. The environment forecast system based upon massive data, globe perspective, becomes popular in management affair of various fields, which will affect the development of PM theories profoundly. System theories, information theories and related mathematics methods will get prevalent in PM theories, or, in the future, affected by international situation, system school of PM will become the favorite of PM theory researchers. For very long historical periods, the 'paradise' of human society or the primitive communism would hardly come into true, the inertia of competition among people will continue, mental stress and mental trauma after fierce competition will persist for long time, mental school of PM will perform irreplaceable role. Religion treatment for soul has being existed in human history, and will not disappear in the future, religion thoughts in line with truth principles would get into PM theory research. As to current situation, the PM connotation is more affluent and more profound than western self management theories, the important branch of PM theory, PM knowledge management theory is getting mature. In the future, PM concept will replace self management concept, PMD theory will enter the classroom of universities as a science.

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# Impact of Rainfall Variability on Food production under Rainfed Agriculture in Homa Bay County, Kenya

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DOI: 10.29322/IJSRP.8.8.2018.p80110

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80110>

**Abstract:** Rainfall variability exacerbated by frequent dry spell occurrences within the growing seasons is a common phenomenon in many regions of the world.. Homa Bay County located in the western part of Kenya in the Lake Victoria Basin is a sub humid region characterized by frequent dry spells resulting to poor yield in crops and livestock production in the County. This paper examines the impact of dry spells occurrence on food production under rainfed agriculture in Homa Bay County. The study used a sample size of 384 households. Primary data was gathered through use of questionnaires, interview guides, Focus Group Discussions and observation while secondary data including content analysis obtained from publications, journals, newspapers and internet sources. Data for evaluating dry spells and rainfall variability was obtained from Kenya Meteorological Department (KMD). Descriptive and inferential analyses were done for household data using statistical package for social scientists (SPSS) version 20. Results indicated that during dry spells, annual crop yield production for maize and beans fall below average of 1.44 tons/ha and 0.78 tons/ha while sorghum and millet were above average of 0.94 tons/ha and 1.61 tons/ha respectively. Livestock production (48%) was impacted upon greatly through weight loss and reduced milk output (23.8%). The findings revealed that rainfall variability and dry spells have serious impacts on food security in the Homa Bay County causing massive crop failure and reduced livestock production and death. It is therefore recommended that both national and county governments and other stakeholders put in place effective risk transfer strategies to ensure sustainability in rainfed agriculture in the area.

**Key Words:** Annual crop yield, dry spell occurrence, rainfall patterns, crop stages, food security

## 1. Introduction

Increasing crop production in semi-arid areas remains a challenging task due to rainfall that is low and erratic (Heng *et al.*, 2007), since it is the primary source of water. The success or failure of crops under rain-fed conditions is determined by the rainfall patterns and amount received. Consequently rainfall amounts and seasonality are essential to an in-depth understanding of the biotic and a biotic environment. Rainfall trends are important for optimizing the spatial distribution and adaptability of different agricultural enterprises (Monadjem & Perrin, 2003).

Most parts of the world's agricultural systems are rainfed, and hence the occurrence of dry spells during the growing season greatly affects yield and productivity. Adamgbe *et al.*, (2013) observed that in most of the tropics and equatorial regions of the world, and across large areas outside the tropics, the agricultural yield is determined more by the amount of rainfall received and stored by soil than by the air temperature. The amount of water transpired by the crops is also determined by air humidity with generally less matter produced in drier atmosphere (Parry *et al.*, 1990). Therefore changes in rainfall and air temperature are likely to have a significant effect in crop yield and livestock.

Dry spells occurrence poses a great challenge to rainfed agriculture that hinders the constant supply of food needs for the increasing African population. For instance, rainfall in West Africa is characterized by high spatial and temporal variability for decades hence affecting the rain dependent agriculture (Nicholas, 2001). West Africa has experienced a decrease of 20 – 40% in annual rainfall amount in the last decade. This indicates the extent of loss in agricultural production hence putting the lives of population at risk of hunger and food insecurity in the region.

According to Parry *et al.*, 2007, the climate variability has generated major phenomena in the Sahel by increasing the frequency and duration of occurrence of dry spells and droughts. This change in rainfed agriculture causes uncertainty in planting period and other farm practices. This in turn has greatly reduced agricultural productivity in many parts of the continent that are agriculturally viable.

The frequency of dry spells has increased in the recent years in Kenya and other nations in the horn of African. The increase has been attributed to the global climate change which has led to spatial and temporal reduction of rainfall (Gitau, 2012). Kenya has experienced some of the worst forms of dry spells that have claimed many lives in the present times due to hunger and famine (Gitau, 2010). Most of the socio-economic activities in Kenya are rain dependent. This may affect the status of food security in a place given that food security is defined by socio economic activities and climatic factors (Scoones *et al.*, 1996). Rainfall is therefore the most important climatic element over Kenya, yet it displays the largest variability in both space and time (Jaetzol *et al.*, 2007).

Most parts of Kenya experience two rainfall seasons that alternate with dry seasons. The two rainfall seasons are the long rainfall season which is concentrated between March – May and the short season which occurs from September to Early December (Gitau *et al.*, 2008). The probability of these seasons getting interrupted by dry spells is very high mostly in the ASALs and sub humid regions such as Homa Bay County as opposed to wetter regions of the country (Awange *et al.*, 2007). This is exacerbated by climate change that has influenced the climate in most regions during the last decade.

The required amount of rainfall for better agricultural yield and productivity is important however, the distribution in space and time plays a critical role in certain crops that are regarded as staple food crops in most parts of Kenya. According to Mugalavai and Kipkorir (2013), the impact of dry spells to rainfed crops like maize is felt most in the critical stages of crop development like flowering and grain filling.

The global climate shows an increasing trend in average air temperature (IPCC, 2008). In relation to the changes in temperature, the cropping period is expected to become shorter and even more irregular distribution of rainfall is expected. Increased frequency

and prolonged duration of dry spells occurrences impact on; crops and livestock production, water access and market prices (Onchiri *et al.*, 2016). In humid countries the success or failure of crops, particularly under rainfed conditions is highly related with the distribution of dry spells.

Adger *et al.* (2003), discussed adaptation to climate change related phenomena in developing countries while Barret (2002) described food assistance programs. The impact of climatic extremes in the context of climatic change in Lake Victoria basin has been assessed in Phoon *et al.* (2004), while Awange *et al.* (2007), has assessed the frequency and severity of dry spells and drought in the lake Victoria basin region (Kenya) and its effect on food security.

Dry spells affect not only agriculture but also other sectors such as fisheries, health, electricity etc. The fish productivity as the second major sector within the County from is likely to be stricken by longer dry spells (Odhiambo, 2013). Longer dry spells also interrupt generation of electricity from hydroelectric power as was experienced in 2011 in the areas bordering Horn of Africa. Information on dry-spell duration is useful in decision making with respect to supplemental irrigation and field operations in agriculture. Prior knowledge of dry spell studies can be applied to generate systematic sequences of rainfall and the estimation of the irrigation water demand, (Mathlouthi, 2008).

Crops are more likely to do well with uniformly spread 'light' rains than with a few 'heavy' rains interrupted by dry periods. The timing of breaks in rainfall (dry spells) relative to the cropping calendar rather than total seasonal rainfall is fundamental to crop viability (Usman, 2004). The longest period of several long spells is therefore of crucial importance in planning agricultural activities and managing the associated water supply systems but also the timing of dry spell occurrence in mostly in growing calendar plays a critical role in agricultural production.

A major challenge of dry spell research is to develop suitable methods and techniques for forecasting the onset and intervention points of dry spells, (Panu, 2002). Past studies done on dry spells in Sri Lanka and in Kano plains in Kenya highlighted the heavy losses in paddy production caused by prolonged dry spells and the importance of studying the temporal and spatial variability of dry spells (Ariyabandu and Hulanagamula, 2002) and (Ochola and Kerkides, 2003) . The objective of this study was to examine the impact of dry spells occurrence on rainfed agriculture in Homa Bay County.

## **2. Materials and Methods**

## 2.1 Study area

The study was carried out in Homa Bay County which is located in the Western part of Kenya in the former Nyanza province with an area of 3,154.7 km square. It is bounded by latitude 0° 15' South and 0°52' South and longitudes 34° East and 35° East (Figure 2.1). It has an altitude of 1146 m above the mean sea level.

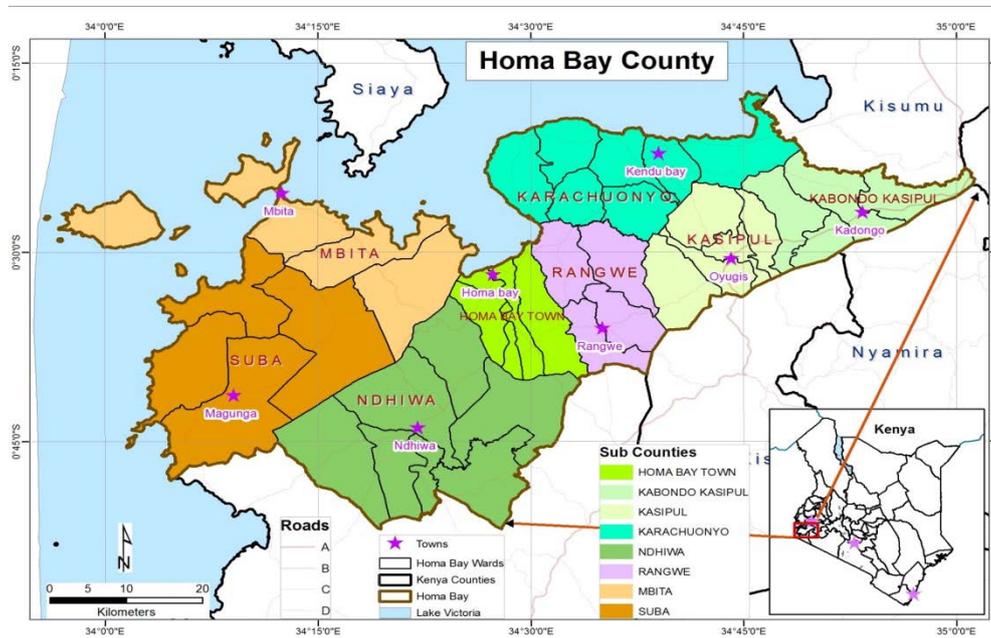


Figure 2.1: Location of the study area

Source: (Researcher, 2017)

## 2.2 Research design and sampling procedure

Descriptive research design was used to examine the impact of dry spells occurrence on rainfed agriculture in Homa Bay County. Additionally, the study utilized both qualitative and quantitative approaches. A sample size of 384 households was identified for this study. Homa Bay County was purposively selected due to the magnitude of the recurrent dry spells and droughts that reduce its huge potential as a food basket within the Lake Victoria region (GoK, 2013).

The study took a multistage sampling approach where 50% sampling units as supported by Mugenda and Mugenda (2003) were selected and two out of four sub counties were purposively selected for the large scale farming areas like Ndhwa, Suba, Mbita and Karachuonyo; while another two out of four Sub Counties were selected for the small scale farming areas like Homa Bay Town, Rangwe, Kasipul Kabondo and Kasipul hence a total of four sub counties were selected for this particular study.

According to Awange et al., (2007), the most affected sub counties by dry spells and droughts were the peripheral ones neighbouring Lake Victoria, but for the wards that are located far away from the lake shores. These sub counties including Karachuonyo, Mbita, Homa Bay Town and Rangwe receive relatively low rainfall amount (KMD, 2015). The wards under these sub counties (Table 2.1) were purposively sampled given their proximity to the lake shores that defines the rainfall variability in

the areas. The proportion of wards where the study was conducted were computed from the four sub counties based on 30 % sampling units as supported by Mugenda and Mugenda (2003).

**Table 2.1: Proportion of wards Sampled**

S/N	Sub counties (Wards)	Total number of wards	30% Sample of wards
1	Karachuonyo (Kibiri and Kanyaluo)	7	2
2	Mbita (Kanyamwa and Kolongi)	7	2
3	Homa Bay Town (Arujo)	4	1
4	Rangwe (Kagan)	4	1
<b>Total</b>		<b>22</b>	<b>6</b>

**Source:** Field data, 2017

In-depth interviews were conducted using interview guides with 2 representatives (Table 2.2) from each organization including Ministry of Agriculture, Kenya Meteorological Department, Non Government Organizations and County disaster management committee totaling to Eight (8).

**Table 2.2: Summary of study population units, sampling methods and sample size**

Population Units	Sample size	Sampling strategy
Households	384	Multi stage
Ministry of Agriculture (MoA)	2	Purposive
Kenya Meteorological Department (KMD)	2	Purposive
Non Governmental Organizations (NGOs)	2	Purposive
County Disaster Management Committee	2	Simple random
FGD respondents	4	Quota

**Source:** Field (2017)

The key informants were identified through a combination of simple random sampling, purposive and quota sampling techniques. Appointments were scheduled by telephone with those respondents who were available and willing to speak to the interviewers about rainfall variability, dry spells occurrence and their impacts on the rainfed agriculture in Homa Bay County.

### 2.3. Analysis criteria of rainfall variability in Homa Bay County

Annual and seasonal rainfall patterns were analyzed from daily rainfall data and the variations illustrated using of graphs and trend lines. The study divided the years into four seasons (DJF, MAM, JJA, and SON) for comparison between the growing

seasons and the non growing seasons in relation to rainfall variability. The main growing seasons in Homa Bay County are (MAM) and (SON) that is during the long and short rains respectively.

The trend line  $y = mx + c$  was used to describe changes in rainfall amounts where “y” represented rainfall amount in millimeter (mm), “m” represented slope showing the rate of change of rainfall over the period under consideration while c represented the intercepts on y – axis.  $R^2$  was used to determine the significance of change at 0.05 level in both seasonal and annual rainfall amounts over the years in consideration. Standard deviation (SD) was used to vary the magnitude of annual rainfall about the mean rainfall over the years. A time series analysis showing the long term mean rainfall, (mean + SD), (mean – SD) in order to describe the wet, dry and normal rainfall year for Homa Bay County. The graph demonstrated years regarded as wet (mean + SD) and dry (mean – SD) respectively under the years in consideration in Homa Bay County (Mugalavai and Kipkorir, 2015). The normal rainfall years were those falling between (Mean – SD) and (Mean + SD). Moving averages of 5 and 10 years were used to smooth the time series analyses of rainfall over the years in consideration in Homa Bay County in order to describe the climatic characteristics of the study area.

#### **2.4 Analysis criteria of crop yield in relation to annual rainfall variability and dry spell occurrence (1950 -2017) in Homa Bay County**

Crop yield data were obtained from the Ministry of Agriculture of the County Government of Homa Bay for the period (2007 – 2016). The crop yields were measured in tons/ha. A regression approach was used to establish relationship between the crops yield and annual rainfall variability in Homa Bay County.

Regression equation of  $y = bx + c$  was used to describe the changes in crop yield against the annual rainfall amount. “y” represented annual rainfall amount in (mm), “b” = the gradient showing the rate of change in rainfall and crop yield while “c” represented the intercepts of y – axis.

Questionnaires for primary data were also subjected to descriptive statistical and inferential analysis, which gave the frequencies and proportions between the dry spells occurrence and the crop yield and livestock production. Descriptive statistical analysis was done to examine the relationships among different variables of the study. Inferential analysis obtained cross tabulation distributions with Chi square ( $\chi^2$ ) significance tests and single tailed analysis of variance. The ( $\chi^2$ ) statistics establishes the statistical association between variables both of which must be in nominal ordinal scales.

### 3. Results and Discussions

#### 3.1 Annual rainfall variations for Homa Bay County: 1950–2017

The analysis in Figure 3.1 reveals that the annual rainfall mean for Homa Bay County is 1200 mm with a standard deviation of 230 mm (Table 3.1).

**Table 3.1: Analysis of rainfall for the (1950 – 2017) period**

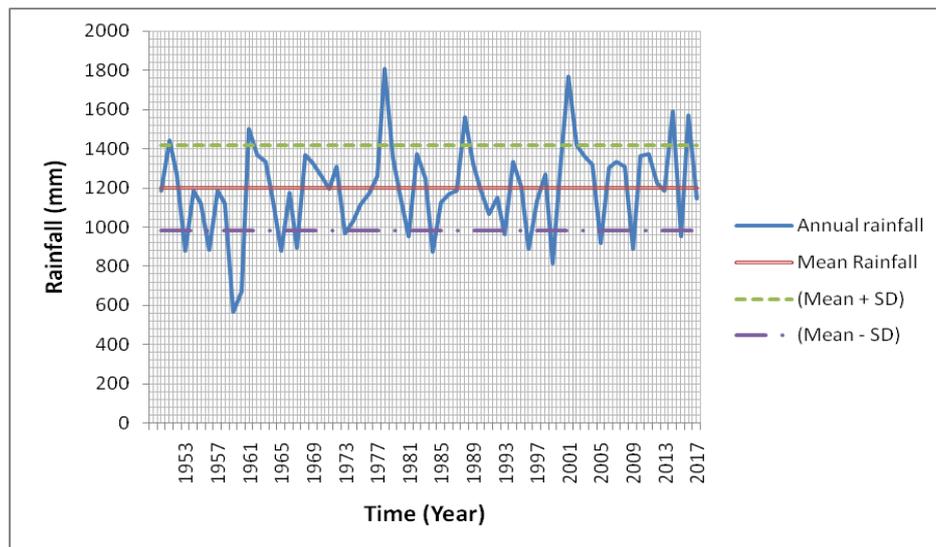
Rainfall	(1950 – 2017) Period
Mean (mm)	1200
Standard Deviation (mm)	230
Trend (mm)	0.046
Total change calculated from the trend (mm/ 67years)	2.4

**Source:** Data from the Kenya Meteorological Department: 1950 – 2017.

\*Total change is the difference between the trend line values of the last and the first year

In order to categorize rainfall characteristics into wet, normal and dry years, the standard deviation was used to vary the rainfall received about the mean annual rainfall over the period (Figure 3.1). Climate can be classified into below normal  $<$  (mean-SD), normal between (mean-SD and mean + SD) and above normal  $>$  (mean + SD) conditions based on the Kenya Meteorological Department (KMD) convention (Mugalavai and Kipkorir, 2015). Using one standard deviation as appoint of reference, the region above (mean + SD) is categorized under wet years. Rainfall data analyses for the period under consideration (1950 – 2017) reveals that 10% (7 out of 67) were wet years in Homa Bay County. The extremely wet years occurred in 1951, 1961, 1977, 1987, 2001, 2014 and 2016 causing Elnino in the various years. The normal annual rainfall years fall between the (mean + SD) and (mean – SD) considering the period under investigation. The analysis reveals that 67% (45/67) of the years received normal annual rainfall but with frequent dry spell seasons within the years in Homa Bay County.

Homa Bay County like many other parts of the Lake Victoria region experiences frequent and prolonged dry spells. The analysis reveals that the period under consideration had dry years with rainfall below the long term mean (Figure 3.1) that refers to the years falling below (mean – SD). The analysis reveals that 22.4% (15 out of 67) were dry years in Homa Bay County. The prolonged droughts occurred in 1953, 1956, 1959, 1960, 1965, 1967, 1973, 1981, 1984, 1993, 1996, 1999, 2005, 2007, 2009 and 2015. In line with the historical analysis of the weather, both Dry spells and extreme rainfall over the years have had a great potential of occurrence in Homa Bay County (GoK, 2016).



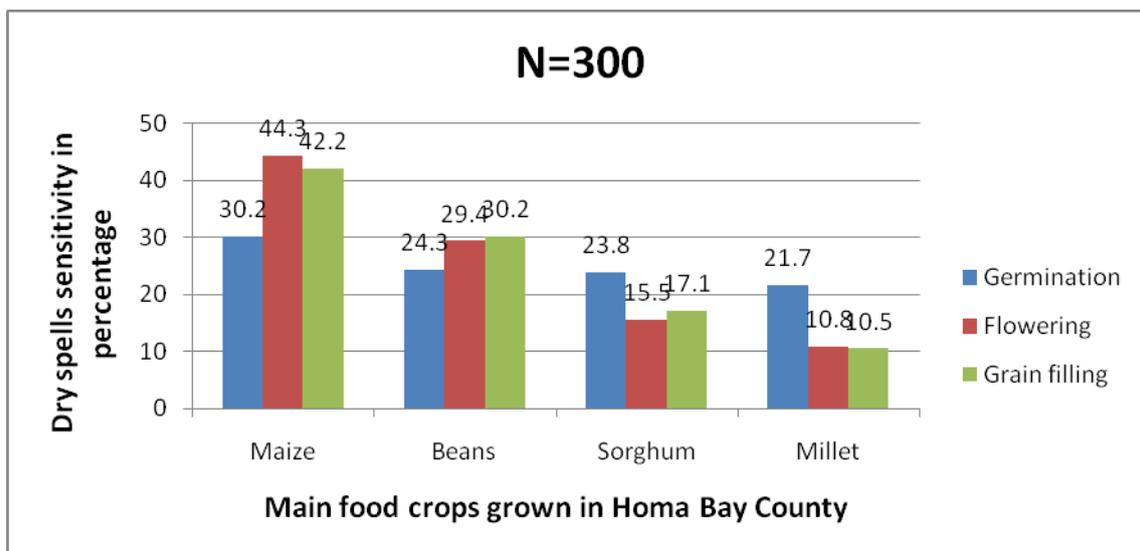
**Figure: 3.1: Annual rainfall variations for Homa Bay County: 1950–2017**

**Source: Based on data from Kenya Meteorological Department (2018)**

Many ASAL areas in Kenya are prone to rainfall variability but droughts have increased in frequency and are the major constraint to rainfed agricultural production (Huho and Mugalavai, 2010). This study findings resonates with a study by Awange *et al.*, (2007) who observed that many parts of Kenya including Lake Victoria region experienced drought in the years between 1983 – 1997 and Onchiri *et al.*, (2016) who observed frequent occurrence of drought in Mbita between the years 1983 – 2012. Within the 67 year period, 34 years had annual rainfall below the mean of 1200 mm that forms 57.7% of the entire study period. The duration of the prolonged droughts ranged from 1–2 years with the most affected years being 1959 – 1960 which had a 2 year span of prolonged droughts.

### 3.2 Impact of dry spells on different phenological stages of crops

The study sought to examine the impact of dry spell on different phenological stages of crops and in particular food crops that are regarded as staple food crops. The results in Figure 3.2 shows that maize which is cultivated by the majority of the residents of the County is most affected at the flowering at 44.3%, followed by grain filling stage at 42.2% and the germination that according to the respondents is not much affected at 30.2%. The impact on beans mostly affects flowering stage at 29.4%, pod filling at 30.2% and less at the germination stage at 24.3%. Sorghum in contrary is mostly affected at the germination stage at 23.8%, 15.5% flowering stage and 17.1% at the grain filling stage. Millet is affected more at 21.7% in the germination stage, 10.8% flowering and at 10.5% in the grain filling stage



**Figure 3.2: Impact of dry spells to different phenological stages on main food crops**

**Source: Field Data (2017)**

Based on the distribution and cross tabulation analysis computed,  $\chi^2$  value of 179.8, with 3 degrees of freedom and a p- value of 0.052 at 0.05 margin error, suggesting higher chance that dry spells impact on different phenological stages of different crops thus impact were significantly different in terms of their consequences on food security in the study area. The most adversely affected by the extreme climatic conditions like prolonged dry spells is the agricultural sector and mostly the crop production which has obvious implications on food security (Ngaira, 2005). The respondents were asked to show which phenological stages of the most common cultivated food crops were affected by dry spells in Homa Bay County.

This question was asked with the intention of determining the most affected stage of growth and development in order to inform the best intervention to mitigate the dry spell effects on crops for food security. Biamah (2005) observes that food crops that are majorly rainfed dependent in the semi arid areas of Kenya have a 25 – 75% risk of crop failure due to the extreme climatic changes like dry spells. Therefore, it was meant to inform small scale farmers who are dependent on rainfall for their agricultural activities on the most suitable crops that are drought tolerant for increased food security in Homa Bay County.

Further analysis shows that the average percentage impact of dry spells on all food crops confirms that maize is the most sensitive to dry spells in virtually all critical stages of growth and development at 39% followed by beans at 28%, Sorghum at 19% and Millet at 14% respectively. Maize and beans are more affected at the mid season stage of flowering and grain filling and this increases their general percentage in sensitivity to water shortage. Nyandiko *et al.*, (2013) observe that soil moisture condition during germination is of higher significance and determines crop performance. This is because it is the period of highest crop water need. If water shortage occurs during the mid season stage, the negative effect on crop yield will be pronounced (Bergaschi *et al.*, 2004).

Maize crop tends to experience extreme sensitivity to water deficit, during a short critical period, from flowering to beginning of grain filling phase (Bergaschi *et al.*, 2001). Huho *et al.*, (2010) observe that maize crops are more sensitive to the drought related climatic factors than other crop types in water stressed regions yet in the eyes of the rural small scale farmers, lack of maize means hunger and famine. Farmers who have majored on maize and beans cultivation can therefore be advised on the most appropriate time and stages of development of different crops to mitigate the severity of the dry spells. Crop development stages are in the initial and mid season stages in regard to water shortage sensitivity (Adejuwon, 2004). During this time, some crops react favorably to water shortage by developing deeper rooting system which is helpful during the later stage when the crop is about to be harvested. The study therefore indicates that millet is the most suitable crop for Homa Bay County followed by sorghum in regard to their increased level of tolerance to drought than maize and beans for food crops. Homa Bay County that forms part of the Lake Victoria basin has been found to be an agriculturally potential zone as it has moderately favorable climate for both food crops and cash crops. Food crop farming is practiced to a large extent in the study area despite of the challenges regarding climate related hazards that affect the crops at different stages of growth and seasons of planting (GoK, 2013).

The findings of this study are hence supported by Mugalavai and Kipkorir (2013) on evaluation of dry spells during sensitive stages of growth of maize crop in Western Kenya which indicates that the dry spell severity during germination and flowering stages is highest towards the northern part of Lake Victoria Basin (Kenya) and around the Lake shores. From the FGDs conducted it was revealed that grain filling stage is also impacted on by the dry spells but not to a larger extent as for germination and flowering stages.

The results indicate that the most vulnerable phenological stages to dry spells for maize crop which is a major food crop in the area are germination and flowering. Maize crop is very sensitive to water deficit in the critical stages due to its high water requirement in terms of evapotranspiration and high physiological sensitivity when determining its main yield components such as number of ears per plant and number of kernels per ear (Slingo *et al.*, 2005). However, the impact on the initial stage (germination) highly depends on the crop variety, planting date and the climate, consequently the effective full cover for many crops including maize occurs at the initiation of flowering. Hence, lack of or insufficient rainfall during these stages retards the development of the crops and may lead to total crop failure.

### **3.3 Impact of rainfall variability and prolonged dry spells occurrence on crop yield**

Studies carried out on the crop – climate relationship around the world have revealed that there is a considerable relationship between climatic condition and the crop yields (Bergaschi *et al.*, 2001; IITA, 2004; Hulme *et al.*, 2001). Based on the rainfall variability and prolonged dry spell occurrence experienced during drought years in Homa Bay County, it is prudent to investigate its impact on food crops and its relation to risk of food insecurity. Concerted efforts by various studies to investigate the effects of

drought onset and duration on food security, gives a clear foundation of enquiring the rainfall variability and extreme dry spells conditions and years to their impacts on common food crop yields every year in Homa Bay County. Nyandiko *et al.*, (2013) observes that in Lower Eastern Kenya region, inter annual rainfall variability has caused a major stress to farming and crop production that has only resulted to famine and hunger to the poor and vulnerable rural population.

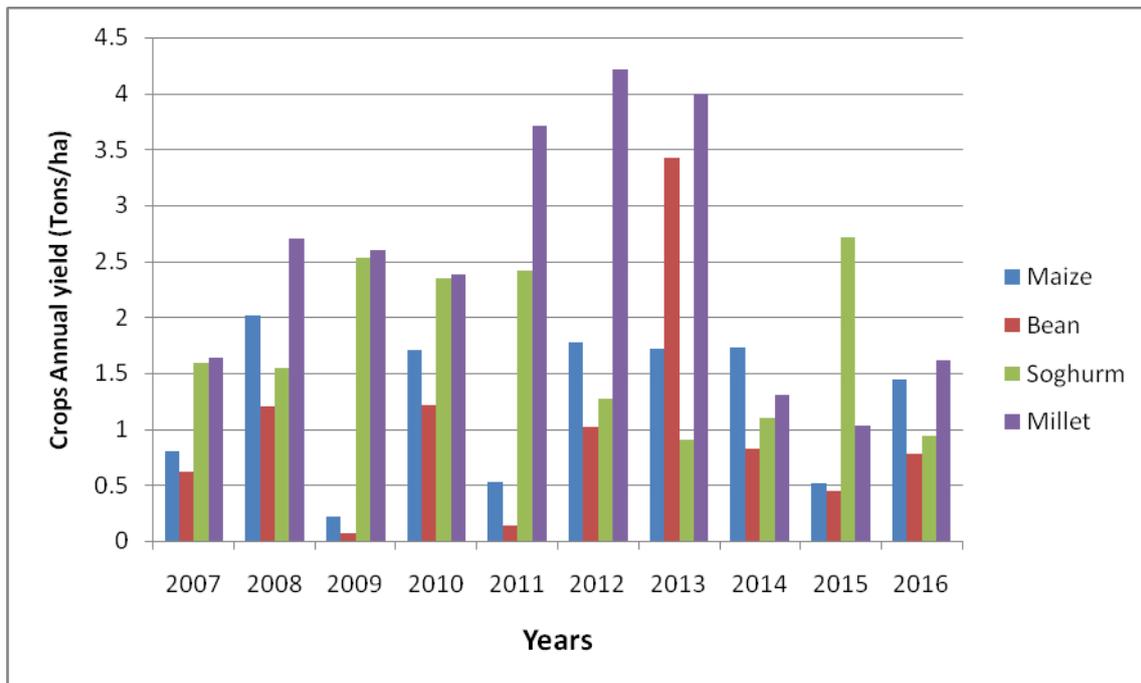
The results from the analysis of food crop yield data were based on their availability from the County Government of Homa Bay County. An annual crop yields for ten (10) years from the years (2007 – 2016) were acquired and analyzed. The food crops that are mainly grown in Homa Bay County are maize, sorghum, millet and beans. According to the County Integrated Development Plan for 2013 -2017 for Homa Bay County, food crops majorly maize and beans take account of about 80% of the crops cultivated in the County while the rest with very minimal of the remaining percentage(GoK, 2013). This forms the back drop of its choice of evaluation in relation to drought years in Homa Bay County.

The analysis in Figure 3.3 shows that during the dry years, Maize and beans were mostly affected and did not achieve the minimum average yields of 1.44 tons /ha and 0.78 tons/ha respectively while Sorghum and millet were not so much affected and attained yields that were above average of 0.94 tons/ha and 1.61 tons/ha respectively. This suggests that despite the low acreage covered by sorghum and millet as compared to maize and beans that take 80% of food crops in Homa Bay County, the two crops can improve food security in the event of prolonged dry spells.

Maize and beans showed a high significance that was of no substantial increase in yield while Sorghum and millet indicated a low significance that showed substantial decrease in millet yield under the years in considerations. Due to overdependence on maize and beans that are drought sensitive, there is a substantial decrease in other food crops cultivation that has reduced their cumulative yield over the years in Homa Bay County hence exacerbating food insecurity (Daily Nation, 2016). The most affected years by droughts were 2007, 2009, 2011, and 2015 that indicated lower food crop production than the rest of the years under consideration. Yield of various crops were average during the years that were considered to receive normal amount of annual rainfall while during the wet years, the crops experienced reduced yields too.

Previous studies on the drought occurrences in the Lake Victoria region by Awange *et al.*, (2007) and that of Onchiri *et al.*, (2016) in Mbita Sub County revealed that Homa bay County experienced drought conditions in the years (1991/92, 1995/96, 1999/2000, 2004/05, 2008) with extreme drought in 2009/10. One of the years that experienced much lower crop production as a result of the extreme drought is 2009. Between July 2011 and mid 2012, a severe drought affected the entire East Africa region causing severe food crisis in Kenya (UN, 2012).

Mateche, (2011) observes that in 2015, prolonged dry spell affected over 1.6 million people in Kenya with marginal agricultural livelihoods subjecting them to famine. Ifabiyi *et al.*, (2011) points that rainfall amount received in an area has a greater effect on the crop yields in a given year of production. The study finds out that the low annual rainfall amount in specific years contributed immensely to the low production of the specific food crops under investigation in Homa Bay County. These results therefore confirm the assertion that climate change is expected to increasingly impact on crop production and livestock in Busia and Homa Bay County (Luedeling, 2011).



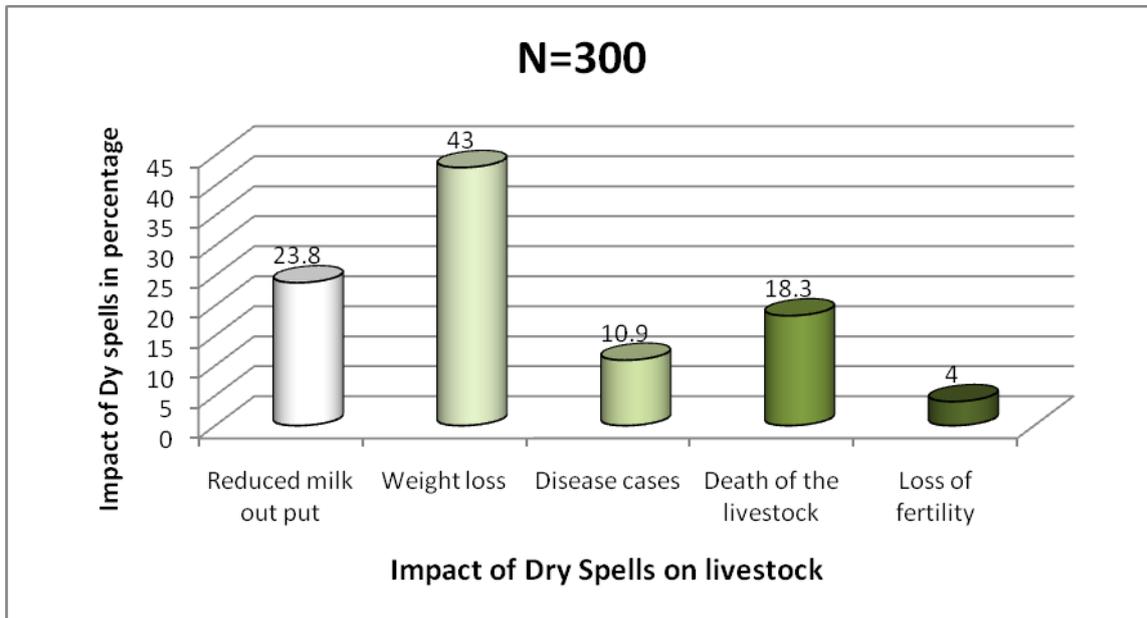
**Figure 3.3:** Impact of dry spell on main food crops in Homa Bay County  
**Source:** Field Data (2017)

Variability in rainfall characteristics have a greater potential to crop failure and majorly in food crop yield and hence food insecurity in most Sub Saharan Countries in Africa (Adamgbe *et al.*, 2013). However, the impact is exacerbated by the fact that a large proportion of these population depends on rainfed agriculture where there financial, technological, political and social capacities both at the national and local levels adaptability to the changing climatic conditions are slow (Ifabiyi *et al.*, 2011). Rainfall variability worsened by prolonged dry spell occurrence within seasons and years of agricultural production therefore has serious repercussion to small scale farmers in food crop production. Evaluating crop response to the changing annual rainfall amounts received in a given area can hence inform the best mitigation strategies to reduce the impact of the prolonged dry spells and improve crop yields.

### 3.4 Impact of dry spell on livestock production in Homa Bay County

Livestock farming is also an important source of livelihood for the communities in Homa Bay County. This section presents findings on the impact of dry spells on livestock production which also affects food security (Figure 3.4). The results reveal that

majority of the respondents at 48% indicated weight loss, reduced milk production was second at 23.8%, death of livestock was rated third at 18.3%, rise in disease cases indicated at 10.9% and 4% pointed at the loss in fertility during dry spells respectively.



**Figure 3.4:** Impact of dry spells on livestock production in Homa Bay County

**Source:** Field Data (2018)

Based on the Chi-Square analysis obtained a computed  $\chi^2$  value of 119.9 with 4 degrees of freedom and a p- value of 0.082 at 0.05 margin error, which has less significance level, indicated variation in dry spells impacts on different aspects of livestock production and health that can negatively reduce production hence food insecurity. Livestock production is a major economic and social activity in many parts of Kenyan ASAL communities that account for nearly 90% of the employment opportunities and 95% of the family incomes (Huho and Mugalavai, 2010). Like many parts of ASALs globally, prolonged dry spells impacts on livestock in Homa Bay County causes reduced production hence food insecurity that results to starvation. Participants of the FGDs and face to face interviews of the household heads that during the dry spells accompanied by high temperature that characterizes the Lake Basin region, evaporation is high hence leaving the soil with moisture deficiency.

Dry spells make the fodder and pasture to dry up faster and thus causing insufficient feed for the livestock (GoK, 2004). Due to insufficient feed, it was evident as stated by the participants in the FGDs that animal weight is affected by the shortage of quality and quantity feed for livestock that accounted for the high number (48%) of respondents. Prolonged dry spells is pose a major constraint to livestock by lowering the quality and quantity of the feed that largely causes animal starvation and hence reduced productivity (GoK, 2004). Water is another important factor for the health of livestock. During dry spells, there is more water stress and the livestock are in dire need of safe and plenty of water for survival.

Water pans are impacted on through excess evaporation due to high temperature. Intense evaporation reduces the water levels in the water pans hence making it inaccessible. This is also attributed to the fact that at this time so many households have exhausted water stored at the homesteads and share on the use of water pans with the livestock as well as for supplemental irrigation mainly for small scale vegetable famers around the water pans. Though there are some water pans and ponds in the area, the scramble between livestock and human beings for water for both domestic and agricultural use is an indication that dry spells has adversely impacted on the area. The few water pans like Kobondo and Okii are insufficient, they evaporated and dry up very fast in the event of dry spells. This in turn impacts on livestock through reduced feed and hence reduced production. It was therefore revealed that reduced pasture and water stress affect the general health of the livestock that contribute to other impacts like reduced milk (23.8%) production. Reduction in milk production is one of the greatest economic impacts of dry spells. Nardone *et al.*, (2010) observes that decreased synthesis of hepatic glucose and lower non esterified acids in blood during dry spells characterized with high temperature causes reduced glucose supply to the mammary glands resulting to low lactose synthesis hence reduced milk yield.

Reduced milk yield is further intensified by reduced feed consumption by the livestock. This is attributed to the high temperature caused by the dry spells that makes the pasture dry and of low nutrition. Generally, milk reduction due to prolonged dry spells is attributable partly to reduced feed intake. Rege and Tawah (2006) found out that approximately 35% of the reduced milk production is due to decreased feed intake while the remaining 65% is attributable to increased heat stress. However, other factors that are responsible for reduced milk production during dry spells are decreased nutrient absorption, effects in rumen function and hormonal status of the animal (Wheelock, 2010).

Temperature increase as high as 38 degrees Celsius due to prolonged dry spells in Homa Bay County is normally severer in the months of January and February and extents to early March (GoK, 2013). This causes severe depletion of natural pasture on which 99% of the livestock in the County depends on. Due to lack of or insufficient feed, there has been continued loss of livestock every time the dry spells occur (GoK, 2016). In this study, livestock deaths were rated third by the respondents in regard to impacts dry spells at 18.3%. Focus group discussions revealed that during the dry spells, the livestock sector is one of the sectors worst hit. This is characterized by weight loss due to lack of feed, followed by deaths when the dry spells persist. Some of the causes of deaths of livestock as stated by the residents are long distances travelled by the livestock in such of forage and water that continues to reduce their energy and weakens them more and more.

The other factor that has been the cause of livestock deaths during the dry spells in the area as indicated by the participants in a FGD is that due to lack of the usual feed, the livestock start eating other plants that may be poisonous to them. This was evidenced in Arujo village in Homa Bay where 18 cattle died as a result of consuming poisonous weed. This was also confirmed

by a KII informant with the County chief officer for Agriculture that the cattle belonging to six farmers died after consuming poisonous weed known as bracken fern. He reported that the poisonous weed is drought resistant and remains the only surviving plant during drought and that is why the animals tend to consume it. During dry spells, pastures are short in forage but can be full of plants that are toxic and deadly to animals. In good pasture condition, animals avoid eating such plants unless accidental. The common toxic chemical to animals is prussic acid. Other plants with concentrated levels of nitrate and nitrite are found in Sudan grass, pigweed and ragweed (Knight *et al.*, 2004). These plants should therefore be made known to farmers to be cautious in their pastures during drought situations.

Dry spells have high potential of increasing the livestock disease risks. In this study, 10.9% of the respondents indicated that there are increased cases of livestock diseases during dry spells. Livestock health majorly depends on the type, quantity and quality of feed it consumes but during drought, these important factors are reduced hence increased vulnerability to diseases. Drought conditions potentially affect all sources of water and specifically surface water (Abebe, 2009). It is of great importance to monitor the quality of water especially when the amount gets limited. It helps get track of the quality parameters of water like dissolved solids, sodium, sulfates and nitrates. Mendelson and Rober (2000) observed that blooms of blue or green algae are of great risk during dry spells. The Cyan bacteria produce toxins that can affect the liver and the nervous systems. Depending on the specific and quantity of toxins ingested, the animals will get weak, and sometimes die suddenly.

The effects of parasites and infectious diseases are often amplified during drought conditions. Admasu, (2005) observes that it is partly because of increased transmission in crowded places like the water points and pasture fields but also due to lower immunity resulting from poor nutrition. Diseases like Salmonellosis, fibrinous pneumonia and pinkeye are always devastating during prolonged dry spells in many parts of the world (Mochabo, 2005). This is therefore an indication of the number of respondents suggesting increase in livestock disease cases causing reduced livestock production hence increased incidences of hunger in Homa Bay County.

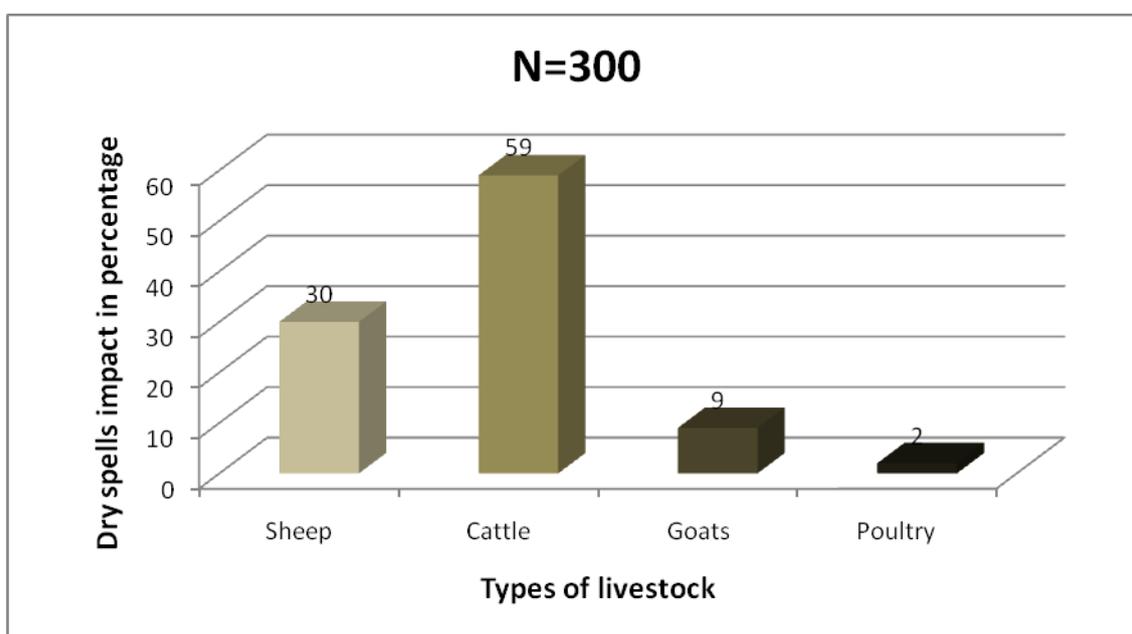
Prolonged dry spells generate a range of challenges to small scale livestock farmers when they occur. From the study, 4% of the respondents show that livestock farmers experience loss of fertility among their livestock during dry spells in Homa Bay County. Earnerson *et al.*, (2014) observes that dry spells are always accompanied by high temperature that exacerbates heat stress which may decrease fertility in both male and female animals. Semen quality and vitality may also be negatively impacted on. In female animals, the heat may reduce expression of estrus and conception rate. Drought increases incidents of abortion due to reduced nutrients in feed and heat stress. In his study, it was however observed that on average pregnancy rate, 93% of the livestock was not significantly affected by drought but severe heat stress. From the Focus Group Discussions, the participants raised concerns

on the rate of reproduction of the livestock during dry spells. It was mentioned that when the dry spells occur, the livestock stops conceiving and the poultry too stops laying eggs. It was mentioned that it is because of the stress experienced by livestock from low quantity of feed that lowers the bulls' energy.

Key informants revealed that Okii water pan is one of the most relied upon water source in the area serving many communities for both domestic and agricultural practices. Reports from a FGD conducted in Kobondo and Arujo concurred with the field observations that the few water pans and ponds dry up in the event of a severe dry spells. Field observations revealed that most areas where the water sources are located do not have either piped water or reliable bore holes. Owing to the perennial nature of the water sources and impact from dry spells, the households in this study area fall under the 3.5 billion continuously unsatisfied population with water scarcity world wide as established by United Nations World Water Assessment Program (2014).

### 3.5 Impact of dry spells on different types of livestock in Homa Bay County

The study sought to establish the types of livestock reared in the study area. It was established that the main types livestock reared in Homa Bay County are the zebu cattle, red Maasai sheep, the small East African goat and indigenous poultry (GoK, 2013). The livestock are bred on subsistence basis and not for commercial purposes. This is due to the limited grazing land in the County hence hindering commercial practice. The study sought to determine the impact of dry spells on different types of livestock and the results are as shown in Figure 3.5. The results in Figure 3.5 reveal that majority of the respondents 59% (177) indicated that cattle are the most affected when the dry spells occur. Sheep were the second most affected at 30% (90), followed by goats while poultry were the least affected during dry spells at 9% (27) and 2% (6) respectively.



**Figure 3.5:** Impact of dry spells on different livestock in Homa Bay County  
**Source:** Field data (2018)

The Chi-Square value ( $\chi^2_{3,0.005} = 38.9$ ) of the variation in household heads of the respondents was significant at ( $P > 0.05$ ). This suggests that the dry spells impacts are varied on cattle, sheep, goats and poultry when it occurs. Livestock rearing as one of the main sources of livelihood experiences different forms of impacts hence food insecurity based on the livestock mostly bred and impacted on by dry spells in Homa Bay County. Small scale farmers attest to the continued change and variation in climate that has increased chances of long dry spells and drought that has impacted on livestock in Homa Bay County. The major challenges facing livestock in Homa Bay County are drought, malnutrition due to low quality feed and tsetse fly infestation specifically in Lambwe valley (GoK, 2016). Malnutrition, pests infestation and low quality and quantity of feed are exacerbated by dry spells and drought (De La Rocque *et al.*, 2008).

Death rate during of prolonged dry spells is usually high among particular species and types of livestock. Cattle, donkeys and horses are generally less resistant to drought than sheep, goats and camels (Musimba *et al.*, 2004). There are other livestock that can endure drought impacts than others. This may be based on different characteristics encountered in different environments for easy adaptability and survival in different environments with different characteristics. This means that there are other livestock that are drought tolerant than others. From the Focus Group Discussions, participants tended to agree more that cattle are the most vulnerable to dry spells than any other livestock like goats in the County. The cattle and sheep tend to highly depend on grass than any other edible plants. The natural pasture are affected so easily by dry spells than other plants hence they suffer more than other types of livestock like sheep and goats. Other factors which were mentioned by the participants were that cattle consume and require more feed and water than the other livestock so in the event of dry spells, due to lack of quality and quantity feed they die or get diseased easily.

During dry spells, there is increased temperature that induces heat stress in the livestock. The heat stress therefore has numerous effects on livestock from reduced energy due to low feed consumption and increased vulnerability to diseases. GOK (2016) observes that livestock have different mechanisms to dissipate heat and maintain the normal temperature. These mechanisms include conduction, radiation, convection and evaporation. However, the cattle have limited ability to sensibly lose heat through conduction, radiation and convection but only through evaporation. This explains the increased vulnerability to dry spells as indicated by majority of the respondents in Homa Bay County by 59% in agreement that they are the most impacted on during dry spells.

Sheep were secondly rated at 30% as the most impacted and vulnerable to dry spells after cattle in Homa Bay County. It was established that like cattle, sheep also to a higher percentage depend on grass that is more vulnerable to dry spells than other plants. During dry spells there is increased disease and parasite occurrences. Due to the fact that sheep graze close to the ground,

they easily pick up worm larvae. Sheep and specifically lambs take long to develop immunity hence they easily succumb to secondary bacteria infection that may lead to death (Salem, 2010).

Both external and internal worms are a big problem to sheep production than any other animal during the dry spells. However, it was established from the County Agricultural Officer that sheep fall under the category of drought tolerant livestock naturally due to the fats that helps the sheep to take long before being affected by intense dry spells. It is therefore clear that the main cause of vulnerability to sheep in Homa Bay County is disease and parasite infestations.

Goats bred in Homa Bay County are basically indigenous. Findings shows that they are the least vulnerable livestock to dry spells in Homa Bay County. It was rated by the respondents as third most vulnerable at 9% among other livestock bred in the County. From a focus group discussion, one participant explained that goats consume less compared to other livestock and are not easily affected by diseases during dry spells. Given the fact that goats eat any vegetation available, it therefore confirms why they survive longer than other various livestock that solely depend on grass in Homa Bay County. Abella (2005) observes that in semi arid areas, goats have comparative advantage over cattle and other livestock because they are more tolerant to drought and are increasingly used to augment cash income and enhance food security. Due to their resistance to drought, goats use a wide range of plants and their high reproductive rate enable them to recover quickly even during drought situations (Alamer, 2009). During prolonged dry spells, sheep and goats are under stress. Maria *et al.*, (2007) observes that the stress increases their susceptibility to the outbreak of coccidiosis and other related diseases. Frequent inspection is therefore recommended to the herd to reduce the disease cases. This will hence increase production of the livestock for small scale farmers.

Majority of the respondents in Homa Bay County do not agree that poultry farming is not much affected by dry spells as compared to other livestock. It is rated at 2%, the lowest impacted by dry spells among other livestock. Dry spells that manifest into a acute shortage of water and reduced feed availability has affected the poultry farming among the small scale farmers. It was established from the focus group discussions that majority of small scale farmers in Homa Bay County practice free range poultry farming “kienyeji” farming. Local poultry production is found in all AEZs in the County. The indigenous poultry are reared for mainly food security and for income generation to pay school fees and other expenses (GoK, 2016). However, there are other economically enriched farmers who can afford to supplement their stocks to improve the local breeds productivity during drought situations. Due to the fact that most of the stocks greatly rely on free range for their feed, they stand to be more resistant to dry spells conditions even without supplements than exotic breeds.

### **3.6 Dry spells impact on the different agricultural commodities available and market prices**

Besides the impact of dry spells on crop and livestock, respondents also reported on the impacts on market prices of the agricultural products and yields that destabilizes the food accessibility as one of the pillars of food security. Based on this,

respondents were asked to indicate if the crop and livestock products market prices increase or decrease in the event of dry spells in the study area. The results in Table 3.2 show that 98.3% (295) of the respondents strongly indicated that fodder and pasture for livestock feed price increase in the event of a dry spell; 99% (297) indicated that food crops prices increase; on livestock products, 35% (105) indicates that the prices increase while 65% (195) disagreed by showing that the prices decrease; and 98% (294) strongly indicated that the livestock prices in the market decreases while only 1% (3) shows that prices increase.

**Table 3.2: Level of impact of dry spells on different agricultural products market prices**

Impact on Market Price	Increase		Decrease	
	Frequency	Percent %	Frequency	Percent %
<b>Pasture/fodder</b>	295	98.3	5	1.7
<b>Food crops</b>	297	99	3	1
<b>Livestock products</b>	105	35	195	65
<b>Livestock prices</b>	3	1	294	98

**Source:** Field data (2017)

Cross tabulation of the data obtained gives a  $\chi^2$  value of 0.860, with 3 degrees of freedom and a p – value of 0.09, which was less significant at 0.005 error margins. The results there for show variation that there are change in market prices of different agricultural commodities during dry spells. According to the United Nations world summit, 1996 definition, food security is a situation where all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Gaus, 2012). In the event of a dry spell, the accessibility that is informed by availability, stability and utilization becomes compromised.

The study reveals that crop failure to achieve the expected yield and livestock production, reduces to a higher percentage availability of safe food that can satisfy the dietary need of the community and the unavailability may have impact on the food prices. Most households get access to food by purchasing (93%) followed by own food production (4%) in most African countries (Mjonono *et al.*, 2009). From the FGDs, livestock solely depend on water and grass to produce milk and other quality products but has not been the case in different seasons. Increased temperatures as high as  $38^{\circ}C$  around January to February lead to depletion of natural pastures on which 99% of livestock depend on as well as loss of livestock. Around January and February, the communities experience water scarcity because the rivers dry up. Increased incidences of crop and livestock diseases in the County were also reported, ( GoK, 2013). Increased disease incidence on livestock during dry spells therefore explains the reason for 65% decreased livestock product prices. This is due to the low quantity and quality feed for livestock providing low quality products like meat, milk, hides and skins that many regard as unhealthy for human consumption.

During prolonged dry spells, many livestock are rendered unhealthy and that is the time when many farmers rush to sell them to slaughter houses at throw away prices or some are slaughtered at home and sold cheaply to the residents due to their low quality. The low quality of livestock products in return compromises the principle of food security and healthy food which threatens the health of many residents in Homa Bay County. From a FGD, the participant added that the dry spells in other cases push the cost of production materials high hence reduced production. This makes the affordability high affecting many households in the County. However, it depends on the type of products from the livestock where the participants indicated that there are other products like skins and hides whose quality will reduce in the event of a dry spell. This reduces the prices of livestock products in the markets and can account for the 35% who indicated that prices reduce when dry spells occur. Food crop prices have also shot up due to the dry spells that reduce their production hence scarcity in the stores and markets. The situation hence impact on the access and availability of the food that affect the food security situation of the study area. From the FGDs, livestock market prices are determined by the health of the livestock. Healthy livestock fetch higher market prices compared to unhealthy livestock. From key informant in the ministry of agriculture, the health of the livestock is primarily determined by the prevailing environmental conditions and quality and quantity of the feed.

In the event of the dry spells, the feed quantity and quality reduce. This impact on the health of a good percentage of the livestock in the study area hence reduced market prices. The farmers are hence enabled to sell their livestock at throw away prices \$150 from \$200 for a mature cow to get money to buy other commodities like the staple feed such as maize, beans, and vegetables. This observation supports the large percentage of 98% of the respondents that indicated the reduced market prices for livestock during dry spells. Food security is hence destabilized when there is no sustainability in production and consumption.

#### **4. Conclusions and Recommendations**

Annual Maize and beans production for the years that were affected by prolonged dry spells (2007-2016) were below average of 1.44 tons/ha and 0.78 tons/ha respectively while Sorghum and millet were above average of 0.94 tons/ha and 1.61 tons/ha respectively hence sorghum and millet are suitable for increased food security in this region. Livestock production was impacted greatly at 48% through weight loss and 23.8% reduced milk output respectively. Homa Bay County residents are therefore susceptible to agricultural production failure hence food insecurity.

The findings revealed that rainfall variability and dry spells impact on food security in the County through mass crop failure and reduced livestock production and death. It is therefore recommended that both national and county governments and other stakeholders put in place effective risk transfer strategies to ensure sustainability in rainfed agriculture in the area.

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# Comparison of the Sorption Capacity of Heavy Metals from Wastewater Using Immobilized, Grafted and Membrane *Stereospermum Kunthianum* Stem Bark

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DOI: 10.29322/IJSRP.8.8.2018.p80111

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80111>

**Abstract-** This study was conducted to explore the sorption capacity of three different industrial prepared products of *Stereospermum kunthianum* plant for the removal of some heavy metal ions from waste water. The plant stem-bark was first immobilized by entrapping the biosorbent with in a polymetric matrix of calcium alginate to produce immobilized stem-bark (IMSB). The stem-bark was also synthesised by reacting it with Acrylamide at 60°C using Ceric Ammonium Nitrate as an initiator to obtaine grafted stem-bark (GSB) and the plant stem-bark was also mixed with glutaraldehyde to obtained Membrane stem-bark. The sorption efficiencies of some heavy metals (Pb, Mn, Zn, Cr, Fe and Cd) were investigated in aqueous solution using IMSB, GSB and MSB and the residual metal ions in solutions were determined using Atomic Absorption Spectrophotometer (AAS). The results obtained shows that the sorption efficiencies of Pb, Mn, Zn Cr, Fe and Cd by IMSB were 94.50%, 87.50%, 85.84%, 80.94%, 65.08% and 58.46% respectively. That of GSB were 97.85%, 90.00%, 91.60%, 95.89%, 78.52% and 65.20% respectively and sorption efficiency of MSB was 99.80%, 97.80%, 99.70%, 95.40%, and 97.70% for Pb, Mn, Zn, Cr, Fe and Cd respectively. MSB has maximum sorption capacity of metal ions in aqueous solution and occur in the trend MSB > GSB > IMSB. The result of this study present synthesized *Stereospermum kunthianum* stem-bark as potential bioremediation agent for treatment of water because it has the potential of removing heavy metals from water.

**Index Terms-** Stereospermum-kunthianum, Immobilization, Grafting, Membrane, Sorption and Heavy-metals.

## I. INTRODUCTION

Environmental pollution is currently one of the most important issues facing humanity. It was increased exponentially in the past few years and reached alarming levels in terms of its effects on living creatures. Toxic heavy metals are considered one of the pollutants that have direct effect on man and animals. Industrial wastewater containing lead, copper, cadmium and chromium, etc for example can contaminate groundwater resources and thus lead to a serious groundwater pollution problem (Renge *et al.*, 2012).

Water of high quality is essential to human life and water of acceptable quality is essential for agriculture, industrial,

domestic and commercial uses. All these activities are also responsible for polluting the water. Billions of gallons of waste from all these sources are thrown to freshwater bodies every day. The requirement for water is increasing while slowly all the water resources are becoming unfit for use due to improper waste disposal. The task of providing proper treatment facility for all polluting sources is difficult and also expensive, hence there is pressing demand for innovative technologies which are low cost, require low -maintenance and are energy efficient. The adsorption technique is economically favorable and technically easy to separate as the requirement of the control system is minimum. In this article, the technical feasibility of various low-cost adsorbents for heavy metal removal from contaminated water has been reviewed (Varsha *et al.*, 2010).

Instead of using commercial activated carbon, researchers have worked on inexpensive materials, such as coconut shell, sawdust, mango leaves, chitosan, egg shell, and other adsorbents, which have high adsorption capacity and are locally available.

## Stereospermum kunthianum plant

*Stereospermum-kunthianum* belongs to the family *Bignoniaceae*. The plant has vernacular names known by traditional herbalist and the communities where it is commonly found; *SanSami* (Hausa), *Ndengal-mbalu*, (Fulfulde), *Kengyartuma* (Babur-Bura), *Kera-thla* (Marghi), *Ayada* (Yoruba), *Alakiriti* (Ibo) and *Umana* (Tiv).

*Stereospermum kunthianum* is found in dry areas of deciduous forest, woodland, bush, rocky outcrops, termite mounds and margins of evergreen forests. The species is well spread all over the Sahel region and is often found near streams. Geographic distributions include Nigeria, Democratic Republic of Congo, Djibouti, Eritrea, Ethiopia, Kenya and Mozambique.

Biophysical limits Altitude : 500-2400 m, Mean annual temperature : Up to 40 °C, Mean annual rainfall : 450-900 mm. Soil type : Grows well on light silty and sandy soils. Reproductive ; the bisexual flowers appear in the dry season before the new leaves, between February and March, and pods ripen between April and May (Aliyu Babayo, 2011).

*Stereospermum kunthianum* is a multipurpose plant of significant importance to local communities. According to traditional healer in Biu, Borno Nigeria (Bulama Fori, 2018), one of the major uses of the plant is in the treatment/purification of water by local communities where the plant is found. The plant is most useful when there is an outbreak of water born disease such

as cholera. Apart from the above, the plant has numerous uses to the local communities where they are found. The plant leaves are used as feeds to animals (Cattles, Sheep, and goats). It has repellent property. The stem and roots of the plant if boiled and allowed to cool or if soaked in cold water over night could be used for many purposes according to Fori (2013).

The results of the heavy metals removal performance are compared to that of activated carbon and are presented in this study. It is evident that low-cost adsorbents have demonstrated outstanding removal capabilities for certain metal ions as compared to activated carbon. The adsorption process is being widely used by various researchers for the removal of heavy metals from waste streams despite its extensive use in the water and waste water treatment industries; activated carbon remains an expensive material. In recent years, the need for safe and economical methods for the elimination of heavy metals from contaminated waters has necessitated research interest towards the production of low cost alternatives to commercially available activated carbon. Therefore there is an urgent need that all possible sources of agro-based inexpensive adsorbents should be explored and their feasibility for the removal of heavy metals should be studied in detail.

#### Sources of heavy metals

The term heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Examples of heavy metals include mercury (Hg), cadmium (Cd), arsenic (As), chromium (Cr), thallium (Tl), and lead (Pb). Heavy metals are natural components of the Earth's crust. They cannot be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. As trace elements, some heavy metals (e.g. copper, selenium, zinc) are essential to maintain the metabolism of the human body. However, at higher concentrations they can lead to poisoning. Heavy metal poisoning could result, for instance, from drinking-water contamination (e.g. lead pipes), high ambient air concentrations near emission sources, or intake via the food chain.

Heavy metals are dangerous because they tend to bioaccumulate. Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted. Heavy metals can enter a water supply by industrial and consumer waste, or even from acidic rain breaking down soils and releasing heavy metals into / streams, lakes, rivers, and groundwater.

#### The effects of heavy metals

Many of the products, which we have used contain heavy metals in them. Heavy metals are in the foods we eat, water we drink, and the air we breathe. We need very little of only a few heavy metals including zinc, copper, cobalt, manganese, molybdenum, vanadium and strontium. These good heavy metals become toxic to us when the quantity is too high and it takes really very little to be too much. On top of that, we take in more than twenty heavy metals which are non-essential for our healthy functioning.

How do they get into the body? Heavy metals enter your body through drinking, eating, inhaling, and skin. Once in the body they do damage on the cellular level by causing dangerous free radicals production. The damage that they do is on the cellular level, and can cause cancer and many other diseases (Oremusova et al., 2007).

## II. MATERIALS AND METHODS

### Sample Collection and Identification

A sample of the stem bark, of *Stereospermum Kunthianum* plant was collected in paper bags from creek Waka Biu, in Biu local government area, Borno State, Nigeria and was identified by Bulama Fori, Mbulamel Biu, Borno State, and confirmed by a plant Botanist Prof S.S Sanusi, Department of Biological Sciences, University of Maiduguri.

### Sample Preparation

The stem bark, sample was freed from sand particles and dead dried tissues by carefully scraping with spatula. It was chopped to pieces, air dried for two weeks. The pulverized samples was stored in paper bags for further analysis (Osemeahon et al., 2007).

### Dissolution of Plant Samples

The dissolution of the *stereospermum kunthianum* stem was done by weighing 4.00 g of the stem bark powder and dissolved in 100 cm<sup>3</sup> of water, then the mixture was poured into a separating funnel and allow to stand for 12 hrs to observe the possible separation into various fractions. (Osemeahon et al., 2007).

### Preparation of Sodium Alginate and Calcium Chloride to Immobilized Sample

Sodium alginate was made by weighing 4.00 g and making it up to 100 cm<sup>3</sup> mark with distilled water in a volumetric flask and allow overnight for complete dissolution to give 4% w/w. Calcium chloride (0.12 M) was prepared by weighing 26.28 g into 1L volumetric flask and make up to the mark with distilled water (Wuyep et al., 2007).

### Synthesis of Immobilized Samples of *Stereospermum kunthianum*

25 cm<sup>3</sup> viscous layers of dissolved *Stereospermum kunthianum* stem bark sample were mixed with 25 cm<sup>3</sup> of 4 % stock solution of sodium alginate and stir vigorously for even mixing in 250 cm<sup>3</sup> beakers. The mixture was then transferred into another beaker containing 30 cm<sup>3</sup> of 0.2 M Calcium chloride solution. The reaction was allowed retention time of 1 hour for complete precipitation. The precipitate blend solid of the stem sample was filtered and dry at room temperature (30<sup>0</sup>C) for 24 hrs. The dried solid was stored in polyethylene bag for further use (Wuyep, et al., 2007).

### Adsorption of Heavy Metals from Aqueous Solution Using Immobilized *Stereospermum-kunthianum* Plant

#### Preparation of synthetic waste water

The metal ions chosen for this study are Pb, Fe, Cr, Cd, Mn and Zn. The reason they are chosen is because of their

toxicity. The standards of these metal ion solutions was prepared from their salts by dissolving 1.60 g, 3.54 g, 4.10 g, 2.10 g, 3.46 g and 2.90 g of Lead nitrate, Iron nitrate, Chromium (II) nitrate, Cadmium nitrate, Manganese nitrate and Zinc nitrate in deionised water respectively and made up to 1 litre in a Volumetric flask to gave the stock solution of 1000 ppm of the metal ions. Serial dilution of 200 ppm of each metal ion solution was prepared with distilled water. The synthetic waste water was kept for further use (Ogali *et al.*, 2008).

#### Immobilization of *Stereospermum kunthianum* Stem-barks

The immobilization of *Stereospermum kunthianum* stem-bark was achieved by entrapping or caging it within the polymeric matrix of Sodium alginate. It has been established that Sodium alginate consist of L-guluronic acid and D-manuronic acid units (Mary *et al.*, 2005). The contacting of  $Ca^{2+}$  ions with gulunoric acid block forms an ionically cross-linked structure in aqueous environments. The cross linking of the polymer is due to binding of divalent cations ( $Ca^{2+}$ ) to the carboxylic (-COOH) group of L-guluronic acid block (Mary *et al.*, 2005). Divalent cations act as a cross-links and cause an ionic binding between G-blocks in polymer chains and forms three dimensional network (Naghan and Ageena, 2010). This network mobilizes *Stereospermum kunthianum* bark to produce a biosorbent.

#### Sorption experiment using immobilized *Stereospermum kunthianum* plant stem-bark

Experiments was carried out in the batch mode for the measurement of adsorption capacities. From 200 ppm of each metal ion solution, 50 cm<sup>3</sup> was taken into a 250 cm<sup>3</sup> conical flask and 0.2 g of the *immobilized Stereospermum kunthianum* plant samples was added and corked with a rubber bung and shaken with a flask shaker for 2 hrs at room temperature (30°C) at 150 rpm. The separation of the adsorbents and solutions was carried out by filtration with whatman filter paper and the filtrates was stored in Sample cans for use. The residual metal ion Concentrations was determined using Atomic Absorption Spectrophotometer (AAS) The percentage adsorption was calculated using the following equation.

$$\% \text{ Adsorption} = [(W_x - W_y / W_x)] \times 100$$

where  $W_x$  = Initial metal ion Concentration and  $W_y$  = Equilibrium metal ion Concentration (mg/l)

#### Synthesis of Grafted Copolymer

*Stereospermum kunthianum* polyacrylamide was synthesized by reacting *Stereospermum kunthianum* plant samples with acrylamide at 60°C using Ceric ammonium nitrate (CAN) as an initiator (Osemeahon *et al.*, 2008). Aqueous *Stereospermum kunthianum* solution (2%) was prepared and stirred well for 1 hr with 0.105 mol of acrylamide at 60°C. The initiator solution containing  $2.5 \times 10^{-3}$  mol of CAN was added to the mixture and stirred well by using magnetic stirrer for another 5 hrs. The mass obtained at the end of this period was precipitated in excess acetone. This was then filtered, washed with a 7:3 ratio of water/ methanol mixture to remove the homopolymer formed. The solid mass was then dried in an electrically controlled oven at 40°C and weighed using metter balance.

#### Sorption experiment using grafted *stereospermum kunthianum* stem-bark

Experiments were carried out in the batch mode for the measurement of sorption capacities. From the 200 ppm of each metal ion solution, 50 cm<sup>3</sup> was taken into a 250 cm<sup>3</sup> conical flask and 0.2 g of the **Grafted *Stereospermum kunthianum* Stem-bark** was added, corked with a rubber bung and shaken with a flask shaker for 2 hours at room temperature (30°C) at 150 rpm. The separation of the sorbents and solutions was carried out by filtration with whatman filter paper No 42 and the filtrates were stored in Sample cans for use. The residual metal ion Concentrations was determined using Atomic Absorption Spectrophotometer (AAS) Buck Scientific Model 210. (Air/Acetylene Flame, Integrated Model ). Normal Parameters for Cd, Pb and Cr. The percentage sorption was calculated using the following equation

$$\% \text{ Adsorption} = [(W_x - W_y / W_x)] \times 100$$

where  $W_x$  = Initial metal ion Concentration and  $W_y$  = Equilibrium metal ion Concentration (mg/l)

#### Membrane Preparation

A 4% mass of stock solution of sodium alginate and *Stereospermum kunthianum* stem-bark was prepared in water mixed in the ratio of 80:20, (Osemeahon *et al.*, 2008), (Toti *et al.*, 2002).

The stock solution with a volume of 100 cm<sup>3</sup> was taken in a beaker and mixed with 0.00175 mol of glutaraldehyde (GA). This mixture was stirred for 2 hrs at 25°C and then poured uniformly on a plastic tray. The membrane was allowed to dry at room temperature (25°C) for 12 hrs. The cast membrane was cross linked by immersing in a 1% HCl solution taken in an equimolar mixture of methanol and water for 24 hrs. It was washed thoroughly in water and allowed to dried.(Barminas *et al.*, 2005).

#### Sorption capacity using membrane *stereospermum kunthianum* stem-bark

A concentration of 200 ppm of each of the metal ions were prepared with deionised water. From the 200 ppm concentration, 50 cm<sup>3</sup> of solution of metal ion was taken into a conical flask. 0.2 g of dried membrane was added and then shaken vigorously for 2 hrs by using flask shaker. The mixture was then filtered and the residual metal ion concentrations were determined using Atomic Absorption Spectrophotometer (AAS) (Barminas *et al.*, 2005).

### III. RESULTS AND DISCUSSION

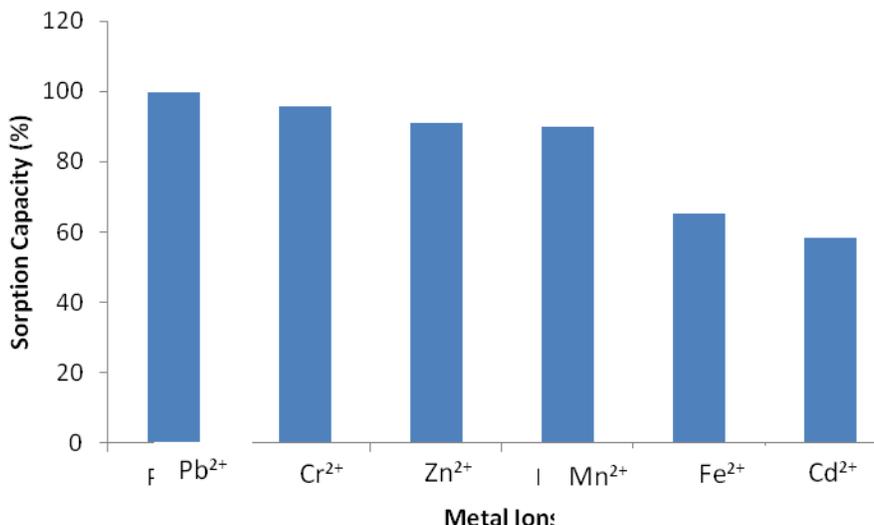
#### Sorption Capacity of Immobilized *Stereospermum kunthianum* Stem-bark

The stem-bark was immobilized to obtained immobilized stem-bark (IMSB) and the sorption of heavy metal ions namely  $Pb^{2+}$ ,  $Mn^{2+}$ ,  $Zn^{2+}$ ,  $Cr^{2+}$ ,  $Fe^{2+}$  and  $Cd^{2+}$  was determined in aqueous solution using IMSB and the residual metal ions in solution was determined using Atomic Absorption Spectrophotometer (AAS).

Figure 1 shows the sorption capacity for different metal ions. The sorption capacity for  $Zn^{2+}$ ,  $Pb^{2+}$ ,  $Cr^{2+}$ ,  $Cd^{2+}$ ,  $Mn^{2+}$  and  $Fe^{2+}$  using **immobilized *Stereospermum kunthianum* Stem-bark** were found to be 91.60 %, 97.85 %, 78.46 %, 85.08 %, 65.20 %, and 78.52 % respectively. This shows that the highest value of

sorption capacity was recorded for  $Pb^{2+}$ , while the lowest value was recorded for  $Cd^{2+}$ . The differences observed in the sorption capacity for the different metal ions can be explained in terms of difference in hydration free energy which is the energy released upon the attachment of ions to water molecules. The ability of metal ions to form covalent bonds with functional group present in the biomass and nature of the sorption sites as regard to porous nature of the bio-sorbent is always a factor (Mahvi, 2008). This

is as a result of the biomass having negative charge functional groups such as hydroxyl, carbonyl and sulphate. When the biomass is immersed in water containing the metal ions, the positively charged metal ions combine with the negatively charged functional groups there by forming a covalent bond between the metal ions and the functional groups.



**Figure 1: Sorption Capacity of Metal Ions by Immobilized *Stereospermum kunthianum* Stem-bark. (Time: 2 hrs; Temperature: 30°C; Initial Metal Concentration: 200 ppm).**

**Sorption Capacity of Grafted *Stereospermum kunthianum* Stem-bark**

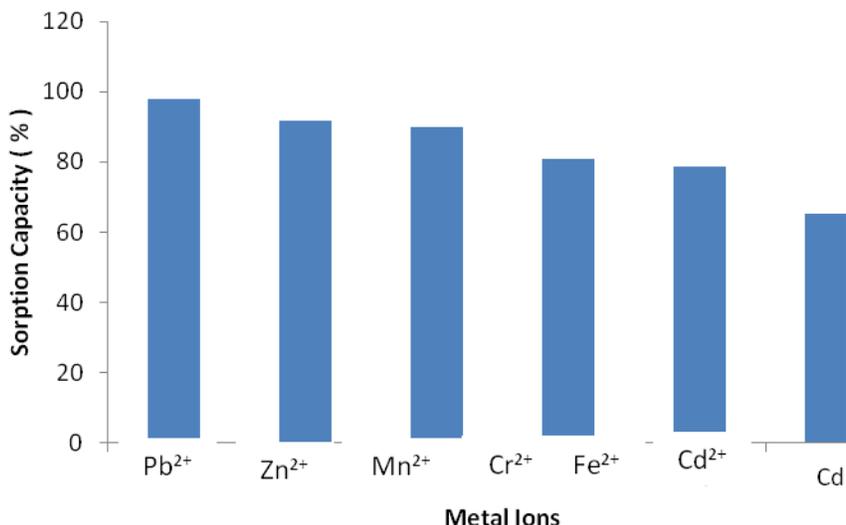
In order to improve the sorption capacity of the *Stereospermum kunthianum* stem-bark, it was grafted and the effect of grafting studied.

**Effect of grafting on the sorption capacity of *Stereospermum-kunthianum***

Figure 2 indicate the equilibrium sorption for  $Pb^{2+}$ ,  $Zn^{2+}$ ,  $Cd^{2+}$ ,  $Cr^{2+}$ ,  $Fe^{2+}$  and  $Mn^{2+}$  by grafted *Stereospermum kunthianum* stem- bark (GSKB). It is observed that this grafted plant bark has the ability to remove significant quantity of the metal ions. The values 98.89 % , 97.84 % , 89.93 % , 80.94 % , 98.52 % , 90.20 % respectively were obtained as sorption capacity from the present study using grafted sample. This has more advantage over

immobilized biomass by having higher values. The values obtained during metal sorption using immobilized biomass were 97.85%, 91.60%, 85.08%, 78.46%, 78.52% and 65.20% for  $Pb^{2+}$ ,  $Zn^{2+}$ ,  $Cd^{2+}$ ,  $Cr^{2+}$ ,  $Fe^{2+}$  and  $Mn^{2+}$  respectively. As can be seen from the results in Figure 2, grafted biomass has more efficiency over immobilized biomass.

By grafting the stem-bark, positive development has added value to the efficiency of the biomass. The sorption of the metal ions by the grafted biomass is higher than the immobilized biomass because of the added functional group. The Acrylamide that was used for the grafting has amide functional group and the nitrogen in the amide have three unpaired electrons and therefore has more negative charges that will attract and bind more metal ions.



**Figure 2: Sorption Capacity of Grafted *Stereospermum kunthianum* Stem-bark (Time: 2hrs, temperature: 30°C, initial metal concentration: 200 ppm)**

**Membrane Sorption Capacity**

The stem-bark was also converted to Membrane to obtain membrane stem-bark (MSB). The conversion or preparation of the biomass into a membrane is to find out any possible advantage of the membrane over the grafted and immobilized plant stem-bark biomass.

**Determination of Sorption Capacity of Membrane *Stereospermum kunthianum* Stem-bark**

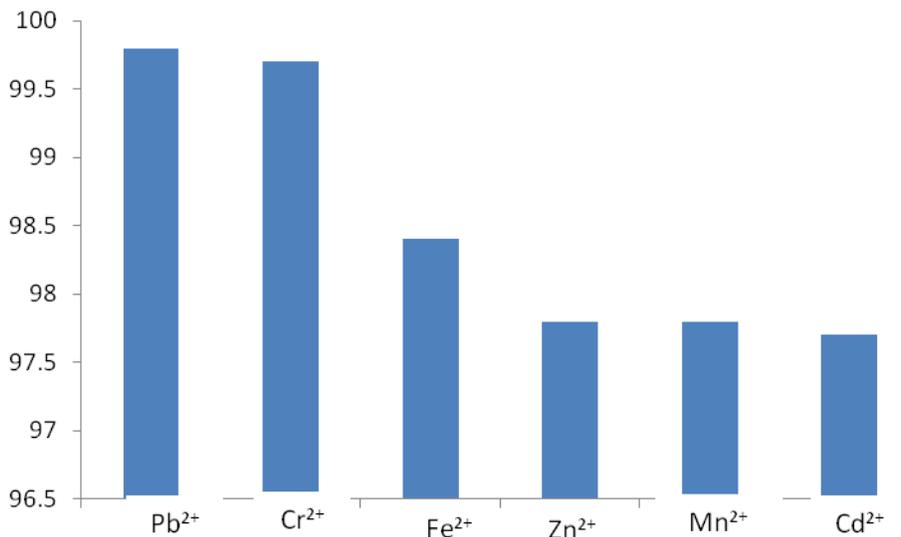
The sorption capacity for metal ions by membrane is presented in Figure 3. The result show that membrane can take up significant quantities of Pb<sup>2+</sup>, Cr<sup>2+</sup>, Fe<sup>2+</sup> but relative lower amount of Zn<sup>2+</sup>, Mn<sup>2+</sup>, and Cd<sup>2+</sup>.

The sorption capacity of this membrane for the metal ions are in order Pb > Cr > Fe > Zn > Mn > Cd respectively. The values 99.80%, 99.70%, 98.40%, 97.80%, 97.80% and 97.70%

respectively were obtained from the present studies and are higher than that of grafted which is 98.89%, 80.94%, 98.54%, 97.84%, 90.20% and 89.93% for Pb<sup>2+</sup>, Cr<sup>2+</sup>, Fe<sup>2+</sup>, Zn<sup>2+</sup>, Mn<sup>2+</sup>, and Cd<sup>2+</sup> respectively.

The result shows that, membrane can take up more quantities of the metal ions than the grafted and immobilized biomass. The main reasons why membrane adsorbed more metal ions is because of the fact that, more or larger surface sorption sites were created, the binding sites and active surface area for attracting the metal ions were more.

The difference observed in the sorption capacity for the different metal ions can be explained in terms of the ability of the metal ions to form covalent bonds with ligands, the metal polymeric cations with in the membrane structure and the nature of the surface sites available (Cooper *et al.*, 2000).



**Figure 3: Sorption Capacity of Metals by Membrane *Stereospermum kunthianum* Stem-bark**

(Time: 2 hrs, temperature: 30°C, initial metal concentration: 200 ppm)

#### IV. SUMMARY

The stem-bark was immobilized to obtain immobilized stem-bark (IMSB) and the sorption of heavy metal ions namely  $Pb^{2+}$ ,  $Mn^{2+}$ ,  $Zn^{2+}$ ,  $Cr^{2+}$ ,  $Fe^{2+}$  and  $Cd^{2+}$  were determined in aqueous solution and the residual metal ions in solution were determined using Atomic Absorption Spectrophotometer (AAS). The sorption capacity for IMSB was 94.50%, 87.50%, 85.84%, 80.94%, 65.08% and 58.46% for  $Pb^{2+}$ ,  $Mn^{2+}$ ,  $Zn^{2+}$ ,  $Cr^{2+}$ ,  $Fe^{2+}$  and  $Cd^{2+}$  respectively.

In order to improve the sorption capacity of the *Stereospermum kunthianum* stem-bark, it was grafted and the effect of grafting studied. The stem-bark was grafted to obtain grafted stem-bark (GSB), and was used for sorption of  $Pb^{2+}$ ,  $Mn^{2+}$ ,  $Zn^{2+}$ ,  $Cr^{2+}$ ,  $Fe^{2+}$  and  $Cd^{2+}$  in aqueous solution and the percentage sorption capacity obtained for the metal ions using GSB were 97.85%, 90.00%, 91.60%, 95.89%, 78.52% and 65.20% respectively.

The stem-bark was also Membraned to obtain membrane stem-bark (MSB). The conversion or preparation of the biomass into a membrane was to find out any possible advantage of the membrane over the grafted and immobilized plant stem-bark biomass. The percentage sorption for the MSB was 99.80%, 97.80%, 97.80%, 99.70%, 95.40% and 97.70% for  $Pb^{2+}$ ,  $Mn^{2+}$ ,  $Zn^{2+}$ ,  $Cr^{2+}$ ,  $Fe^{2+}$  and  $Cd^{2+}$  respectively. MSB has maximum sorption capacity of metal ions in aqueous solution and occur in the trend MSB > GSB > IMSB.

#### V. CONCLUSION

The result of this study present *Stereospermum-kunthianum* as potential bioremediation agent for the treatment of wastewater because it has shown clearly that *Stereospermum kunthianum* Stem-bark has the potentials of removing heavy metals from water.

The result of this studies show that the quality of water for consumption for developing countries can be improved by first adding membrane stem-bark of *Stereospermum kunthianum* plant.

The use of Stem-bark of *Stereospermum kunthianum* plant is to be given attention for its effectiveness in waste water treatment. The technologies involved are economical, traditional, easy to implement and ideal for rural areas. The process being biological in nature does not generate any non-treatable wastes. These processes are easy to operate and require little or no maintenance.

#### ACKNOWLEDGEMENT

I Wish to Acknowledge Tertiary Education Trust Fund (TETFUND) for Sponsoring this Research Under Institution Based Research.

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# The Factors of Choosing Location of Low Cost Housing in Kertak Hanyar Subdistrict, Banjarmasin

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DOI: 10.29322/IJSRP.8.8.2018.p80112

<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80112>

**Abstract-** The increase in the growth of low-cost housing in Kertak Hanyar Subdistrict occurred since the launch of the One Million Houses Program by the government and the issuance of beleid which stipulated the distance of land areas permitted to transfer functions and the existence of directives for housing development Kertak Hanyar Subdistrict by the Banjar Regency government as a City Settlement area and village housing, which is useful as a buffer for housing needs for the City of Banjarmasin and its surroundings. However, the increase in housing can cause sporadic housing distribution (unpredictable) can result in inefficient provision of infrastructure, public transportation, urban facilities and infrastructure and trigger regional growth that is not in accordance with spatial plans. The purpose of this study was to determine the factors that influence low-cost housing developers in determining the location of housing in order to make the government can be more effective in providing infrastructure, public transportation, urban facilities and infrastructure. This type of research is correlation research, which is looking for the relationship between independent variables and dependent variables in choosing a low-cost housing location in Kertak Hanyar Subdistrict. The research method used is quantitative methods. Quantitative approach is used to measure the factors that influence the selection of housing locations in Kertak Hanyar Subdistrict using statistical analysis tools namely scoring techniques. Data collection in this study was carried out in two ways, which are primary survey and secondary survey. Primary survey is a survey carried out directly related to low-cost housing developers directly in the field. Primary surveys are carried out in various forms, namely by preparing questionnaires, visual observations in the field, interviewing the objects of the study and group discussions. Secondary survey is carried out indirectly where researchers search data from the government or agencies related to housing. The contents of the questionnaire consisted of 2 types, that are low-cost housing developers data and questionnaire tabulation, which is by giving a score or value based on the developer's perception. The results of the studies suggest that factors influence the price of land has the highest levels of the other factors. This is due to cheap land prices economically will certainly be more beneficial for low-income housing developers.

**Index Terms-** housing, low-cost,

## I. INTRODUCTION

The rise of the construction of low-cost housing built by developers in a number of suburbs of large cities is now beginning to attract the public to own it. It happened since the launch of the One Million Houses Program in 2015 by the government, which is by offering KPR low interest mortgage offers, cheap installments, and a long period of credit to consumers makes cheap home sales continue to increase. In addition, the convenience is also given to the housing developer, namely the existence of a stimulant assistance program in the provision of Infrastructure, Facilities and Utilities (PSU) so that the selling price of houses for low-income communities (MBR) can be reduced according to what is set by the government.

Kertak Hanyar Subdistrict is one of the many suburbs experiencing housing growth. This can be seen from the emergence of many cheap home developers since the One Million Houses Program. In addition, there are directives from the local government of Banjar Kertak Hanyar Subdistrict is an urban settlement and village housing area., which is useful as a buffer for housing needs for the city of Banjarmasin and its surroundings [1]. However, the increasing number of housing in the Kertak Hanyar Subdistrict was not accompanied by the role of the government as the supervisor. As a result, the Kertak Hanyar Subdistrict area occurred with uneven housing growth and infrastructure networks that were less supportive for residential areas [2]. The location of sporadic (unpredictable) housing can result in inefficient provision of infrastructure, transportation, urban facilities and infrastructure and trigger regional growth that is not in accordance with the spatial plan [3].

Thus, to control the growth of housing in Kertak Hanyar Subdistrict, it is necessary to develop a research on the factors that influence low-cost housing developers in determining the location of housing in Kertak Hanyar Subdistrict. It is hoped that later this research is able to be a guide in making housing zoning in order to create a regular housing area and in accordance with local regulations. In addition, this is an important stage that determines the success of the One Million Houses Project, because the selection of housing locations involves the large role of developers can affect the development of a city.

## II. RESEARCH ELABORATION

The theoretical studies presented in this chapter contain supporting literature related to the research theme. This literature review describes the factors of housing location selection.

### A. The Understanding of Housing

Housing is a collection of houses as part of settlements, both urban and rural which are equipped with infrastructure, facilities and public utilities as a result of efforts to fulfill livable houses [4]. Low-cost housings is type of housing that are usually reserved for low-income people, still has minimal facilities and are usually located far from the downtown [5]. It has a floor area of <36 m<sup>2</sup>, a land area of <90 m<sup>2</sup> and a selling price of 30 million < S <150 million. Based on the explanation above, subsidized houses are part of a low-cost house.

### B. Housing Selection Criteria

There are 7 factors that influence developers in determining the location of housing, that are law and environment, facilities, factors, location, community, service facilities and costs [5]. Furthermore, these 7 factors are influenced by some 18 variables, which are:

1. Legal and environment - consists of 2 variables, that are:
  - a. Regulations and permits in building (X1)
  - b. Clear land ownership status (X2)
2. Facility – that is the availability of regional facilities (X3).
3. Technical factors - consists of 3 variables, that are:
  - a. Land characteristics (X4)
  - b. Easy to do (cut & fill) (X5)
  - c. Easy to do expansion (X6)
4. Location - consists of 5 variables that influence it, that are:
  - a. Accessibility (X7)
  - b. Ease of transportation infrastructure (X8)
  - c. Close to the city center (X9)
  - d. Directions for the development of the city (X10)
  - e. Not in disaster-prone areas (X11)
5. Society - there are 4 variables that influence it, that are:
  - a. Traffic conditions (X12)
  - b. Noise (X13)
  - c. Purchasing power (X14)
  - d. Not a pollution area (X15)
6. Service facilities - availability of social infrastructure (X16)
7. Costs - there are 2 variables that influence it, which are:
  - a. Land price (X17)
  - b. Easy sales (X18)

### C. Population and Research Sample

The population was housing developers in Kertak Hanyar Subdistrict. The population of low-cost housing developers in Kertak Hanyar Subdistrict is 25 developers. This study uses a total sampling method (uses all members of the population) to achieve more accurate results.

## III. FINDINGS AND RESULTS

### A. Distribution of Housing Development Locations in Kertak Hanyar Subdistrict

Since the launch of the "one million homes" program in 2015, there has been housing growth in Kertak Hanyar Subdistrict, especially in low-cost housing. This matter because the government programs provide convenience for low-income people (MBR) to be able to own a house. In addition, the convenience is also given to developers. There is a stimulant assistance program in the provision of Infrastructure, Facilities and Utilities (PSU). Therefore, the selling price of houses for MBR can be reduced according to government regulation.

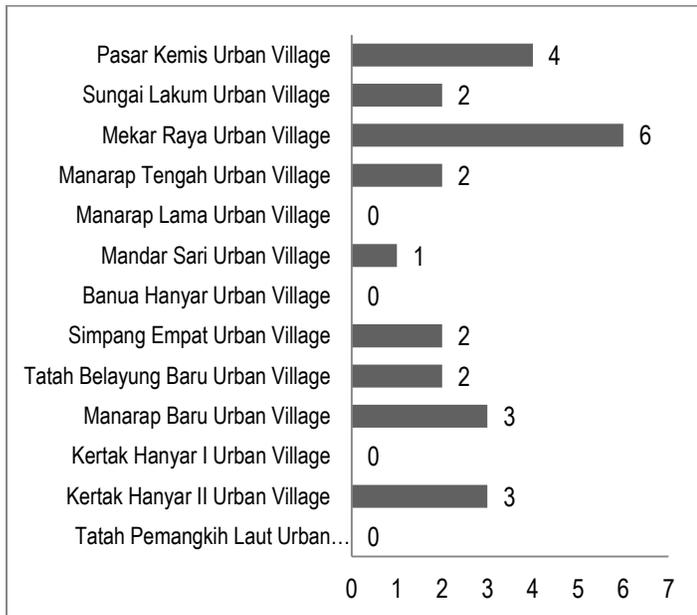
There are currently 25 low-cost housing developers in Kertak Hanyar Subdistrict. The following is the distribution of low-cost housing developers that are active in each Urban Village in Kertak Hanyar Subdistrict.

Table I : Distribution of Low-Cost Housing Development Locations in Kertak Hanyar Subdistrict

No	Kelurahan	Number
1	Pasar Kemis Urban Village	4
2	Sungai Lakum Urban Village	2
3	Mekar Raya Urban Village	6
4	Manarap Tengah Urban Village	2
5	Manarap Lama Urban Village	-
6	Mandar Sari Urban Village	1
7	Banua Hanyar Urban Village	-
8	Simpang Empat Urban Village	2
9	Tatah Belayung Baru Urban Village	2
10	Manarap Baru Urban Village	3
11	Kertak Hanyar I Urban Village	-
12	Kertak Hanyar II Urban Village	3
13	TatahPemangkih Laut Urban Village	-
Total		25

Source: Researcher's Analysis, 2018

Graphic 1 : Number of low-cost housing developers in Kertak Hanyar Subdistrict



Source: Researcher's Analysis, 2018



Fig. 1. Distribution of Low-Cost Housing Development Locations in Kertak Hanyar Subdistrict  
Source: Researcher's Analysis, 2018

**B. Analysis of Influencing Factors in Determining Housing Location**

Analysis of factors influences the determination of location using scoring techniques. Giving an answer score is the answer value that will be given by the respondent. The first thing to do is to determine the score of each answer that will be given [6]. The score used numbers from 1-5 to indicate the level of influence, which are:

- Score 1 : stating the level is very uninfluential
- Score 2 : stating the level is uninfluential
- Score 3 : stating the level is influential enough
- Score 4 : stating the levels is influential
- Score 5 : stating the level is very influential

The next step is analyzing. It is done by using statistical calculation by grouping based on a predetermined scale. The purpose of this grouping is to determine the index of the level of

influence of a variable as a whole. The next step is to value the questionnaire that has been distributed to 25 housing developers.

Table II: Low-cost housing questionnaire calculation

Var.	Value and score	Level of influence					Total
		1	2	3	4	5	
X1	Number	-	-	5	7	13	
	Value	-	-	15	21	65	101
X2	Number	-	-	2	13	10	
	Value	-	-	6	52	50	108
X3	Number	3	8	12	2	-	
	Value	3	16	36	8	-	63
X4	Number	-	10	13	2	-	
	Value	-	20	39	8	-	67
X5	Number	6	7	9	3	-	
	Value	6	14	27	12	-	59
X6	Number	2	4	6	10	3	
	Value	2	8	18	40	15	83
X7	Number	1	10	6	5	3	
	Value	1	20	18	20	15	74
X8	Number	2	14	6	2	1	
	Value	2	28	18	8	5	61
X9	Number	1	10	11	2	1	
	Value	1	20	33	8	5	67
X10	Number	-	5	11	8	1	
	Value	-	10	33	32	5	80
X11	Number	4	2	2	10	7	
	Value	4	4	6	40	35	89
X12	Number	2	7	11	4	1	
	Value	2	14	33	16	5	70
X13	Number	-	4	12	9	-	
	Value	-	8	36	36	-	80
X14	Number	-	2	6	11	6	
	Value	-	4	18	44	30	96
X15	Number	1	8	8	3	5	
	Value	1	16	24	12	25	78
X16	Number	3	8	12	2	-	
	Value	3	16	36	8	-	63
X17	Number	-	-	2	5	18	
	Value	-	-	6	20	90	116
X18	Number	-	4	12	8	1	
	Value	-	8	36	32	5	81

Source: Researcher's Analysis, 2018

The following step is to calculate the index value of each variable with the formula:

$$\text{Index Formula \%} = \frac{\text{Score Total}}{Y} \times 100$$

Total score : Represents the number of scores for a variable

Y : Likert highest score (5) X number of respondents

After obtaining the index value for each variable, the level of influence of each variable on the dependent variable is the value.

After obtaining the index value of each variable, the next step is to calculate the class interval distance to get a

description of influence level of each variable. The following calculations are carried out:

$$R = \text{The biggest data} - \text{The smallest data}$$

$$R = 92,80 - 47,20$$

$$R = 45,60$$

Therefore, the range is 45,60 . Then the next step is to calculate the class interval in the following way.

$$I = R / K$$

$$I = 45,60 / 2 \text{ (number of classes)}$$

$$I = 22,80$$

Description :

- I = Class interval
- R = Range
- K = Number of classes to be made (number of likert scale scores)

Therefore, the class interval is **22,80**. The next step is to make the table score interpretation criteria based on the class interval:

Table III: Score Interval

Answer	Description
Angkat 47,20 – 70	No effect
Angkat 70,10 – 92,80	Take effect

Source: Researcher's Analysis, 2018

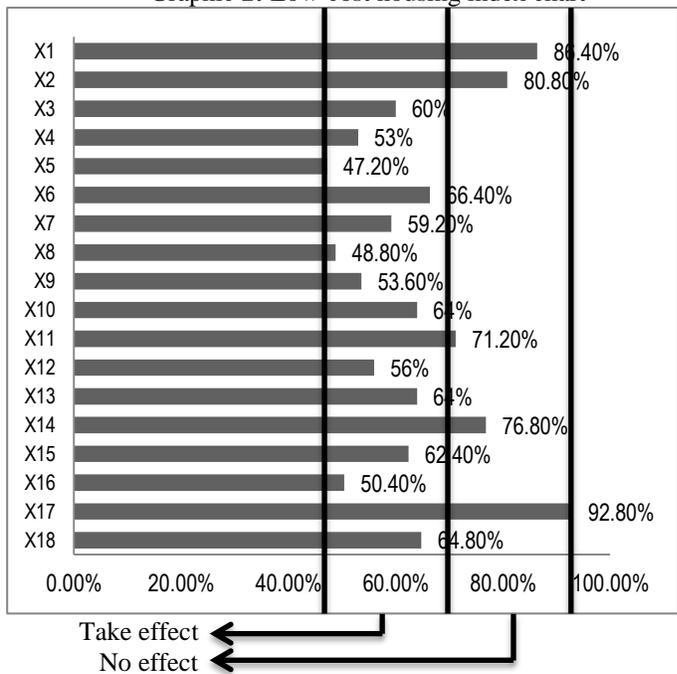
Table IV: Low-cost Housing Index Value

Var.	Factor	Total	Index	Description
<b>Legal and Environmental Factors</b>				
X1	Clear land ownership status	108	86,4%	Take effect
X2	There are regulations and permits in building construction	101	80,8%	Take effect
<b>Facility Factors</b>				
X3	Availability of regional facilities	75	60%	No
<b>Technical Factors</b>				
X4	Land Characteristics	67	53,%	No
X5	Easy to do (cut & fill)	59	47,2%	No
X6	Easy to do expansion	83	66,4%	No
<b>Location Factor</b>				
X7	Accessibility	74	59,2%	No
X8	Ease of transportation infrastructure	61	48,8%	No
X9	Close to the city center	67	53,6%	No
X10	Directions for the development of the city	80	64%	No
X11	Not in disaster-prone areas	89	71,2%	Take effect

Community Factor				
X12	Traffic conditions	70	56%	No
X13	Noise	80	64%	No
X14	Purchasing power	96	76,8%	Take effect
X15	Not a pollution area	78	62,4%	No
Infrastructure Factor				
X16	Availability of regional infrastructure	63	50,4%	No
Cost Factor				
X17	The land price	116	92,8%	Take effect
X18	Easy sales	81	64,8%	No

Source: Researcher's Analysis, 2018

Graphic 2: Low-cost housing index chart



Source: Researcher's Analysis, 2018

This calculation was carried out on 25 low-cost housing developers in Kertak Hanyar Subdistrict. The results obtained are as follows:

Table V: Score interpretation

Take effect	No effect
1. Land price	1. Easy to do expansion
2. Clear ownership status	2. Easy sales
	3. Noise

3. There are regulations and permits in building construction	4. Directions for the development of the city
4. Purchasing power	5. Not a pollution area
5. Not in disaster-prone areas	6. Availability of regional facilities.
	7. Accessibility
	8. Traffic conditions
	9. Close to the city center
	10. Land characteristics
	11. Availability of regional infrastructure
	12. Ease of transportation infrastructure
	13. Easy to do (cut & fill)

Source: Researcher's Analysis, 2018

### 1. The land price

The price of a land is different from the price of another land. One of the causes is the value of the land. The value of land that functions as a productive agricultural area is different from the value of agricultural land that is not productive. Land value is a measurement based on the ability of the land economically in relation to its productivity and economic strategy. The value of land is influenced by two things [7], which are:

- Direct land values such as land or land that can directly produce, for example agricultural land.
- Indirect land values such as land capability are seen in terms of strategic location such as land located in the trade center, offices and educational facilities.

There is a relationship between land prices and accessibility to the city center [8]. Achievement or access will gradually decline in all sides. Therefore, the price of land will decrease as the location goes from the center of the city. The price of land along the main road is higher compared to the price of land that is not on the main road.

Therefore, it can be said that the value of land in Kertak Hanyar Subdistrict may be low because of its low fertility level, but based on its strategic location it is very economical. Economically cheap land prices will certainly provide more benefits for low-cost housing developers. This matter because the target of this housing is the low-income community, thus the developers look for locations that are far from the main road, due to the cheap land prices. Hence, it can be concluded that cheap land prices affect low-cost housing developers in Kertak Hanyar Subdistrict in choosing housing locations.

### 2. Land ownership status

Land is an investment that can be used as collateral to financial institutions [9]. However, to get a plot of land is relatively not easy for most people. Therefore, it is necessary to provide legal certainty to provide protection for land rights that are owned by individuals or communities. Hence, it is necessary to provide legal certainty to provide protection for land rights that are owned by individuals or communities. Residents are more likely to buy the land, if it has a strong legal status of ownership. Thus, ownership of

land whose fields have been arranged with an orderly environment results in increased land prices

Based on the calculation of the questionnaire on 25 respondents, they agreed that the variable land ownership status was influential in determining the location of housing in Kertak Hanyar Subdistrict. This is because clear land ownership status can provide security in infestation for developers and consumers. It is very concerned for housing developers in determining the location of housing. Those lands that already have a strong legal status of ownership, such as property rights, will make the price higher than the land that is not a property. Thus, the legal status of land ownership can be used as a determinant of land prices.

### 3. Regulations and permits

Based on the calculation of the questionnaire on 25 respondents, they agreed that the regulatory and licensing variables were influential in determining the location of housing in Kertak Hanyar Subdistrict. This was due to avoiding problems and constraints in future development.

This permit is intended as a control of spatial utilization in urban development [10]. When build buildings in Kertak Hanyar Subdistrict, there are several regulations and permits that are:

- Local Environmental Permit
- Permit for Land Use or Land Drying Permit
- Principle permit
- Location permit
- Permission from the Environmental Agency (BLH) or Environmental Impact Assessment (Amdal).
- Analysis of Traffic Impact
- Validation of the site plan

After these stages are implemented, the Banjar Regency government provides building permits (IMB) to people or companies to build buildings so that the design, implementation of construction and buildings are in accordance with the City Spatial Plan, Basic Building Coefficient (KDB), Floor Coefficient Buildings (KLB) that apply in Kertak Hanyar Subdistrict.

The next stage is the calculation of the IMB fee. IMB costs are calculated based on the level of use of services with a coefficient quality system of:

- Building floor area
- Number of building levels
- Building location
- Use of building
- Building construction

By having an IMB, it is easier for developers in Kertak Hanyar Subdistrict to get legal certainty and also for legal protection. The permit is done so that the building can ensure that it does not interfere and also harms the interests of others.

The construction of a residential environment in a location can only be done at a location that has been designated and approved as a residential area in accordance with the plan that has been determined and passed by the local government. This is done to create a housing environment that is organized and in accordance with local regulations. In addition, this is an important step that also

determines the success of the housing development project in Kertak Hanyar Subdistrict.

#### 4. Purchasing power

Purchasing Power is the ability of the community to spend money in the form of goods and services. Under affordable prices, people can buy or decide where to live. In the other words, if the price of an item is higher, the lower the demand for the product. The purchasing power of people is influenced by 4 factors, which are: price, income, location and facilities [11]. The first factor is the price. The price has a negative connection to the demand for an item. When the prices rise, the demand will go down, and vice versa. The income factor also influences the demand. Income has a positive influence on the demand for an item. When the income increases, the demand for goods made by an individual tends to increase, and vice versa. Location factors can affect the demand for a house. It was stated that the location had a positive effect on the demand for a house. The better and strategic the location of a house, the more likely the demand for the house increases. Moreover, it was also stated that the existence of facilities are important in influencing the demand for a house. It was stated that there is a positive relation between facilities and housing demand, that is the better the application of infrastructure means that the demand for housing will increase, and vice versa. The high and low purchasing power of the people in Kertak Hanyar Subdistrict is determined by these four factors.

The higher a person's income, the more he wants to have a comfortable place to live. Unlike low-income people that will choose location of a place to stay that is close to workplace as the main option to reduce transportation costs. People who have experienced an increase in welfare will begin to think of owning their own homes in other places with better conditions, as the priority is far from the location of the workplace [12]. This group chooses their place of residence towards the city which will promise comfort in their residence.

#### 5. Not in disaster-prone areas

The Kertak Hanyar area is a tornado area and a fire-prone area [1]. Areas that often experience fires are those that are used as agricultural areas. Fire occurs naturally in summer or sometimes intentionally burned by the owner in order to make the land becomes more fertile. This is very dangerous for housing directly adjacent to agricultural areas. This incident could have made the housing less interested due to fire-prone. Therefore, it is important to choose the location of housing that is not directly adjacent to the area of agricultural residents.

In addition to these two natural disasters, the disaster caused by human activities, that is floods. However, the flood did not last long. The floods soaked residents' settlements, roads, cemeteries and community farms. This is common in settlements that are directly adjacent to luxury

housing. All luxury housing in Kertak Hanyar Subdistrict is built with Cut & Fill system or pile up system in order to tamp soft swampy soil. It can affect the surrounding community, one of which was flooded. However, not all housing that implements the Cut & Fill system is detrimental to the surrounding settlements. Flood can be avoided by applying the system correctly, like making drainage canals, ponds or storage lakes and others. Areas affected by floods will affect the value of land [13]. Areas that are often flooded make land prices decrease. This is what happened in Kertak Hanyar Subdistrict.

## IV. CONCLUSION

In determining low-cost housing locations there are 5 factors that influence it, which are: land ownership status, purchasing power, land prices, not in disaster prone areas and the existence of regulations and permits. Of these 5 factors, it can be concluded that the orientation of low-cost housing in determining the location of housing is the price of land. This can be seen from the score tabulated by the questionnaire which states that the land price factor has the highest index value of 17 other variables. This means that land prices affect low-cost housing developers in determining the location of housing. This is proven to be true and can be seen from the calculation of the questionnaire that cheap land prices are directly proportional to accessibility, infrastructure, transportation networks and social facilities. When land prices are cheap, accessibility, infrastructure, social facilities and transportation networks are inadequate. The high and low price of land will have an impact on accessibility, infrastructure, transportation and social facilities. This is because the price of land will determine the type of housing that housing developers will offer. Low-cost housing is intended for low-income people who are going to have implications for the selling price of the house.

## V. ACKNOWLEDGMENT

The author would like to thank Trisakti University Department of Urban Design, Banjar Regency Government and low-cost housing developers in Kertak Hanyar Subdistrict, because of them this research can be completed properly.

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# Teenagers' Preferences, Creations and Participation in Vlogging Activities

## (Case in the City of Jakarta, Indonesia)

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DOI: 10.29322/IJSRP.8.8.2018.p80113  
<http://dx.doi.org/10.29322/IJSRP.8.8.2018.p80113>

**Abstract:** *One communication activity through cyberspace, or more precisely called social media, is to upload videos through social media blogs or social media video content such as Youtube or Instagram. This communication activity is commonly referred to as video blogging or shortened to vlogging. This study used qualitative descriptive method by interviewing teenagers as social media users and actively uploads videos on their social media accounts. The results show that the factors behind their vlogging activity is to share, share the experiences and the information about culinary, follow the trend, to be exist and use vlog as a platform of online business. The activity they are most excited about is uploading a video to educate the audience. Meanwhile, they create their ideas by optimizing the quality of its content and visual. In addition to uploading videos to Instagram and Youtube, teenagers also like in reading the comments from their viewers and watching the video that uploaded by the other vloggers.*

**Key words:** *social media, vlog, teenagers*

### Introduction

The advancement of internet technology has not only had a powerful impact on its users, but also created a new life for the structure of human interaction patterns. The present communication process can not only be done conventionally which only sends messages in the form of voice and writing. Now, the interaction can be done by sending various types of messages, from the actual image to the modified image. Green (2002) stated that individual users on the internet can now choose between different types and forms of messages and channels within them. By using the Internet, they also tend to express their personalities and express differences in their views with others.

Previously, Markham (1998) also stated that someone will have a different personality when they go online, because it can reduce the shame and feel more confident. They will have more to say. By using technology, they can enjoy the freedom of being able to organize or do something other than the practice of everyday life.

Social media has brought great changes to human life, including the ways and patterns of human communication. Baym, Zhan and Lin (2000) stated that socializing with others is the most popular way to use the Internet in the United States. Researchers see that to understand the role of the Internet in social life, one must differentiate various online activities, identify individual relationships that can be monitored through various media, because internet usage is determined by the choice of its users and makes a direct comparison between social relations and other meanings. Current information and communication technologies have aroused the emergence of community networks for organizations, coordination and conservation of 'real-life activism' (Biddix and Park, 2008).

One communication activity through cyberspace or more precisely social media today is when uploading videos through social media blogs or social media content video content such as Youtube. This communication activity is commonly referred to as a video blog or abbreviated vlog. When answering the question 'what is vlog,' we are more focused on its meaning as a mode of communication than a visual or style attribute. Vlog are a way to connect with others and how to express themselves: "Everyone in the world, and on the other side of the world, can see what we have to say."<sup>1</sup>

A video blog or video log, usually abbreviated as vlog (Pilkington, 2009) is a blog form whose medium is video<sup>2</sup>, and is a form of web television. Vlog entries often incorporate embedded videos (or video links) with supporting text, images and other metadata. Entries can be recorded in one retrieval or cut into sections. Vlog categories are very popular on YouTube with various types of video content can be loaded in vlogging activities.

YouTube, one of the most used websites around the world, is a video platform that focuses on video sharing, with the capacity to enable it to be managed in various ways. Together with the commercial logic in it, this is the site where audio visual documents play a relevant role. Youtube is a growing platform on the need to communicate (in this case through audio-visual

<sup>1</sup> Atomsound, "What is a vlog?" (January 14th, 2007), at <http://www.youtube.com/atomsound>.

<sup>2</sup> "Media Revolution: Podcasting." *New England Film*. Archived from the original on August 14th, 2006.

pieces, comments or 'likes' or 'dislikes' reactions, among other things), a very appropriate space for adolescence with regard to innovation in the form of communication and expression.

This study aims to find out what factors are behind teenagers in doing vlogging activities, knowing the preferences of the type of activities and types of content they like in vlogging activities and knowing the creation and participation of adolescents in vlogging activities.

### **Social Media as a New Media**

New media terms are often used to refer to media that operate on the basis of digital or internet technology and the integration of technology, images and sound. Most technologies described as new media are digital, often have manipulated characteristics; can be involved in one network (networkable), solid, compressible, and interactive. Some examples may be internet, websites, multimedia computers, computer games, CD-ROMs and DVDs. New media does not include television programs, movies, magazines, books, or paper-based publications - unless they contain technologies that enable digital interactivity (Konieczny, 2009). Meanwhile, Crosbie (2002) in an article entitled "What is New Media?" States that the typical characteristics of this media are:

1. Those individual messages can simultaneously be sent to an unlimited number of people.
2. Everyone involved shares mutual control over the content.

In other words, the new media has the advantage of both interpersonal and mass media, but if they are without complementarity, then there is no advantage. Next, it needs to parse some sense, when explaining online media. In general, online media is defined as interconnected media, either with other (media) devices such as printers, scanner video cameras (scanners) and others or when one medium can be connected globally by using internet connection.

The Internet makes it easy for people to communicate with each other. Facilities that use internet technology for discussion are often referred to as social media. Social media is a medium for social interaction and uses access with high quality and extensive communication techniques. Social media use mobile technology (mobile) based on the web (web-based technology). According to Mayfield (2008), social media is defined as a group of several types of online media that have the following features:

1. Participation  
Social media encourages contributions and input from anyone who is interested. It obscures the line between the media and the audience.
2. Openness  
Most social media provide services openly to anyone to provide feedback and accompany them. This works to make a draw (voting), provide comments and share information. Protection of its contents can be done by using a password.
3. Discussion (Conversation)  
Traditional media is related to 'broadcast' (its content is distributed to audiences), social media is more likely to be seen as bilateral talks.
4. Community  
Social media allows people to form quickly and communicate effectively. Communities share interests and common interests, such as photography, political issues or television programs.
5. Connectedness  
Much of social media evolves through the interconnectivity between them. People make use of this connectivity to access websites, sources and links with friends.

DeChoudhury et. all. (2010) stated the characteristics of social media communication in terms of social interaction are as follows:

1. Messages, social sites like MySpace have the ability of users to send short messages about their friend's profile.
2. Blog comments / replies, the ability to comment and reply provided by different blog sites, such as Engadget, Huffington Post, Slashdot, Mashable or MetaFilter, provide evidence against mutual communication within users, related to the topic of blog submitted.
3. Discussion around shared media artifacts, many social sites allows users to share media artifacts with their local network or a group of contacts. For example, through the Flickr application users can upload images that are viewable by contacts, while YouTube lets users upload videos that include categories of different topics. Both types of media sharing enable a rich communication activity centered on the media elements through comments.
4. Social action, one type of communication modalities provided by certain social sites, such as Digg or del.icio.us involves participation in various social actions by the user.
5. Micro-blogging, defined as a communication modality based on user micro-blogging activities, such as those provided by Twitter.

### **Teenagers and Social Media**

In addition to the general use, one of the issues discussed in Subrahmanyam, Greenfield and Michikyan (2015) studies related to the use of social media among teenagers is the idea of privacy and intimacy. There are many different studies that indicate teenagers make use of social media consciously while presenting images and ideas. This will indicate their capacity to control the public, some public or personal dimensions of the information they present to others. Likewise, this confirms their

capacity to control access to their own profiles, the content they want to share and the list of people who interact with it (Madden, Lenhart, Cortesi, Gasser, Duggan and Smith, 2013).

However, Callejo and Gutiérrez (2014) referred to the concept of dialogue as the current trend in which the flow of information is never closed. No end of words or anything that allows the topic to conclude; this can produce something somewhat potentially addictive. From their point of view, closeness, synchronization and deterritorialization of social media affects the low level of reasoning, along with fast and perhaps weak social relationships. Other studies focus on the differences between social media as long as expressing emotions and well-being. In this case, it seems Facebook is more likely to emotional disclosure, while Pea et al. (2012) suggest that face-to-face communication is attributed, to a higher level, to welfare than to video use. Other research centers analyze what motivates the use of social networking sites.

From the point of view of users regarding the use of social media as a means of mobilizing social awareness, Sulisty and Azmawati (2016) found in their research that communication through social media is relatively cheap and easy to access, so it is easy to gather people to engage in one social movement. If community involvement in mainstream media is very limited, but in social media such as Facebook it is more open, everyone can aspire opinions, so it can be said in that context social media has more power. Meanwhile, Barker (2009) detects transcendence of identification with defined group and collective self-esteem, ie individual identity derived from values, emotional meanings and knowledge aspects associated with group membership. Similarly, it was observed that adolescents who exhibit low levels of collective confidence are sought, to a higher extent than others, compensation formulas through social networking sites.

### **Teenagers and Vlogging Activities**

Teenagers are currently developing in the smartphone era and it is not known when they were involved in social media. They are called Generation Z and are defined by birth year from the late 1990s to 2010 (Tulgan, 2013), they are often referred to as millennials. They watch fewer traditional television shows and consume more digital content from sites like YouTube than ever before. According to a recent report from Defy Media on the viewing habits of children ages 13-24 (2015), 96% of those age groups spend an average of 11 hours a week to watch online videos through social media sites. While based on survey results of teenagers in Jakarta, obtained data that some young people spend less than four hours in one day in using social media but others spend five to nine hours. In addition to the time spent young generation to play social media that turned out to be quite high, they also use more than one social media. Most of the younger generation uses four to seven social media alternately (Hamid, Rahman and Morissan, 2015: 59-60).

The younger audience is more likely to identify with YouTuber than with regular TV and movie stars. As many as 59% of 13-year-olds follow YouTuber on social media and only 32% follow television and movie stars. According to a study conducted by Variety Magazine (2014), six out of ten influential parties for 13-18 year olds are YouTuber. Teenagers find the influencers on YouTube more reliable than traditional celebrities (Defy Media, 2015) and identify themselves more with YouTuber than traditional celebrities (in Westenberg, 2016).

Although YouTuber can be compared to celebrities in traditional media, there are interesting aspects that make YouTube celebrities more popular and admired than their Hollywood celebrities. According to some studies, among American youth, remoteness and achievement are the two biggest reasons teenagers are affected by YouTuber (Defy Media, 2015; Cassandra Group Intelligence Report, 2013, as quoted in Adweek; Variety, 2014). Teenagers feel more associated with YouTuber, as they are considered equivalent. They are 'just' ordinary kids who create unique content on the internet and can be boys or girls who live next door or children from the same school. Attention is attributed to their unique personality, talents and creativity, which teenagers are trying to achieve. They start from zero and grow with many followers.

Intimate stories about personal life make them seem approachable and trustworthy. According to a study by Variety (2014), not many teenagers can relate to the lifestyle of Hollywood celebrities like Jennifer Lawrence and Justin Bieber or the amount of money they get. YouTuber swallowed by Hollywood is in danger of being a less authentic version of themselves. Teens will notice it soon. YouTubers often position that they are the same age as their audience. For them it's easier to create content that matches the adolescent reference frame right now. People tend to copy the behavior of people they like, or share the same style of behavior (Bentley, Earls & O'Brien, 2011). According to Brook (2015), behavior and trust are more contagious among people with shared social connections. Imitating others leads to social benefits, such as binding each other in social groups.

### **Reserach Methodology**

This research method is qualitative descriptive research. Qualitative research is directed to make careful observations and detailed documentation of interesting phenomena. Descriptive research only describes the situation or event. This study did not seek or explain the relationship, did not test the hypothesis or make predictions (Rachmat, 1990). Qualitative research is a research method used to examine natural objects, (as opposed to experiments) in which the researcher is a key instrument, data collection techniques are conducted in triangulation, inductive data analysis, and qualitative research results emphasize the meaning of generalization. The natural object is an object that is what it is, not being manipulated by the researcher so that the condition at which the researcher enters the object, after being in the object and after leaving the object is relatively unchanged. The subject of research according to Amirin (2000) is someone or something about it to obtain information, while Arikunto (2006) gives the subject of research limits as objects, things or people where the data for research variables are inherent, and in question. Based on the two restrictions above, it can be concluded that what is meant by research subjects are individuals, objects or organisms used as sources of information needed in data collection research. The subjects of this research are teenagers in Jakarta who actively use social media Youtube and Instagram to do vlogging activity.

## Research Results

### Teenagers' Preferences in Vlogging Activities

Inspiration of teenagers to do vlogging activities obtained from the vloggers who previously successfully using their social media for their respective purposes. They see some YouTubers and 'selebgram' (a term for those who are already popular through instagram accounts) as a figure who manages to achieve their goals through social media. Whether it's a commercial purpose, as well as a social goal. Their strategy in becoming famous first, or in other words can attract an audience as much as possible, if it already has many audiences then their next goal will be more easily achieved. Commercially, there are teenagers who want to use this vlogging activity to market their products or services through the means of audio visual content. Another goal is to provide moral messages or educational messages to teach the audience to do good things, a kind of social campaign, and also to share experiences. If the vloggers are well known to their audience, then they will be easier to get through persuasive messages. This is as stated by Faisal, one of the sources of this research,

*"Because I see it on YouTube many artists who like endorsers, they are easy to persuade the community. Buy this product, it tastes so good right. People are more attracted to known people than people who are not known."*

By presenting themselves in conveying these social messages, as well as being better known, they also consider it to increase their credibility in the audience's view. Thus, it can make it easier for them to conduct social campaigns because as a communicator they have been considered credible. This is as stated by Josep, one of the sources in this study:

*"If I am recognized with others, for example until the rector knows who I might be if there is an event like digital communication or meet the YouTuber, I will be invited as a speaker. It's also true that my friend told me that if I have a relationship I can also go anywhere easily."*

In addition to the purpose of sharing with the audience, the vloggers also have a self-oriented reason. Their vlogging activity is recognized as a means to train themselves, especially in the psychological aspects. Some of them admitted that they initially had doubts in communicating with the public directly. But with the social media that allows them to express themselves, they feel they have the opportunity to express themselves. It is recognized as an effective means of public speaking practice. In a sense, they do not have to meet directly with the audience but can convey the message according to the concept of the message they are designing. In addition to strengthening their existence in cyberspace, they can make the process of producing audio visual messages as a means for them to practice packing audio visual messages professionally and using the media as a means of them in pursuing their professional careers.

YouTube, Instagram and other social media have given them an alternative choice in their communication activities, especially communication with many people. Thus, the psychological barriers that previously arose, with the presence of social media can be overcome even they have the opportunity to be more expression by exploring creativity, especially in the production of audio visual content.

*"I decided to go to campus actually because I was a shy person. Even when invited to take pictures I was shy, I do not want to be photographed, feel uncomfortable. Then, if talking in front of what is in the mind is not there, still empty. So, it should be glued to the text if I want to forward to the front of the class for example. But now whatever is in my head directly express and I immediately reveal. It also helped me in completing my college assignments, during class presentation assignments for example."*

The same thing is also stated by Dino, one of the other sources, that through this vlogging activity, they are more able to train themselves, especially in terms of communication skills,

*"So, because my vlogging activity so I can speak in public, honestly I was from the first difficult to do public speaking, so because I used to be in front of the camera, although my friend once said to speak in front of the camera and directly different, but I still try talking in front of the camera, so maybe so far it has not been proven that I'm getting better in public speaking but there has been an increase."*

Meanwhile, in terms of the type of content that prefers to be uploaded or watched, teenagers have quite diverse preferences. Their preferences in doing vlogging activities, from just entertaining, sharing experiences and information about tourist attractions, culinary, to the information about education and business. There are also teenagers who prefer to upload videos with entertainment content, by conveying content with a humorous approach. But they admit, however, that the humor they present is not just limited to humor, sometimes they deliver moral messages through humorous approaches. As stated by Dino,

*"I'm more into humor, because all those people ever feel bored and want humor and thank to God, now I like humorous content, lots of indofeedgram comedy, so I do prefer humor content. I will insert things that entertain only, there are educated so not all there is education but there are some that just entertain."*

Sharing in terms of knowledge is also one of the vlogging activities favored by teenagers. For example by sharing knowledge about new software, then how to use and utilize the software, they serve through video tutorial. The other videos they upload are short films and story telling content, delivering video messages with a story-telling approach to the audience. The

content of the story telling approach is diverse, but the most popular is the theme of educational content, moral messages and culinary themes. The following statement from Faisal,

*"I myself, I prefer content that gives my audience an insight like a tutorial. I usually give a tutorial about software because of the knowledge I get about it."*

Conveying something that the audience does not know yet is a challenge for them. They feel satisfied when they can convey something previously unknown to many people. They feel challenged to keep thinking out of the box or out of the ordinary. This is also done as one strategy to attract more audiences to view their videos. As stated by Josep,

*"I like the most educational and culinary and science too, because I need to know also the insights from the world that other people do not know, so I can make something that others do not know, so they want to come to my account. Because I know what they do not know. So, want to increase knowledge, so can be shared to others through vlogs that I make."*

Meanwhile, from their side as an audience, ie watching videos from other vloggers, it can be seen that their preferences are also varied, from just looking for entertainment videos, to educational content that covers the world of science and business. Others like video content that includes coverage of vloggers that unlock boxes from items purchased using cell phones, or they call it unboxing. Youtuber bought a product, then recorded themselves in the moment of opening the pack, next opened the box of the product, made a few comments, then uploaded it to Youtube. At the same time, the viewer spends time watching others open the box, commenting on the activity. Unlike video reviews that feature an individual figure in front of the camera, a video opening box just shows someone's hand opening a product box using a faceless narrative. As stated by Dino,

*"I like funny videos and also unboxing videos."*

The preference of teenagers in uploading and watching the videos in their vlogging activities varies. This is of course influenced by the nature, taste and experience of each.

### **Teenagers' Creations in Vlogging Activities**

In producing video content that they will upload on their social media accounts, teenagers choose a theme first that they think may benefit their audience. Beneficial in the sense not only in fulfilling the need for information, education, naun also in meeting the entertainment needs of the audience. However, the themes of social issues with educative content are most of the themes they prefer. For example by showing the theme of how to respect the differences that exist in society. The social theme will be packaged in the form of a short film with a simple storyline but full of moral messages. Some teenagers claim to be inspired by searching information through online media, as well as through social media. They admit that their inspiration also gets from overseas channels, as they also want their uploaded videos to broaden their audience and broader insights. This is as stated by Josep,

*"My inspiration from foreign channels, so we know how to speak properly and effectively, there is also from the Indonesian vlogger, how cinematic to be nice to see people."*

Through short film they do what is called story telling. Deliver messages through the short film they have created. They try to translate the ideas that are in their mind through the means of audio visual media. Nevertheless, they avoid themes that might lead to debate. For example, by asking the audience, what is the punishment for the perpetrators of bullying. There are respondents who think that such questions will lead to debates, so they avoid them.

In terms of visual quality, in addition to paying attention to image quality when they shoot, they also maintain visual quality during the editing process. In the editing process used transition techniques that can create a good mood, for example by using a particular transition technique so that the movement of images looks so dynamic. In addition, respondents acknowledged that the use of directly captured images was considered more vivid than visualization through graphics. So, at the time of shooting, all messages will be delivered they record via speech directly, without any process of dubbing or additional graphics.

Another thing that concerns is the element of audio, creativity in creating informative, educative but entertaining verbal messages is a challenge for them. However they still try to convey a message that contains elements of humor but still trying elegantly. In other words, they avoid messages that are not considered funny by the audience, as they try to approach the humor in the messages. This is as stated by Faisal,

*"We more glimpsed overseas vloggers, because they were elegant, so they were smoother than local vloggers, they were rougher, more vulgar verbal and non verbal messages. Vloggers from out there that they start from the preparation of words, graphics and design they also retain the elegant element it. They remain stable if they can keep up not to go down. That's the principle they hold, and we're referring to their principles."*

The making of this elegant message has also begun from the process of drafting the script. The script should be completely systematic, so that when the message is delivered it is a trace, so the message is easily understood by the audience. In the script is also written the technique of shooting so that it can guide them in maintaining the quality of the image they will produce. The manuscript made also includes aspects of audio engineering, this is to anticipate the sound quality produced. Including keeping

the surrounding sounds does not interfere with the audio quality in the created movie. In terms of equipment used, most respondents use smartphones in the process of shooting, of course, by maximizing the functions of the features available on their smartphone. Although by using the means of smartphones, they try to express their creativity as much as possible, which displays a video that aims to provide solutions to the problems faced by the audience. As stated by Dino,

*“Actually the vlog is for teenagers to pour their creativity, where teenagers like us are required to provide solutions for the wider community not just people who only make conveying in the level of common sense or the like, but there must be a solution, we must be able to act as a problem solver.”*

Their creativity also arises because of concerns on video content displayed by other vloggers who embrace them merely to exhibit the goods or activities that they do.

*“Even if they have the goods or do extraordinary activities, they should be able to deliver them from different sides. The packaging should be more informative, for example, so do not be an impression of showing off, but rather sharing the information.”*

From the side of the goal in capturing the number of audiences, they have a principle although one of the goals is to get the audience as many as possible, but must still be balanced with good video quality. In other words, although the audience is not too many, but when the video they uploaded successfully gets positive comments from the audience, they claim more satisfied than they get many audiences but the comments given mostly are negative comments. But they have a strategy, if it turns out that the video uploaded gets very few viewers, they will re-edit the video by adding visual and audio elements. The first thing to note is that the content of the delivered message must use an effective sentence, the second corresponding intonation, the third remains elegant, one of which is by presenting the images with soft colors.

The other creativity they do is in terms of audio, especially in the context of delivering the message content. Although talents are not well-known people, but when conveyed by collaborating on various elements proportionally and pleasing to the eye and to hear the ear, they believe it will attract the audience's interest. In addition, the duration of the video shown is not sought too long, maximum duration is three minutes. Because, they assume the audiences are not really like watching the videos through Youtube or Instagram when it is too long, in addition to being considered boring, it will also use a large internet quota.

### **Teenagers' Participation in Vlogging Activities**

Related to the frequency of vlogging activity, the teenagers who responded in the study had quite varied answers. There are answered once a week, two weeks and once a month. Among the reasons why they uploaded the video in a long time span, they stated that they not only upload videos just like that, but also keep looking at the results. After they upload the video, they will see the trend of audiences who watch, not only in terms of numbers, but also from the audience's comments side. According to their comments the audience is an indicator of the effectiveness of the video they upload. If the audience is satisfied, the audience will give positive comments and vice versa.

Meanwhile, as the audiences, the respondents admitted almost daily watching videos uploaded by other vloggers, both locally and abroad. There are even respondents who can spend more than five hours a day. It also indicates how vlogging became a trend and part of the daily activities of teenagers. However, they do not watch all the videos on their social media accounts, they select them first according to their preference. Some respondents stated that they would first see the comments of the video they were watching, if the video got a lot of negative comments from the previous audience, then they left the video, and instead they watched videos that received many positive comments. This is as stated by Faisal,

*“... so I read the comment first if the comment is negative, I leave it, otherwise if positive, sure I will watch it.”*

In the meantime, if they plan to upload videos on social media accounts, they will think carefully about whether the video they are uploading has been really feasible and to the taste of the audience. Although they will respond any comments to the audience with positive thinking. If there are positive comments they will make the motivation, otherwise, they get negative comments, they will perceive as a challenge to do better.

### **Discussion**

The choice of teenagers in vlogging activities is quite diverse, some like the kind of informative content, some love educational content, but some also like entertainment content, whether as uploaders or as audiences for both social and business purposes. But most of them prefer the video themes that are not just entertaining, but also content that can contribute to society, for example in growing social awareness. This is as stated by Sulisty and Azmawati (2016) that communication through social media is relatively cheap and easy to access, so it is easy to gather people to engage in one social movement. If community involvement in the mainstream media is very limited, but in social media like Facebook it is more open, everyone can aspire to his opinion, so it can be said in that context social media has more power.

If they have to deliver the activities they are doing, they will pack them informatively rather than just showing off their activities. This indicates that teenagers in vlogging activities try not only to express themselves but also to bring their social mission. In terms of creativity, they are quite aware that social media like YouTube and Instagram is a fairly effective platform today in spreading messages through videos that they upload. Therefore, they pay enough attention to the video production process that they will upload, from searching for references, inspiration, script writing, shooting and editing. They do this not only

in an effort to maintain their visual and audio quality, but also for achieving their goals in conveying the message. Through activity in this new medium, the unique creativity of teenagers grows and develops. They make the successful YouTubers as inspiration. This is, as stated by Variety Magazine (2014), six out of ten influential parties for 13-18 year olds are YouTubers. Teenagers find the influencers on YouTube more reliable than traditional celebrities (Defy Media, 2015) and identify themselves more with YouTubers than traditional celebrities (in Westenberg, 2016).

The participation of adolescents in vlogging activities is quite diverse, not only in capability as a uploader, but also as an audience. The frequency of activity as audiences is more frequent, compared to those as video uploaders. As uploaders, they will first see and watch the audience's comments on their videos. While as an audience, they claim to watch videos almost every day, some even watch more than five hours in a day. This reinforces previous research findings that some young people spend less than four hours a day using social media but others spend five to nine hours. In addition to the time spent young generation to play social media that turned out to be quite high, they also use more than one social media. Most of the younger generation uses four to seven social media alternately (Hamid, Rahman and Morissan, 2015: 59-60).

## Conclusions

Based on the data analysis and discussion above, it can be concluded some of the following:

1. Factors behind the teenagers in doing vlogging activities in between them are to share information, educate and also economical factor, that is using vlog means to promote their product or service.
2. Their preferences both in watching and uploading videos through their social media accounts are quite diverse. From the nature of the message content, they like videos that are informative, educative and also that use the entertainment approach. From the theme side of the message, they prefer social, culinary, tutorial and business video campaigns.
3. The teenagers claimed to get the inspirations from the vloggers they already considered successful, in the production of the videos they will upload through their social media accounts.
4. In producing the videos they will be uploading, they are quite well-prepared, from start-up ideas, scriptwriting, shooting and editing with attention to current issues as well as adjusting to the current preferences of the audiences.
5. The participation of teenagers in vlogging activities tends to be higher as a viewer than as a video uploader. This is of course caused by a longer preparation process, especially in the production process of the video to be uploaded.
6. In terms of the frequency of their vlogging activity is quite diverse, some spend one to two hours a day, but some are spending more than five hours a day.

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