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## NACESTMAK MULTI-DISCIPLINARY JOURNAL OF TECHNOLOGY AND HUMAN DEVELOPMENT

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## STAFF MANAGEMENT STRATEGIES FOR JOB PERFORMANCE AMONG LIBRARY STAFF IN BENEUE STATE POLYTECHNIC'S LIBRARY, UGBOKOLO

**Dinah Innocent Adanuh CLN**

07062076001 email: [dinahadahnu@gmail.com](mailto:dinahadahnu@gmail.com)  
NACEST Makurdi Benue State

**Atuh ObisikeNwachukwu.JP.CLN.PhD(Nig)**

07054373067,07031288891 email: [atuhobisike99@yahoo.com](mailto:atuhobisike99@yahoo.com)  
NACEST Makurdi Benue State

**Ibrahim Ogbole, CLN, PMGT.**

07038175932 email: [ogboleibrahim20@gmail.com](mailto:ogboleibrahim20@gmail.com)  
Strategic Information/ Health Informatic Unit,  
Apin Public Health Initiative,  
Makurdi, Benue State

### **Abstract**

*In the Benue State Polytechnic's Library Ugbokolo, the study's primary focus is on staff management techniques for job performance among library staff. The goal of the study is to find out how motivation, professional growth, and workplace harmony affect how well library workers do their jobs. Because there were only 47 library staff members, the study did not sample them. Questionnaires were used as the instrument for data collection, which was analysed using descriptive statistics in SPSS version 23 to address the study topics. Each survey item must have a mean score of 2.5 in order to be considered genuine. According to the study's findings, professional growth was also found to be a very significant positive predictor of the motivation that affects job performance. Motivation has been shown to positively correlate with job performance. The study suggested that in order to improve the job performance of the library staff at Benue State Polytechnic's Library Ugbokolo, the relevant authorities should give priority to motivation, professional development opportunities through workshops, seminars, and additional coursework, inclusive leadership styles for workplace harmony, and performance evaluation as a feedback mechanism.*

### **Background to the Study**

Because productivity is primarily based on the calibre of employees or library staff and the organization's capacity to develop them, human resources development is crucial to the growth of any library.

The terms "Staff Management," "Personnel Management," "Manpower Management," and "Human Resource Management" are used interchangeably. Employee management strategies are consciously thought out and deliberate actions are made by a library's administration to support a desired behaviour on the part of the staff. Staff management strategies are

In both industrial and organizational settings, the idea of staff management is frequently employed since it focuses on how employees are managed, guided, and given the tools they need to execute their jobs.

simply described by Aktouf (2012) as long-term planning that is meticulously created by management of organisations in order to achieve organisations' goals. Additionally, management of businesses develops modalities to encourage or reinforce workers for better or more efficient job performance. Promotion, a democratic leadership style, in-service training, proper

infrastructure, industrial harmony, and discipline are only a few examples of such techniques. Therefore, it can be expected that any library staff member who experiences the influence of the aforementioned tactics will be compelled to give their all when performing their duties since they will enjoy the gratification of

In order to achieve an organization's or library's strategic aim, strategic management is viewed as a dynamic process of design, execution, evaluation, and control of strategies (Kazmi & Kazmi 2019). When managers make a conscious effort to affect the direction and pace of employees' behaviour, motivation as a management approach applies to all facets of individual behaviour. There are many methods for motivating employees, but in the context of this work, the techniques are restricted to ensuring that the library staff are safe and secure and promoting them when it is due. For the employees of the library to be motivated, they

Posigha and Seimode (2015) claim that professional development activities in libraries are intended to help librarians advance both personally and professionally. Academic librarians' demand for ongoing knowledge and skill acquisition is satisfied through professional development in a way that neither formal schooling nor

According to Saka and Haruna (2013), job performance is the capacity to carry out legal obligations that are based on a person's area of expertise or areas for growth as well as the goals of an organisation. The cataloguing and classification of resources, the provision of reference services, the charging and discharging of materials to users, etc., are all jobs done in libraries. In a library, job performance is focused on not only satisfying the information needs of patrons but also serving as a foundation or standard for staff promotions.

### **Statement of the Problem**

Libraries are organizations, therefore, staff management tactics for job performance are vital as well necessary. What, therefore, is the cause of the poor performance of the library personnel that this researcher saw at Benue State Polytechnic's Library Ugbokolo? Is there a gap in the tactics the college's management uses to manage are vital, as well necessary. The library staff? Are library employees

doing so. Therefore, the impact of these management practices on the job performance of the library staff at Benue State Polytechnic's Library Ugbokolo remains to be tools seen from this study.

must be designed in such a way that they are committed to achieving both the institution's and the students' goals. Individual staff requirements and goals must therefore be satisfied. The main goals of colleges around the world are to advance knowledge via instruction, research, learning, and community service. We rely on the expertise of skilled and competent library personnel to successfully meet these goals. However, in addition to skills (qualification and competence), motivation also affects the effectiveness of library workers (Ngu, 2012).

on-the-job training could. The "technology imperative"—the rapid technological development that characterises modern university libraries—and the fact that librarians share with other specialists the practice of being paid for both their knowledge and their work—serve as the driving forces behind this necessity.

Therefore, staff development is the process of giving employees the abilities they need to do their jobs well. Staff development programmes (Ifidon & Ifidon, 2007) include simple orientation programs, scheduled visits, seminars and conferences, participatory management, internal training programs, formal professional library education, and short courses. The library workers at Benue State Polytechnic's Library Ugbokolo can only do their best work if they are motivated enough.

actually driven to perform their duties? It is indeed of great concern that the polytechnic's library staff produces so little work. Therefore, this situation represents the issue that the study set out to explore, utilizing management strategies including motivation, professional development, and proper provision of infrastructural facilities on library staff work

performance in Benue State Polytechnic's Library

### Objective of the Study

The following goals serve as the study's direction  
To find out how motivation affects the job performance of the library staff Benue State Polytechnic's Library Ugbokolo.

### Research Question

To direct the investigation, the following research questions are posed:

How much does Benue State Polytechnic's library staff's professional development impact job performance?

### Review of Related Literature

Numerous studies have been carried out to determine the impact of staff management strategies on the job performance of library staff. In a related study, Onyeukwu & Ekere (2018) proposed that motivation is a combination of internal and external elements that piques people's interests and drives them to remain dedicated to a task, role, or subject while also making consistent efforts to achieve a goal. The level of effective job performance and the pleasure of the library employees are more influenced by internal and external factors than anything else. According to Bamgbose & Ladipo (2017), motivation is the process through which a learner directs their internal resources toward different objectives or things. According to him, motivation is an innate state that activates activity, gives it direction and energy, and then directs it toward behaviour that is goal-oriented.

Participants from the library staff highlighted a number of ways to enhance professional development, including making conferences and workshops mandatory for all staff categories, allocating a special annual budget for training activities, and ensuring that librarians attend workshops and conferences at least once each academic year (Posigha & Seimode 2015). Olaniyan and Ojo (2008) conducted a study to investigate the potential impact of employee training and development on organisational advancement. According to the study, in addition to holding workshops, conferences, and seminars for staff training and development, organisations should make training and retraining

Ugbokolo.

To assess how professional development affects the job performance of the library personnel at Benue State Polytechnic's Library Ugbokolo.

To determine the impact of labour peace on the productivity of the library staff at Benue State Polytechnic's Library Ugbokolo

How much does the Benue State Polytechnic's library staff's motivation impact work performance?

How much does the Benue State Polytechnic's Library Ugbokolo library staff's job performance depend on industrial harmony?

programmes mandatory in order to fulfill their goals and objectives.

Ikonne (2015) asserts that using employee output as a management tool is intended to increase employee performance as a way to determine staff compensation, but not as a way to improve the connection between superiors and subordinates. Additionally, he mentioned how employee motivation and job performance could be impacted by one another. The cataloguing and classification of resources, the provision of reference services, the charging and discharging of materials to users, etc., are all jobs done in libraries. Meeting user information demands is a primary focus of job performance in a library, which also serves as a benchmark or criterion for staff promotions. According to Asamu (2013), if performance evaluation is carried out appropriately and logically, the organisation may be able to influence its employees to pursue their goals. Additionally, performance evaluation tries to inspire employees by giving them enough tasks and responsibilities in relation to the organisational goals for the company. Workplace features like skill diversity, task relevance, and task identity result in psychological situations that boost motivation, performance, and job satisfaction (Lilin, 2018). Understanding the relationship between overall job happiness, motivation, and productivity is crucial. Promotions, pay increases, effective staff communication, awards, participative management,

and staff development are just a few ways that management can encourage employees to work effectively. It is believed that highly motivated employees perform better, which increases production (Saka & Haruna, 2013). According to Toyin & Olubunmi (2018), the psychological consequences of job content, matching tasks to individual needs, appropriateness of incentive systems, and use of performance appraisal and compensation evaluation are increasingly significant areas of management concern resulting from the review. Again, management must develop strategies to guarantee that workers feel treated with respect and dignity. Management should be more involved at work to encourage a culture that values teamwork, peace at work, and dedication to one's job (Obi, 2014).

According to Odia and Omofonmwan (2017), industrial harmony increases labour productivity, which raise achievement levels in our educational system. It fosters a tranquil workplace that is supportive of tolerance,

communication, and other non-strike methods of settling labour or industrial conflicts in Nigeria, such as negotiation, mediation, arbitration, conciliation, litigation, or court adjudication. High levels of employee satisfaction are produced as a result. The literature evaluation focused on the effects of motivation, professional growth, and workplace harmony on the job performance of library employees. The review found that the job performance of library employees was influenced by motivation, professional growth, and workplace harmony. The literature analysis, however, reveals that related studies are carried out both inside and outside of Nigeria. They frequently rely on factors like employee motivation and benefits, staff professional development, availability of infrastructure, and a positive work environment, among others, but they almost always leave out democratic leadership style, workplace harmony, and staff discipline. Therefore, this study's goal is to close this gap and advance our understanding of the subject.

### Methodology

The study used the survey method. 47 members of staff made up the study's population, which was not sampled because it was manageable and actual. This is consistent with Afolabi's (1999) claim that a researcher can include the entire population in a study provided it is manageable, accessible to study subjects, and won't pose any financial issues. A questionnaire was used to

collect primary data, and it was given to the Kaduna State College of Education's library employees. To address the research topics, all completed questionnaires were received and analysed using descriptive statistics in SPSS v.23. Every item on the questionnaire must have a mean score of 2.5 in order for it to be recognised as genuine; any mean score below 2.50 is regarded as invalid.

### Data Analysis and Discussion

Table 1: Motivation on Library Staff Job Performance in Benue State Polytechnic's Library Ugbokolo

S/N	Statement	SA	A	D	SD	Total	Mean	Decision
1	Regular promotion motivates library staff in job performance.	20 (43%)	15 (32%)	5 (11%)	7 (15%)	47	3.0213	Accepted
2	Prompt payment of salaries motivates library staff in job Performance	12 (26%)	18 (38%)	10 (21%)	7 (15%)	47	2.8085	Accepted
3	Financial benefits of library staff improve job performance Effectiveness	17 (36%)	21 (45%)	4 (9%)	5 (11%)	47	3.0213	Accepted

4	Rewarding of hard working motivate library staff in job performance.	30 (64%)	14 (30%)	3 (6%)	0 (0%)	47	3.4255	Accepted
5	Welfare packages of library staff motivates job performance	40 (85%)	4 (9%)	2 (4%)	1 (2%)	47	3.3404	Accepted

**Note: SA, strongly agree; A, agree; D, disagree; SD, strongly disagree**

Table 1 reports the perceptions of the respondents regarding different types of motivations. From the analysis all the items scored a mean value 2.5,

indicating that motivation has significant influence on job performance of library staff

**Table 2: Professional Development on Library Staff Job Performance in Benue State Polytechnic’s Library Ugbokolo**

S/N	Items/Description	SA	A	D	SD	Total	Mean	Decision
1	Training and Re-training of library staff enhancing professional development of job performance	6 (13%)	23 (49%)	10 (21%)	8 (17%)	47	2.5745	Accepted
2	Study/fellowship for further studies enhances capacity building and job performance of library staff	12 (26%)	26 (55%)	8 (17%)	1 (2%)	47	3.0426	Accepted
3	Attending of conference/workshops and seminars of the library staff improve job performance	18 (38%)	17 (36%)	8 (17%)	4 (9%)	47	3.0213	Accepted
4	Orientation courses for library staff enhance professional development	21 (45%)	8 (17%)	10 (21%)	8 (17%)	47	2.8936	Accepted
5	Professional	12	22	7	6	47	3.1702	Accepted

development of library staff precipitates the growth of KSCOE and staff job performance s

library staff precipitates the growth of KSCOE and staff job performance s

Table 2 above shows that all areas of professional development which could influence job performance were accepted; having scored a mean

value of more than 2.5, this indicates that professional development has significant influence on job performance of Library staff

**Table 3: Industrial Harmony and its influence on Library Staff Job Performance in Benue State Polytechnic’s Library Ugbokolo**

S/N	Items/Description	SA	A	D	SD	Total	Mean	Decision
1	Cordial relationship between employers and employees improver job performance	14 (30%)	20 (43%)	10 (21%)	3 (6%)	47	2.936 2	Accepted
2	Management cooperation with unions on establishing procedures for negotiations for job performance.	18 (38%)	21 (45%)	5 (11%)	3 (6%)	47	3.127 7	Accepted
3	Effective communication system between employers and employees enhancing job performance of library staff	10 (21%)	27 (57%)	6 (13%)	4 (9%)	47	3.276 6	Accepted
4	Good working environment improve industrial harmony of library staff for job performance	20 (43%)	18 (38%)	4 (9%)	5 (11%)	47	3.085 1	Accepted
5	Failure to implement agreements reached	30 (64%)	12 (26%)	3 (6%)	2 (4%)	47	3.553 2	Accepted

union and managements of KSCOE negatively staff job performance.

From table 3 above it shows respondent opinion on industrial harmony. From the analysis all statements scored above mean value of 2.5, indicating that

industrial harmony have significant influence on job performance of library staff.

**Table 4: Parameter Estimate for ordinal regression analysis**

		Estimate	Std. Error	df	95% Confidence Interval	
					Lower Bound	Upper Bound
Thresho	[Mlsjp 2.40]	13.276	4.417		4.619	21.932
	[Mlsjp 2.60]	15.379	4.463		6.632	24.126
	[Mlsjp 2.80]	15.832	4.490		7.032	24.632
	[Mlsjp 3.00]	16.615	4.547		7.702	25.527
	[Mlsjp 3.20]	17.610	4.626		8.544	26.677
	[Mlsjp 3.40]	19.603	4.762		10.271	28.935
	[Mlsjp 3.60]	20.667	4.816		11.229	30.106
Locatio	Pd	2.476	.791		.925	4.027
Inharm						

Link function: Logit.

According to the study, the ordinal regression coefficient "r" can be easily understood as the change in log chances of being in a higher category or group on the predictor variables per unit increase in the independent variable. As a result, the following is stated in order to address the study questions:

According to the parameter estimate table, the motivation of library staff is a strong predictor of

job performance and statistically significant (p 0.05) with an estimate of increased log odds ranging from 13.00 to 20.667, showing a positive relationship with job performance.

Professional development (Pd) was another highly important predictor of the drive that influences work performance. There is a predicted increase of 2.476 in the likelihood of having stronger motivation for job performance for every unit increase in staff

professional development. This indicates that the growth in staff professional development is a direct outcome of the motivation that pushed employees to do better on the job.

Industrial harmony (in harm) was not a highly reliable indicator of employee motivation. However, there is a predicted value of 1.120 in the

### Discussion of findings

In the first research question, it was determined whether or not library staff motivation in Benue State Polytechnic's Library Ugbokolo, affected their work performance. The results showed a positive correlation between motivation and job performance. The results supported those of Onyeukwu & Ekere (2018), who found that internal and external influences increase people's desire and energy to be consistently engaged in and devoted to a job, role, or subject, as well as to put up consistent effort toward achieving a goal. The workers in the library at Benue State Polytechnic's Library Ugbokolo, are very motivated, which helps them do their jobs well.

In a similar vein, study question 2 looked to see if work performance was impacted by staff members' professional growth. The motivation that influences job performance was also found to be significantly positively predicted by professional development (Pd). There is a predicted increase of 2.476 in the likelihood of having stronger on-the-job motivation for work performance for every unit increase in staff professional development. This indicates that a comparable rise in staff professional development is what gave employees the drive to improve their job performance. In their study from 2015, Posigha and Seimode found that professional development

### Conclusion

Based on the results of the study, the researcher came to the conclusion that organisations like Benue State Polytechnic's Library Ugbokolo benefit from the effective adoption of staff management strategies like motivation, professional

log odds of having a greater degree of motivation for job performance for every unit rise in industrial harmony. This shows that the productivity of the library staff at Benue State Polytechnic's Library Ugbokolo is affected by how happy they are at work.

activities were a constant way to learn new information and skills that could not be Also, a look at Table 3 shows that there is a lot of agreement between work performance and work harmony. This is clear from the fact that the average answer to all five of the survey's questions (1–5) about how labour peace affects the job performance of library staff was "strongly agree." This gave the survey a mean score above the threshold for acceptance. This result is consistent with that of Obi (2014), whose study on labor-management relations found that industrial harmony ensures a friendly relationship between management and staff, which improves employees' performance on the job. The results concur with those of Odia and Omofonmwan (2017), who claimed that industrial harmony increases labour productivity, which in turn improves performance. Industrial harmony fosters a tranquil workplace that is favourable to respect, communication, and other non-strike methods of settling labour or industrial conflicts, like negotiation and mediation. According to this observational study, the management of Benue State Polytechnic's Library Ugbokolo must regularly engage with personnel in order to promote workplace harmony and peace and to improve staff productivity.

development, and industrial harmony because these strategies have a positive effect on the job performance of the staff.

### Recommendations

The following recommendations were made in light

of the study:

Prioritizing motivation has been discovered to be a component of high job performance. In order for the library and Benue State Polytechnic's Library

Sponsor in-service training for library staff members; study fellowships with compensation; seminars; workshops; and symposiums, among other things, are all effective management strategies that improve

The Benue State government and the college administration should make sure that there is industrial harmony and a calm workplace atmosphere that

To encourage others to give their best efforts, the college administration should recognise the excellent

Ugbokolo, to reach their goals, the management should keep motivating the workers and giving them a desire to work.

library staff members' job performance and should, therefore, be given priority by the college management authorities.

promotes tolerance, communication, and other methods of resolving disputes and improving job performance.

services provided by library workers and award them accordingly before they depart.

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## ASSESSMENT OF THE IMPACT OF COST ESCALATION ON BUILDING CONSTRUCTION PROJECTS DELIVERY IN BENUE STATE.

**OGUGUA KELECHI KINGSLEY,**

Department of Quantity Surveying

Nigerian Army College of Environmental Science and Technology (NACEST) Makurdi .

email: Kingkc.ogugua@gmail.com,

### Abstract

*This study investigates the effects of cost escalation on delivery of building construction projects in Benue State. The descriptive survey design was adopted for this study in which 50 respondents were selected by stratified random sampling technique. A questionnaire comprising of 25 items was used to collect data. Analysis was carried out using mean ratings and standard deviation. Results indicated that variation and fluctuation are the most factors responsible for cost escalation; tarnishing the contractor reputations and jeopardizing the contractor chances of winning contracts are the effects of cost escalation; pre-purchase of materials to limit the inflation and recognizing inflation during the design process and modifying the design appropriately, where it may be needed are the ways of reducing cost escalation on the delivery of construction project in Nigeria. It recommends that Government should implement price control system in the market; A clear and thorough client brief should be taken at the inception of the projects so as to avoid or minimize excess variation order; The contractor should be guided by the consultant to adhere to the proposed programme schedule time of work in other to minimize the instance of extension of time and to reduce period of fluctuation.*

**Keywords:** Cost Escalation, Delivery, Construction Projects.

### 1.0 INTRODUCTION

#### BACKGROUND TO THE STUDY

Difference elements make up the entire building project have certain amount of money attached to each of them. There is always an anticipated increase in cost of these elements. This is known as cost escalation. According to Oyewande (2011) cost escalation is defined as an anticipated increase in budgeted cost due to factors such as inflation. This is different from Cost overrun which is an expected cost incurred in excess of a budget amount due to an under estimation of the actual cost during budgeting (Flyvberg, Holm& Buhl 2002). A number of studies have been done on cost of construction projects. Achuenu (1998) observed that in the past few decades

construction project cost in Nigeria has shown a continuous upward trends due to inflation and other associated factors. Nsam (2001) conclude that construction cost in Nigeria is among the highest in the world. The increase has also become excessive to the extent that initial contract sum can hardly be relied upon by the client. This has become worst now that one can hardly rely of market prices which changes like chameleon. Benjamin (2008) studied on factors affecting final cost of construction projects and came up with factors that have significant effect on the final cost and also factors that have less effect on final cost.

#### Aim and Objectives

The aim of this research is to assess the various impacts of cost escalation on delivery of

building project in Benue State

The objectives of the study are:

- To identify the various causes of cost escalation on building project delivery
- To identify the effect of cost escalation on delivery of building project.

### Research Question

- What are the various causes of cost escalation on building project delivery
- What are the effects of cost escalation on delivery of building projects.

- To proffer solution ways of reducing cost escalation on delivery of building project.

- What are the ways of reducing cost escalation on delivery of building projects

## 2.0 LITERATURE REVIEW

The construction industry is seen as the second oldest industry in the world with agriculture being the oldest. It is the sector responsible for planning, designing and procurement of construction and delivery of building projects, Civil Engineering projects and heavy Engineering projects for individual, private institution as well as government at local, state and federal levels (Ene, 2009). Boye (1991) states that the cost of materials which are on the high side cannot be underestimated. Materials are not left alone on this journey to the high side but is also accompanied by all other resources which includes cost of equipment, labour, etc. This is also occasioned by the excessive demand on construction resources due to general economic situation and unavailability of these resources right from the era of the oil boom up till the present day situation. Also Oyewande (2005) asserts that the excessive demand on the construction resources and projects due to massive increment in population and urban migration contributed to high construction project prices. That is generally the theory of demand and supply form economics. High demand in construction resources reflects high cost of construction prices. This kind of situation permits contractors to add higher mark-up on their rates.

According to Ayeni in ( Ene, 2009), the importation of construction materials from overseas is not solving the problems on the ground that their prices will be influenced by extraneous forces. For example, in the importation of bulk materials, the freight and trying added on rates increases the cost of project. According to Okafor (2007) Nigeria's dependence on imported materials for her construction has generated certain key problems like cost

escalation. In a similar work Nyenke (2004) stated that one of the greatest challenges during construction is the direct involvement of the clients giving instructions to contractors sometimes without recourse to the consultant or professional advisers. Such instruction sometimes amounted to variation which requires additional cost to be paid by the clients which end up in escalating the cost of projects.

Building construction estimate has always been a critical part of the design process, but in recent years it has become increasingly difficult to predict the total outcome of building projects. This is because the building construction industry has entered into a period of high market volatility and mitigating the associated risk has become a challenge for owners and consultants alike. In the past years many projects have crashed out because of construction material inflation, oil prices, developing nations increasing consumption of materials, natural disaster and material supply shortfalls have combined to create the perfect storm of market volatility in the construction industry. The cost of construction projects is a combination of individual elements of cost which makes up the total cost. According to Ayeni (1996) elements of construction prices are divided into four (4) which includes: Labour element, Material element, Plant element, Profit and overhead element.

### Causes of Cost Escalation on Building Project Delivery

They two main causes of cost escalations are the contractual causes of cost escalation and the non contractual causes of cost escalation. The contractual causes of cost escalation as identified by Gundiri (2005)

included Fluctuations, Shortage of materials/scarcity, Delay, Government policy, Architect instruction or variation, Re-measurement of provisional quantities in contract bills, Importation of building materials while the non-contractual causes of cost escalation include: Corruption, Lack of proper application of cost control technique, Foreign firms, Market volatility.

**Fluctuations:** Fluctuation is one of the pronounced causes of cost escalation on building project delivery. According to Achuen (2007) fluctuation as used in the context of building contract therefore means “change” in the price of materials and rates of labour. This change could be in the form of an “increase” called inflation or “decrease” in very rare cases called “deflation”. Clause 31 of the JCT 1963 and the Federal Ministry of Works forms of contract deals extensively with fluctuation and various ways and means by which they could be calculated. The main purpose of fluctuation clause is to allow the contractor and the client to enjoy the benefit of increase or decrease in prices arising from inflation or deflation (Stukhart 1998).

**Shortage of materials or scarcity of materials:** Shortage of materials or scarcity of materials is another cause of cost escalation on building project delivery

Boye in Okafor (2007) expressed that the excessive demand on construction resources due to general economic situation most especially during the oil boom contributed to the high cost of project. Generally, following the economic theory of demand and supply, shortage of material will definitely lead to high prices as many people will be chasing the inadequate supplies. This kind of situation permits contractors to add higher mark upon their rate.

**Delay in project delivery:** Another cause of cost escalation on building project delivery is delay in project delivery. Ajbacchi (1999) said delay could occur at various phases of project implementation but subsequently they are bound to affect the final date of completion and stipulated cost. However, some other losses cannot be avoided when there is delay because during the period of delay, cost of materials, labour, plants and equipment may be increased significantly and the changes of preliminary items in the overhead cost are extended. Aqua group (1994) stated that “delay is one of the most common causes of trouble encountered during the Administration of building contract”. This delay can be classified under the following headings: delay caused by the employer or

his consultants, delay caused by the contractor or his representative and team, delay due to factors outside the control of the parties or their representative.

**Government policies:** Policies of government at all levels causes cost escalation on building project. At this juncture, the issue of inconsistency in government policies cannot be left out in this discussion. Oyewande (2006) reported that government policies in terms of increase in changes on importation and local building materials is not considered e.g. import license, increase in tariff charges, minimum wage and lately economic reform.

**Architect instruction or variation:** Despite complete planning and documentation however it will probably be necessary from time to time for Architect to issue further drawings details and instructions which are collectively known as “Architect instruction”. Architects instruction must often lead to variation. The term “variation” as contained in the contract condition clause II (2), is the alteration or modification of the design, quality or quantity of works as shown upon the contract drawings as described by or referred to in the contract bills, and include the addition, omission or substitution of any work. This can also be in respect of standard of any materials or goods executed or brought to the site by the contractor for works other than such materials or goods which are not in accordance with the contract. Variation often leads to cost escalation in contracts. Agbo (1993) noted that variations are entirely necessary in most building contracts and this is so because the contractor is not bound without express provision to carry out work which is more than what was stated in the contract. On the contrary, the employer cannot just omit a part of the work included in the contract without any contractual provision enabling him to do so. Such a good clause in contract condition is not without its shortcomings especially in Nigeria where corruption is at its peak. Since variation has tendency of increasing the contract sums on which the architect fees are based. There are speculations that Architects deliberately issue costly variation with a view of inflating their fees.

**Re-measurement of provisional quantities in contract bills:** There are certain conditions where it becomes necessary to indulge in preplanning of work with re-measurement. In such situations variation becomes meaningless. However, it may happen that there might be variation throughout the whole work; it is far more straightforward to start measurement again. This

prompted Turner (2000) and Giwa (1998) to explain “re-measurement” as the result of a situation in which a firm bill contract is to change that the only realistic course to follow is that of measurement of the whole work afresh. Such cases of measurement often occur due to Engineer or architectural incomplete design at tender stages for instance substructures works. The difference in quantities before and after remeasurement causes net increase in contract sum.

**Importation of building materials:** Honoabi (2005) reported that import is simply the act of bringing goods and materials from another country. Hence the availability of building materials and goods depends on the availability of transportation facilities to carry large and bulk load. These include large ships, aircraft and fast trains. Achuen (2005) found out that in a developing economy like ours, a lot of the components for construction from materials to equipment are imported. The importation of building materials and construction plants depends largely on the foreign exchange mechanism, and is principally responsible for cost-push inflation. Projects with lengthy periods of execution are more likely to be affected for this factor of inflation caused by changes in exchange rates. Okafor (2007) revealed that Nigeria’s dependence on imported materials for her building construction has generated certain key problems like cost implication and maintenance. The cost components of buildings and construction materials consist of the following: Basic cost (factory price), Haulage and delivery charges, Off-loading and storage, Waste allowance, Insurance cost, Import duty tax amongst others. The cost of imported materials for construction depends on the cost of foreign exchange. When the cost or price of acquiring foreign exchange is high, the cost of imported materials will be high and vice versa.

**Corruption:** Corruption has taken its toll in the society such that money or gift presented as part of incentive in securing a project or manipulation of product are essentially recovered back from the first cost of project, thus increasing the final cost. Hoarding, causing artificial scarcity of building components have also contributed to the high cost of building component with the production of low standard products or workmanship, which will invariably lead to failure of the structure even before the completion of the project.

Gundiri (2005) stated that some government officials are very corrupt and they in collusion with some immoral and irresponsible contractors inflate contract sum. This was very common during the construction of many of the government owned projects across the country. The result of this is the abandonment of most of the buildings halfway constructed in every corner of the nation.

**Lack of proper application of cost control technique:** According Boye (1990) cost control in a plain language definition means the controlling measures that can be taken to ensure that the conduct sum of the project is not exceeded. It is observed that most clients do not allow consultant to exercise control at all the stages of construction. Effective cost control is a process that identifies all risk of all times. The ability to effectively forecast and control construction cost starts with the quality of the field budget.

**Foreign firms:** The work of Abiola (2006) stated that the domination of construction industry by foreign firms cannot be undermined when considering high cost of construction project in Nigeria. Some of the big companies executing project in Nigeria are been sponsored by much nationals, an example of this is Julius Berger handling New National Assembly Complex Project, Abuja. Most of these foreign construction companies import everything in terms of materials and plant for the construction from their countries. **Market volatility:** While direct changes in the cost of materials and labour have relatively small impact on the cost of construction, the uncertainty over prices has created significant disruption in the bidding environment. Cement market in Nigeria is a peculiar one with historical seasonal characteristics. The market is characterized by significant behavioral complexity and strategy self-positioning by major stakeholders to manipulate the market to their own advantage at the expense of the helpless consumers. The price trend of the product follows a usual historical cycle annually, which when it eventually settles, leaves consumers usually worse off as it never really reverts to the original pre-price like level.

#### **Effect of Cost Escalation on Construction Project Delivery**

There have been some notable effects of cost escalation on the construction project delivery. Below are some of the

effects of effect of cost escalation on construction project delivery:

**It could tarnish the contractor reputations:** The contractors' accomplishment of as a good and successful project may easily be forgotten but once he makes a mistake, it is remembered even if they were committed years ago, such is the sad nature of man. Clients will remember a company's errors after they have been long solved. People will refuse to award it any construction project even if it offers them the best services or the cheapest price. A single error of the contractor resulting from cost escalation can damage his reputation. The smallest of incidents or mistakes may cause the client to get angry and badmouth when client feels that he has been wronged by a contractor, he may communicate to some other client that he was wronged by this company, the latter may communicate the same thing to someone else.

**It may lead to loss of profit for non-completion:** Cost escalation may also lead to loss of profit for non completion of projects. Loss of profit is the loss accruing to the contractor on account of reduction in the profit margin caused by prolongation of the contract or on account of the profit the contractor could not earn during the extended period by being unable to deploy resources and manpower in some other project due to prolongation of the current contract or when Contractor failed to execute the work due to breach of terms and condition of the Contract by the Employer. It is not unusual for the contractors to claim loss of profit arising out of diminution in turn over on account of delay in the matter of completion of the work. What he should establish in such a situation is that had he received the amount due under the contract, he could have utilized the same for some other business in which he could have earned profit. Unless such a plea is raised and established, claim for loss of profits could not have been granted. In this case, no such material is available on record. In the absence of any evidence, the arbitrator could not have awarded the same."

### **Strategies for Reducing Cost Escalation**

Here are some of the ways of reducing cost escalation on delivery of building project:

**Purchasing of building materials on time to limit the inflation:** Contractors have options related to the

That is how the company's reputation is gradually going to be destroyed, through the spreading of words

**It may jeopardize the contractor chances of winning further jobs:** Cost escalation of construction projects may have another negative on the contractor undertaking the construction project. The contractor is a business man and the dream of every businessman is to start business and remain in business. Cost escalation of projects may have the adverse effect of jeopardizing the chances of the contractor from winning further jobs in the future. This is because of the prequalification criteria of the contractor for successful bidding and winning jobs in the construction industry includes amongst other experience and previous jobs executed in the past. And if the jobs executed in the past encountered cost escalation thereby being delayed, unfinished or abandoned, this could affect his chances of winning future job.

**It may result in loss of confidence reposed in the contractor by his clients:** Another effect of cost escalation is the loss of confidence of the contractor by his client. When some corrupt government officials collide with some immoral and irresponsible contractors to inflate contract sum. This is very common during the construction of many of the government owned projects across the country. The result of this is the abandonment of most of the buildings halfway constructed in every corner of the nation.

**It leads to less return on investment:** Cost escalation of construction projects could lead to less return on investment. Return on investment (ROI) is a performance measure used to evaluate the efficiency or profitability of an investment or compare the efficiency of a number of different investments. ROI tries to directly measure the amount of return on a particular investment, relative to the investment's cost. Return on Investment (ROI) is a popular profitability metric used to evaluate how well an investment has performed. When a building project executed as a investment encounters cost escalation, the return on that project could be reduced.

procurement of materials, and a strategic delivery/storage plan may reduce escalation risk. They may facilitate this via payment for stored materials. The related challenges must be considered: cost, contract, insurance, and a variety of logistical implications. The saying that the world is

getting smaller every day is especially true in construction. Buildings are constructed of the same materials all over the globe, and those materials are manufactured and fabricated from the same supply chains for all their many uses. These materials should be pre ordered for if imported from other countries before inflation catches up with it. Production impacts from supply chain interruptions or increased demand on the other side of the world may affect builders wherever they operate. And, as the world becomes more interconnected through technology and logistics, these rippling effects will become even more pronounced. Purchasing materials on time before inflation sets in could curb the mayhem of cost escalation

**Recognizing inflation during the design process and modifying the design appropriately, where it may be needed:** Contractors are typically aware of general inflation as an escalation risk and build it into pricing using historical data and forward-looking trends. Unfortunately, accounting for general inflation may not address the issue of cost escalation. When cost increases are due to factors like those related to the ones contained therein at the causes of cost escalation, sharp changes in the cost of a single input can have a significant impact. Currently, pain is being felt around wood materials, steel, and resins that go into a variety of construction materials, to name a few. The ability of the contractor to recognizing inflation during the design process and modifying the design appropriately, where it may be needed could go a long way to reduce cost escalation on projects.

**Use of fluctuation clauses:** The term “fluctuation provisions”, or “fluctuation clauses”, refers to compensatory clauses in construction contracts that allow the contract price to be adjusted to reflect changes in the cost of materials or labour during the contract period. You may also see them described elsewhere as “variation of price”, “variation in cost”, “rise and fall” and “cost-adjustment”. In most construction contracts where fluctuation provisions have not been used, the risk of price rises are borne primarily by the Contractor. At the time of tender, the Employer and the Contractor agree a contract for a certain price, and the Contractor is the one who suffers if the materials or labour required go up in price. With fluctuation provisions, the aim is to transfer some or all of the effect of price changes (more commonly, of

course, in an upward direction by reason of inflation) in the cost of labour or materials during the contract from Contractor to Employer by adjustment of the final contract price. However, if the price of materials inflate to a high level, the Employer risks spending increasing, and perhaps unforeseen, amounts.

**Negotiating sub – contacts along with the contractors:** Negotiating with the sub contractor alongside the main contractor is another strategy to reduce the cost escalation of projects. The subcontractor prequalification criteria are checked alongside that of the main contractor. Financial prequalification of subcontractors is critical to insulating a project from the impacts of cost escalation. If subcontractors bear this risk, financial analysis is a critical component of subcontractor prequalification, allowing assurance that subcontractors can absorb the cost of any escalation. Subcontractors' financial ratios, especially days of cash, can speak volumes about their enterprise risk and their ability to be profitable and build a strong balance sheet over the long-term validates that they manage their business well.

**Reducing the bid award period to accommodate shorter price lock:** To remove some exposure to escalation, consider identifying high-risk scopes, educating owners on the risk, collaborating to get the related design early, and expediting buying these scopes to lock in pricing as early as possible. Focused, phased bidding may eliminate the need to wait for complete documents for all scopes prior to procurement. The downside is that later scopes are more exposed to escalation if the overall procurement time frame stretches out, so approach this with the big picture in mind

**Scheduling considerations:** The construction schedules you commit to are a key to escalation risks that will be encountered. Contractors should examine their schedules for areas where cost escalation risks can be mitigated. This could entail accelerating some or all of the projects to reduce the duration and limit exposure to forces contributing to escalation. It could also entail building additional time into the schedule or increasing float to allow for a more reliable or cost-effective supply chain or subcontractor to be used. Time truly may be money in this situation.

### 3.0 RESEARCH METHODOLOGY

#### Research Design

The qualitative research technique was used for this study where the researcher conducted intensive individual interview with the correspondents to explore their

#### Area of the Study

This research was carried out in Benue state. Benue State is one of the 36 states of Nigeria and lies in the North Central of Nigeria with Makurdi as its capital and largest city. Benue State is named after the Benue River and was formed from the former Benue-Plateau State in 1976, along with Igala and some part of Kwara State. Benue State lies within the lower river Benue trough in the middle belt region of Nigeria. Its

#### Population of the Study

The population of the study consists of 84 selected professionals and parties who were involved in some ongoing projects in Makurdi town.

#### Sample and Sampling Procedures

Out of the population of 84 persons in Dantata and Sawoe construction company, 50 persons were selected

#### Instrumentation

The major instrument used for this study is the questionnaire. The questionnaire consists of well structured questions in a pre-determined manner in which all the respondents answer in the same order. They were asked question concerning the cost escalation on projects and their answers were written down for analytical procession. The questionnaire was structured in a five like scale measuring attitude of Strongly Agreed, Agreed, Undecided, Disagree and Strongly Disagreed.

#### Procedure for Data Collection

The researcher personally collected data from the respondents through the help of the human resource

### RESULTS

#### Presentation of Data and Analysis

##### Research question 1

What are the factors responsible for cost escalation? To answer this research question, analysis for factors responsible for cost escalation are shown below in table 1

perspectives on the project method. The design is considered suitable to enable the researcher collect informations directly from the various parties.

geographic coordinates are longitude 7° 47' and 10° 0' East. Latitude 6° 25' and 8° 8' North; and shares boundaries with five other states namely: Nasarawa State to the north, Taraba State to the east, Cross-River State to the south, Enugu State to the south-west and Kogi State to the west. Benue occupies a landmass of 34,059 square kilometres.

using the simple random sampling technique. The logic behind this is in conformity with the views of Okoh (2005) in his book, the principles of educational research. He opined that for any population below 100 persons or object at least more than 50% of the population is adopted as its sample to enhance effective representation so that conclusions from the study can be generalized.

manager. After distribution of the questionnaire, respondents were given three days to fill out the questionnaire. This time frame was given in order to give enough time to the respondents to reflect on the items on the questionnaire to facilitate valid responses.

#### Procedure for Data Analysis

Simple Percentile for general information and descriptive statistics will be used to answer the research questions. The cut-off point of 50% and above was considered accepted while 49% and below will be considered not accepted for the answers to the items on the instrument.

All data are presented in tabular form to show the response obtained from the respondents.

**Table 1. Causes of Cost Escalation.**

ITEM NO	ITEM DESCRIPTION	1	2	3	4	5	MEAN (X)	STD	Rank	DECISION
1	Variation	36	3	0	0	0	4.92	0.07	1	Accepted
2	Fluctuation	35	4	0	0	0	4.90	0.09	2	Accepted
3	Delay	32	5	2	0	0	4.77	0.28	3	Accepted
4	Re-measurement of provisional quantities	29	8	2	0	0	4.69	0.32	4	Accepted
5	Corruption	27	9	3	0	0	4.62	0.39	5	Accepted
6	Government policy	26	9	4	0	0	4.56	0.45	6	Accepted
7	Domination of foreign firms	32	7	0	0	0	4.82	0.15	7	Accepted
8	Market volatility	20	16	3	0	0	4.44	0.40	8	Accepted
<b>Cluster Mean</b>							<b>4.71</b>	<b>0.27</b>		

Table 1 shows the factors responsible for cost escalation. As shown in these tables, respondents ranked variation and fluctuation as the two most factors responsible for cost escalation. The cluster mean and standard deviation are 4.71 and 0.27 respectively; since the cluster mean is above 2.5, hence it is accepted.

**Research question 2**

What are the effects of cost escalation on delivery of construction project?  
 To answer this research question, analysis of effect of cost escalation is shown below in table 2

**Table 2. Effect of Cost Escalation on Delivery of Construction Project.**

ITEM NO	ITEM DESCRIPTION	1	2	3	4	5	MEAN (X)	STD	Rank	DECISION
1	It could tarnish the contractor reputations	32	5	2	0	0	4.77	0.28	1	Accepted
2	It may jeopardize the contractor chances of winning further jobs	30	8	1	0	0	4.74	0.24	2	Accepted
3	It may lead to loss of profit for non-completion	29	6	2	2	0	4.59	0.65	3	Accepted
4	It may result in loss of confidence reposed in the contractor by his clients	24	14	1	0	0	4.59	0.29	4	Accepted
5	It leads to less returns on investment	20	9	7	0	3	4.10	1.37	5	Accepted
<b>Cluster Mean</b>							<b>4.56</b>	<b>0.57</b>		

Table 2 shows the effect of cost escalation on delivery of construction project. As shown in these tables,

respondents ranked it could tarnish the contractor reputations and it may jeopardize the contractor chances

of winning contract as the two most effect of cost escalation on delivery of construction project. The cluster mean and standard deviation are 4.56 and 0.57 respectively; since the cluster mean is above 2.5, hence it is accepted.

**Research question 3**

What are the ways of reducing cost escalation on delivery of construction project?

To answer this research question, analysis of ways of reducing cost escalation on delivery of construction project is shown below in table 3

**Table 3. Ways of Reducing Cost Escalation on Delivery of Construction Project.**

ITEM NO	ITEM DESCRIPTION	1	2	3	4	5	MEAN (X)	STD	Rank	DECISION
1	Pre – purchase materials to limit the inflation.	37	2	0	0	0	4.95	0.05	1	Accepted
2	Recognizing inflation during the design process and modifying the design appropriately, where it may be needed.	36	3	0	0	0	4.92	0.07	2	Accepted
3	Use of fluctuation clauses..	35	4	0	0	0	4.90	0.09	3	Accepted
4	Negotiating sub – contacts along with the contractors.	32	5	0	2	0	4.72	0.51	4	Accepted
5	Reducing the bid award period to accommodate shorter price lock	29	8	0	0	0	4.78	0.17	5	Accepted
<b>Cluster Mean</b>							<b>4.85</b>	<b>0.18</b>		

Table 3 shows the ways of reducing cost escalation on delivery of construction project. As shown in this table, respondents ranked pre - purchase of materials to limit the inflation and recognizing inflation during the design process and modifying the design appropriately, where it may be needed. as the two most ways of reducing cost escalation on delivery of construction project. The cluster mean and standard deviation are 4.85 and 0.18 respectively; since the cluster mean is above 2.5, hence it is accepted.

**4.0 DISCUSSION OF FINDINGS**

The first findings revealed that variation and fluctuation are the most factors responsible for cost escalation. This finding is in agreement with that of Morris and Wilson (2006) who is of this opinion.

The second finding of this study revealed that effect of cost escalation on delivery of construction project includes tarnish the contractor reputations and it may jeopardize the contractor chances of winning contract as the effect of cost escalation on delivery of construction project. This finding agrees with that of Nwuba (2007) who attested to this fact.

The third finding of this study revealed that pre - purchase of materials to limit the inflation and recognizing inflation during the design process and modifying the design appropriately, where it may be needed as the ways of reducing cost escalation on delivery of construction project. This finding agrees with that of Kelly and Brown (2014) who attested to these facts.

**5.0 SUMMARY, CONCLUSION AND RECOMMENDATION**

**Summary of findings**

The following are the findings from the analysis carried out

1. Variation and fluctuation are the most factors responsible for cost escalation

2. Effect of cost escalation on delivery of construction project includes tarnishing the contractor reputations and it may jeopardize the contractor chances of winning contract.

### Conclusion

Based on the findings, the following conclusions were drawn; Variation and fluctuation are the most factors responsible for cost escalation; tarnishing the contractor reputations and jeopardizing the contractor chances of winning contracts are the effects of cost escalation; pre -

### Recommendation

The following recommendations are made from the findings of the study

1. Government should implement price control system in the market
2. A clear and thorough client brief should be taken to the inception of the projects so as to avoid or minimize excess variation order.

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3. Ways of reducing cost escalation on delivery of construction project includes pre - purchase of materials to limit the inflation and recognizing inflation during the design process and modifying the design appropriately, where it may be needed.

purchase of materials to limit the inflation and recognizing inflation during the design process and modifying the design appropriately, where it may be needed are the ways of reducing cost escalation on the delivery of construction project in Nigeria.

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# THE INTERVENTION OF THE NIGERIAN ARMY IN CONFLICT REDUCTION IN AWKA, ETITI IDEMILI LOCAL GOVERNMENT AREA OF ANAMBRA STATE

AKINBILE, I. O.

School of General Studies, Department of Humanities Nigerian Army College of Environmental Science and Technology, Makurdi, Benue State. Nigeria

## Abstract

*The study examined the intervention of the Nigerian Army in conflict incidence in Awka Etiti Local Government Area of Anambra State. The method of random sampling technique was used to select 5 villages from the 7 villages in the area and a purposive sampling was used to select 160 representative residents in the sampled area which were administered questionnaires. Data were collected and analyzed descriptively using tables, charts and Chi-square test. It was revealed that there is a significant difference in conflict incidence at Awka Etiti before and after NA intervention. Result indicated a level of decrease in conflict activities, which was a result of the number of hours agitators spent at homes as a result of the Nigerian Army intervention. It was concluded by highlighting the urgency of the need for the various stakeholders to act in resolving conflict if the goals of protecting lives and properties were to be achieved. Recommendations were made on the responsibility of government at the federal, state and local levels as well as private and traditional institutions to establish all-inclusive processes of dialogue with warring parties.*

**Keywords:** Intervention, reduction, conflict

## 1. INTRODUCTION

The misery of conflict has in recent years become a formidable problem of global significance and implications, Aytac and Ozden (2017) citing (Ladan, 2001). Every country across the globe has its peculiar problems and challenges. Nigeria is not an exception. As a developing country, she faces her own share of social, political, economic and cultural conflict which has in no small measure affected the well-being of the populace. Such conflict, if not manage could threaten the country existence and unity therefore

impede on its national development. Conflict can be defined as “the process where a party purposefully makes an effort to block the efforts of another person and thereby frustrates the latter in his attempt to attain his goals or further his interest” (Robbins, 2004) cited in Shila (n.d.). In a more radical approach, conflict can be defined as an antagonistic process or interaction in which one party attempts to hinder the intentions and efforts of the other party Daft and Marcic (2007) cited in Igbokwe (2014).

The causal factors of conflict in Nigeria have been linked to many unfortunate developments such as scare resource. Momodu (2013) stated that conflict is basically about struggle or competition for scarce resources in which each of the party perceives its goal or interest is been contested for by the opposing party. Momodu and Gambo (2013) further stated that conflict occurs when individuals or group are entangled in the

pursuit of incompatible goals. However, conflict has the potential to assume functional or dysfunctional outcomes, depending on how the party in a conflict perceive the conflict and respond to it. While conflict ranges among party, Wohlforht (2011) advocated mediation or pre-emptive diplomatic engagement to promote alternative to violence. In recent times, Awka-Etiti LGA has been plunged into series of clashes, armed

attacks and silent killings at different locations within the area. Suffice not to say the LGA is largely an urban settlement, whose occupation is mainly commercial, trade and investment, where houses exist not in isolation yet provides a fertile ground for these systematic attacks

### **Purpose of the Study**

The purpose of the study is to examine the intervention of the Nigerian Army in reduction of

### **Hypothesis One**

Ho: There is no significant difference in conflict incidence before and after intervention.

H<sub>1</sub>: There is a significant difference in conflict incidence before and after intervention.

## **2. The Study Area/Method of Study**

### **2.1 The study area**

Awka Etiti is in Idemili South Etiti Local Government Area of Anambra State. It is situated 24km from River Niger, North-East of Onitsha 16 km from Nri and 2km from Igbo-Ukwu. Akajiobi(2012) citing (Dallah, & Nzewi, 1996). The study area was established in the early nineteen and gained prominence in 1944 when Awka Etiti Improvement Union was formed which subsequently change the name to Awka Etiti in 1945. It has 7 villages for administrative convenience and a geographical coordinates: 06°02'0"N, 6°58'0"E. Awka Etiti has a population of 35,000 (NPC 2005).

### **2.2 Method of study Idemili South**

The study area has 7 villages namely; Nkolofia, Umunocha, Ejighinandu, Iruowelle, Umudunu, Nnaba and Oguezele All of which were visited several times during the time of reconnaissance survey in order to; familiarize with the terrain of the area, identify villages with conflict, identify NA base, ascertain the distances of such base from conflict area, establish lives and properties lost, identify the magnitude and type of conflict and assess the cause of conflict and its rationale. Focus Group Discussion was necessary to ascertain extents of conflict, normalcy areas and

to thrive. The present study is to examine the intervention of the Nigerian Army and conflict management in Awka Etiti Local Government Area of Anambra State. The following hypotheses will be tested:

conflict incidence at Akwa Etiti Council Area of Idemili Local Government Area of Anambra State.

Awka-Etiti is a miniature town with people from various parts of the country. This is because Awka Etiti is one of the driving forces behind the development of industrialisation in Igbo land. Tom (1995). Notably among renowned manufacturing industries are the G.M.O Group of Companies, the Roadmaster Industries Ltd, the IKB Cosmetics Product Line and the Interbau Construction Company Ltd ([www.https://interbau.com.ng](http://www.https://interbau.com.ng)) retrieved 21 October 2021. The Awka-Etiti Vigilante Service oversees security with support from the Nigerian Police

predominant lost. Direct field observation was carried out to confirm some responses given by respondents on the questionnaire that was administered. Thus, discussion also took place between the respondents and the researcher to create conducive atmosphere for correct responses. The major instrument of data collection for this research is the questionnaire. Method of data analysis used was frequency, percentages and paired sample t-test. The paired sample t-test technique is used because of the nature of data.

**Administration of Questionnaires across Villages**

	Frequency	Percent
<b>Nkolofia</b>	36	24.0
<b>Umunocha</b>	33	21.9
<b>Ejighinandu</b>	27	17.9
<b>Iruowelle</b>	25	16.6
<b>Umudunu</b>	30	19.9
<b>Total</b>	151	100.0

Source: Fieldwork 2022

Table 1 shows the distribution of questionnaires across the 5 sampled villages in the LGA. Nkolofia has the highest number of respondents 24.0%, closely followed by

Umunocha with 21.9% then, Ejighinandu and Umudunu have 17.9% and 19.9% respectively, the least among them is Iruowelle which has 16.6%.

**3. Result and Discussion****Table 2. Cause of conflict**

Percent	Frequency	Valid Percent	Cumulative
<b>Natural disaster</b>	0	0	0
<b>Resources control</b>	3	2.0	2.0
<b>Boundary dispute</b>	136	90.1	92.1
<b>Chieftaincy tussle</b>	12	8.0	100.0
<b>Information deficiency</b>	0	0	
<b>Total</b>	151	100.0	

Source: Fieldwork 2022.

The data obtained in table 2 shows that 136 respondents confirmed that boundary dispute is the reason for attacks by gunmen in the study area. Killing any one not in support of their interest, only 3 respondents say conflict is consequent on resource control, every communities intend to control their resources while 12

respondents say chieftaincy tussle is the cause of conflict in the study area. No respondent believed natural disaster or information deficiency was responsible for conflict in the study area. In most cases, perpetrators of conflict attack used looting and destruction of properties as a tool to enrich themselves.

**Table 3. Number of Conflict Occurrence before Nigerian Army Intervention**

	Frequency	Valid Percent	Cumulative Percent
<b>Less than 10 occurrences</b>	25	16.6	16.6
<b>15-20 occurrences</b>	14	9.3	25.9
<b>20-25 occurrences</b>	11	7.3	33.2
<b>25 and above occurrences</b>	101	66.9	100.0
<b>Total</b>	151	100.0	

Source: Fieldwork 2022

The data captured in table 3 show the conflict experienced in the community before the Nigerian Army intervention. It shows that; 25 respondents experienced less than 10 conflict occurrences, 101 respondents experienced 25 and above occurrences, 11 respondents experienced 20-25 occurrences

and 14 respondents' experienced 15-20 occurrences. It shows that 66.9% of the residents in the area of study experienced 25 and above conflict occurrences while the least category is those that experienced 20-25 conflict occurrences that make up 7.3% of the sample size.

**Table 4.**  
**Number of Conflict Occurrence Conflict after Nigerian Army Intervention**

	Valid Frequency	Percent	Cumulative Percent
<b>Less than 10 occurrences</b>	40	27.0	27.0
<b>15-20 occurrences</b>	48	32.4	59.4
<b>20-25 occurrences</b>	56	38.0	97.4
<b>25 and above occurrences</b>	4	2.7	100.0
<b>Total</b>	148	100.0	
<b>No response</b>	3		
<b>Total</b>	151		

Source: Fieldwork 2022

The data captured in table 4 show the conflict experienced in the community after the Nigerian Army intervention. It shows that; 40 respondents experienced less than 10 conflict occurrences, 4 respondents experienced 25 and above occurrences, 56 respondents experienced 20-25 occurrences and

48 respondents' experienced 15-20 occurrences. It shows that 38.0% of the residents in the area of study experienced 20-25 occurrences while the least category is those that experienced 25 and above conflict occurrences that make up 2.7% of the sample size.

**Table 5.**  
**Difference in Conflict Incidence Before and After Nigerian Army Intervention**

Occurrence	%	%	%	Remark
	Before	After	Diff	
<b>10 occurrences &amp; less</b>	16.6	27.1	10.5	Increase
<b>15-20 occurrences</b>	9.3	32.4	23.1	Increase
<b>20-25 occurrences</b>	7.3	38.0	30.7	Increase
<b>25 and above occurrences</b>	66.9	2.7	64.2	Decrease

Source: Fieldwork 2022

Source: Author's Table 5, 2022

**Fig 2: Difference in Conflict Incidence.**

Table 5 shows the number of residents that agrees that there is a change in what they observed before and after the intervention. 15 respondents say there is an increase in conflict after the intervention, 97 indicated a decrease in their observed conflict, 36 respondents say there’s no difference want so ever in their observation after intervention while 3 respondents declined the question. The finding has

revealed that there is a change in conflict observed, as number of resident that observed less than 10 occurrences hitherto was 16.6% but has slightly raised to 27.0%. On the other hand, the 66.9% of residents that observe more than 25 occurrences before intervention has dropped to overwhelming 2.7%. Suggesting that majority of residents in the area no longer observe what they normally experience before the intervention.

**Reason for the difference**

	<b>Frequency</b>	<b>Valid Percent</b>	<b>Cumulative Percent</b>
<b>Civil-Military Relations</b>	28	19.0	19.0
<b>Medical Outreach</b>	14	9.5	28.5
<b>Conduct of IS Operations</b>	43	29.1	57.6
<b>Mediation</b>	32	22.0	79.6
<b>Suppressing Provoking Behaviour</b>	20	14.0	93.6
<b>Others</b>	11	7.4	100.0
<b>Total</b>	148	100.0	
<b>No Response</b>	3		
<b>Total</b>	151		

Source: Fieldwork 2022

Table 6 shows the causes of the difference in conflict in the study area; 28 respondents said Civil-Military Relations by the Nigerian Army is responsible for the reduced conflict, 32 respondents said it is frequent mediation by the Nigerian Army that caused the declined in conflict occurrence, 14 respondents said medical outreach by the Nigerian Army caused the dropped in conflict occurrences, 43 respondents believed the change was relative to the conduct of IS Operation,

20 said, the suppressing of conflict provoking behaviour was responsible for the decline occurrences, 11 persons opined other factor beside the one’s mention was responsible, 3 respondents declined to answer the question. The table therefore suggests that an overwhelming 29.1% agreed that declined conflict occurrences in the area was caused by the conduct of Nigerian Army IS Operation and that other factors was the least caused of drop in occurrence in the study area.

**Hypothesis One**

Ho: There is no significant difference in conflict occurrences before and after Nigerian Army intervention.

H<sub>1</sub>: There is a significant difference in conflict occurrences before and after Nigerian Army intervention.

**Table 7:**

**Chi-Square Tests Difference in Conflict Incidence Before and After Intervention.**

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	141.924 <sup>a</sup>	3	.000
N of Valid Cases	299		

The result of the Chi-Square test in table 7 indicated that there is significant association between Nigerian Army intervention and conflict incidence. The reduction/number of conflict occurrence is dependent on the result of the intervention of the

Nigerian Army (P-value < 0.05). This implies that the intervention of the Nigerian Army played a significant role in reduction of conflict incidence in the study area.

**Table 7.1**

Group \* Occurrence Cross tabulation

	Occurrence				Total
	Less than 10	15 - 20	20 - 25	25+	
Group Before Intervention	25 <sub>a</sub>	14 <sub>a, b</sub>	11 <sub>b</sub>	101 <sub>c</sub>	151
Expected Count	32.8	31.3	33.8	53.0	151.0
% within Occurrence	38.5%	22.6%	16.4%	96.2%	50.5%
After Intervention	40 <sub>a</sub>	48 <sub>a, b</sub>	56 <sub>b</sub>	4 <sub>c</sub>	148
Expected Count	32.2	30.7	33.2	52.0	148.0
% within Occurrence	61.5%	77.4%	83.6%	3.8%	49.5%

Each subscript letter denotes a subset of occurrence categories whose column proportions do not differ significantly from each other at the .05 level.

**Table 7.1** showed the distribution in occurrence of conflict before and after the intervention of the Nigerian Army in the study area. The result indicated that there is a significant difference in occurrence of conflict from 25 and above. The number of conflict

occurrence before after the intervention of the Nigerian Army was 101<sub>c</sub>, while the number of occurrence reduced to 4<sub>c</sub> after the intervention. Though, the number of conflict did not reduce for conflict occurrence less than 25.

#### 4. Conclusion.

The study has shown that the causes of conflict in the study area are land dispute, chieftaincy tussle and political inequality by groups who struggle or compete for scarce resources in which contending party perceives its goal or interest has been contested for by the opposing party. This unfortunate incidence has affected the socio-economy and infrastructural development of the Awka Etiti Town. The intervention of the Nigerian Army personnel deployed to reduce conflicts has

#### 5. Recommendations

Based on the findings of the study, the following were recommended:

1. A multi-stage conflict management framework is required to curb the danger posed by groups' conflict. The proposed framework should have committees at community, local, state, and federal government levels. It should also include the relevant stakeholder as members.

2. Traditional and local leaders should be well involved in finding solutions to conflict. The committees proposed above must have representatives of the local leadership.

resulted in decreased conflict situation for enhanced infrastructural development in Awka Etiti Town and beyond. Therefore providing peace is imperative for social change and development in a LGA that seeks to grow her economy. The sustenance of peace in Awka Etiti with high rate of youth unemployment is also paramount. For this reason, the prospects of providing an enabling ground for sustainable peace require continuous attention

3. Education among the parties to conflict should be realistically encouraged. This would not only lead to better perception but also create better opportunity for awareness of realistic coping strategies.

4. The processes of reconciliation should be consolidated by ensuring that perpetrators of the violence are identified and brought to justice.

5. The government should seek technical support and training for improved emergency preparedness and response to conflict- induced displacement at both federal, state and local level.

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## AN ASSESSMENT OF EARLY WARNING SIGNALS AS A PANACEA TO COMBAT TERRORIST ACTIVITIES IN KADUNA STATE NORTH WESTERN NIGERIA

**JA'AFARU, UMAR IDRIS**

Department of languages  
Nigerian Army College of Environmental Science And Technology Makurdi  
Phone: 080838259421  
email: jaafaruumaridris@gmail.com

and

**DR. JACOB OLUMAYOWA AYORINDE**

Department of Social Sciences Education  
University of Ilorin  
Phone: 07030576516  
email: jacobolumayowaayorinde@gmail.com

### Abstract

*Nigeria society is enveloped by dreadful acts of terrorism. The government efforts are not really felt because the terrorist is fully manifested before government interventions, making good result difficult. Early warning therefore became a gap that this study seeks to fill through the assessment of early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria. The objectives of the study were to investigate: (i) early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria; (ii) causes of terrorism in Kaduna State, Nigeria; (iii) identify the motivating factors for recruiting terrorists; (iv) recommend workable early warning signals to combat terrorism in Kaduna State, Nigeria; and (v) differences in demographic perception of people in early warning signals to curtail terrorist activities. In this study a descriptive survey design was adopted. Purposive sampling technique was used to select three LGA. The population of the study consisted of all residents in Chukun, Igabi and Birnin Gwari LGA. The instrument for data collection was a questionnaire titled "Early Warning Signals as a Panacea to Combat Terrorist Activities Questionnaire (EWSPCTAQ)". The percentage was used to describe the demographic characteristics of the respondents, while mean was used to answer the research questions. The independent t-test was used to test the formulated hypotheses at 0.05 level of significant, using SPSS 25 version.*

**Keywords:** Early Warning Signal, Terrorist, Panacea, Combat

### INTRODUCTION

Since its independence, Nigeria has struggled with a number of internal security challenges. These include political instability, social inequality, poor governance, ethnic and religious conflicts, economic hardship, and citizenship issues. These detrimental events have been on an upward trajectory and are becoming worse day by day. Issues of militancy, Boko Haram, banditry, cattle rustling, oil theft, rape, armed robbery, proliferation of small and light weapons, farmers and herders' clashes and kidnapping are some of the effects of the challenge and that by extension informed the nexus of the terrorist activities perpetrated in the North Western Nigeria. A critical assessment of terrorist activities revealed to that of many years of bad governance in Nigeria, the hopes and aspiration of the citizenry could not be met. The inability of our leadership to provide good democratic governance was among factors responsible for the insecurity in the country and this in effect gave rise to armed-robberies, kidnappings, bunkering of oil

pipelines as well as the emergence of militancy across the country.

Because of this, the security situation has gotten worse since 2012, despite the Nigerian government's admission that before June 2012, its security forces had intercepted over 200 rocket launchers and rocket-propelled grenades from terrorist gangs at the country's borders with Chad and the Niger Republic. The improvised explosive devices that the Islamic Boko Haram insurgents in Nigeria currently have been expected to be replaced by the new explosive projectile weapons, which are used to attack targets from a distance. According to Nigeria's security agencies, the weapons were supplied to the terrorists in Nigeria by Al-Qaeda in the Islamic Maghreb with the help of terrorists in Iran, Yemen, and Syria (Ogunseye, 2012). However, the terrorist activities in Nigeria in this study is streamline to the Northwestern part of Nigeria.

As a result, Northwestern Nigeria, which consists of seven states out of the 36 in the nation, is one of the country's six

geopolitical zones, which comprises, states such as, Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, and Zamfara. It occupies 216,065 sq km, or 25.75 percent of the nation's total land area. Its two largest ethnic groups are Hausa and Fulani, who are highly intermarried and have close cultural ties to other, smaller communities, particularly in Kaduna state. The 33 million-strong region has a predominance of Muslims, according to the controversial 2006 census (Sunni). About 80% of the population works as a farmer, rancher, agropastoralist, or small business owner. There are significant solid mineral reserves in the area, including gold mined by artisanal miners in open pits (NNPC, 2006).

The North Western states in Nigeria, have the highest rates of poverty. All the seven states in the region experienced higher poverty rates in 2019 the national average of 40.1%, with Sokoto (87.7%), Jigawa (87%), and Zamfara (74%) leading the way (United Nation International Children Fund, 2019). Numerous people lack access to clean water and basic healthcare, and vaccination rates fall far short of set national goals. Despite a long and rich history of Islamic and Arabic knowledge in the region, apathy toward formal education and inadequate funding have resulted in a literacy rate of 29.7% over the years (Hanna, 2018). Currently, the region in Nigeria has the most children that are not attending school (Hanna, 2018). In addition to the millions of children who do not attend school at all, the Almajiranci, or Quranic school system, has weak resources and oversight and produces cohorts of young people who lack education (Alkali, 2015). Therefore, marginalization is a common theme among the root causes of instability in Nigeria's Northwestern area.

The states of Zamfara, Katsina, Kaduna, Niger, and Sokoto in particular have experienced severe attacks from armed bandits during the past four years. Many interrelated issues, such as cattle rustling, the spread of small arms and light weapons, illegal artisanal mining, youth unemployment, poverty, and social injustice, motivated these terrorist assaults. This is made worse by the overworked and disillusioned security forces, which are present in 35 of Nigeria's 36 states and will shortly begin the second decade of their conflict with Boko Haram, one of the continent's "deadliest terror groups" (Alao, 2013). According to estimates, many of the armed bandits, like many of the victims, are Fulani in origin. Nigeria, Niger, Chad, Cameroon, Senegal, and Mali all have a history of banditry, which includes murder, rape, and armed robbery (National Bureau of Statistics, 2019).

In order to address these issues, the Nigerian security forces increased the military and police presence in the crisis area. Operation Puff Adder, Diran Mikiya, Sharan Daji, Hadarin Daji, Thunder Strike, and Exercise Harbin Kunama 111 were just a few of the code names used for these deployments.

However, the operations have had a range of outcomes. Terrorist attacks have persisted despite security personnel's efforts to stop bandit attacks, destroy multiple hideouts, kill bandits, and apprehend hundreds of them (Momale, Nawaj & Duperas, 2019). More specifically, the state's ability to create synergies to resolve competing challenges has been missing. Where they were deployed, it had arrived too late or at the wrong time, possibly causing the destruction of lives and property as well as wounds that had not yet healed. Conflicts between communities and ethnic, religious, and political groups are common in Nigeria. It is tragic to learn that the majority of the instances in the appendix could have been prevented if the government had responded quickly to early warning. For instance, it has been claimed that the government and security services were informed about the 2010 Christmas Eve bombing in Jos, Plateau State, but did nothing to prevent the attack, which resulted in multiple fatalities and significant property loss. Peacemaking only becomes an option after law and order have been shattered and lives have been lost (Chinwokwu, 2015).

It is crucial to emphasize that whatever early warning systems the government works to establish in order to firmly plant a democracy in Nigeria should be based on the prevention of violent conflicts. It is important to remember that the goal of early warning is to inform peacemakers and experts in conflict resolution that a catastrophic situation (problem) is brewing, gathering steam, or expected so that they can take preventative measures to nip it in the bud before it develops into uncontrollable events. In other words, early warning may also guide steps toward averting a disaster, but the ability of the relevant authorities to tackle the impending issue raises serious doubts. Nnoli (2016) noted this when he claimed that the goal of early warning was not only to alert peace practitioners to the onset of a crisis, but also to create a political will and drive to take action to preserve the position that was eroding.

### **Statement to the Problem**

The collection of literature on early warning systems as a panacea for thwarting terrorist activities is tiny, and there are just a few in-depth evaluations despite some notable outliers. To put it another way, there isn't a lot of theoretical or empirical groundwork to build on. The research on potential indicators of terrorism and radicalization is therefore mostly exploratory in nature. This study, however, makes no assertions on the existence of a causal relationship between certain behaviors or expressions and the desire of individuals or groups to engage in terrorist activity. Instead, they highlight behaviors and viewpoints that, when taken as a whole and in the context of an ongoing investigation into an organization or

individual of interest, can provide important direction for creating a terrorist threat assessment.

Terrorism blatantly violates human rights in very concrete and direct ways, with terrible repercussions for victims' enjoyment of their right to life, liberty, and bodily integrity. In addition to these personal costs, terrorism can weaken civil society, damage peace and security, and hinder social and economic progress. It can even destabilize governments. The enjoyment of human rights is also significantly impacted by all of these. However, in recent years, the measures taken by states to combat terrorism have frequently presented major threats to human rights and the rule of law themselves. While there are legal and practical measures to avoid torture, such as routine and independent monitoring of detention facilities, many States have engaged in torture and other forms of ill-treatment to combat terrorism.

The proliferation of small arms and light weapons used in warfare, particularly in the African Sahel region, makes the problem of armed banditry in the North West worse. This is because disarmament efforts have not been successfully implemented. Targeted groups typically don't do anything more than cross porous borders and assume new identities. Lack of social amenities like good roads, appropriate power supplies, and health facilities, together with inadequate communication, exacerbate the issue, making it the perfect place for rustling, smuggling, and the trade in small guns. Additionally, these circumstances offer prospective pathways for terrorist actions. The failure of democratic government to

provide development and livelihood security for either individuals or groups of people in the research region exacerbates these fundamental problems with human security. Possible symptoms of the deteriorating human security situation and the breakdown of democratic administration in North West Nigeria include severe violent crises. Additionally, it has sparked discussions that frame disputes between other occupational groups, such as crop farmers and grazers (Chuma-Okoro, 2013, Egwu, 2014; Augustine, 2015, Shinkafi, 2020).

As an Islamic anarchist group, terrorists such as banditry and Boko Haram is fighting for democracy in Nigeria and has decided that the country is a good place for their violent operations. This is a result of factors related to politics and religion (Yari, 2019). Al Qaeda is committed to using Nigeria as a base to organize terror strikes against a variety of targets (Shinkafi, 2020). Government attention should be given as soon as possible to the rising prevalence of property and life insecurity brought on by terrorism. Unfortunately, government efforts to stop terrorist activities appear to be having little effect, as some northern politicians who are involved in these murderous acts are obstructing government action (Okoli & Ioroye, 2014). The government efforts are not really felt because the terrorist is fully manifested before government interventions, making good result difficult. Early warning therefore became a gap that this study seeks to fill through the assessment of early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria.

**Objectives of the Study**

The objectives of this study was to assess early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria. Specifically, the objectives of the study were to:

1. Know the contributory role of early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria

2. Causes of terrorism in Kaduna State, Nigeria,
3. Identify the motivating factors for recruiting terrorists,
4. Recommend workable early warning signals to combat terrorism in Kaduna State, Nigeria.
5. Differences in demographic perception of people in early warning signals to curtail terrorist activities,

**Research Questions**

In order to give focus to this study, the following research questions were raised and answered in course of this study.

1. What are the contributory role of early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria?
2. What are the causes of terrorism in Kaduna State, Nigeria?

3. What are the motivating factors for recruiting terrorists?
4. What are the recommended workable early warning signals to combat terrorism in Kaduna State, Nigeria?
5. What are differences in demographic perception of people in early warning signals to curtail terrorist activities?

**Research Hypotheses**

The null hypothesis was tested in the course of the study:

**Ho<sub>1</sub>:** There is no significant difference in the male and female assessment of early warning signals as panacea to combat terrorist activities in Kaduna State, Nigeria.

**H<sub>02</sub>:** There is no significant difference in the civilians and security agencies assess early warning signals as a panacea to

**Scope of the Study**

This study examined the early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria. This study used a descriptive research design, which allowed the researcher to report the findings without having to manipulate them. The population of the study consisted of all residents in Kaduna State. The instrument for data collection was a questionnaire titled “Early Warning Signals as a Panacea to Combat Terrorist Activities Questionnaire (EWSPCTAQ)”. The instrument consisted of two sections; A and B. Section A

**Operational Definition of Terms**

The following terms were defined as operationally used in this study:

**Early Warning Signals:** metric-based statistic able to warn that the terrorist is approaching a sudden attack.

**Terrorist:** a person who uses unlawful violence and intimidation, especially against civilians, in the pursuit of political aims.

**Panacea:** a remedy for all terrorist activities.

**Combat:** take action to reduce or prevent terrorist activities.

**Significance of the Study**

This study apart from serving as information bank for future researchers might be of significance to government, the whole community, security agencies and traditional rulers. Beyond adding to the body of knowledge currently available, it will be useful for people working in criminal investigation, counter-terrorism, or counter-insurgency agencies. As a result, it is hoped that this research will be helpful to both the general public and scholars and students who are interested in education, intelligence, and security studies. This study adds to understanding of terrorism and guerilla tactics used by Boko Haram, as opposed to those of other insurgent groups.

This study will be useful for defense and strategic studies in universities and training facilities. Researchers studying counter-insurgency could learn from Boko Haram's experience

**A Bridge Review of Related Literature**

Related literatures were reviewed and presented under the following sub-headings:

- a. The Concept of Terrorism,
- b. Early Warning and Early Response System to
- f. The Effects of Banditry on Nigeria’s Northwest Security

combat terrorist activities in Kaduna State, Nigeria.

elicited demographic characteristics of the respondents, while section B, was used to elicit information on early warning signals as panacea to combat terrorist activities. A total of 400 copies of questionnaires were administered to the respondents. The percentage was used to describe the demographic characteristics of the respondents, while mean was used to answer the research questions. The independent t-test was used to test the formulated hypotheses at 0.05 level of significant, using SPSS 25 version.

**Boko Haram:** A phrase in Hausa that signifies Western education is not permitted. In Northern Nigeria and the Republic of Niger, the Hausa are a significant tribe. The official name of the organization formerly known as Boko Haram is "Jama' atu Ahlissuna Lidda' Awatiwal-Jihad," which translates to "those committed to the dissemination of the prophet's teaching and Jihad" in Arabic.

**Combat Terrorist Activities:** taking action to stop terrorist threat to peace, security and stability.

as they create counter-insurgency tactics to advance their research. The outcome of this research might be published in a reputable journal for easy access and also serve as a reference point to teachers/academics. This is because it will provide useful information upon which future research studies in related area might be based. Findings in this study might provide educational researchers with useful empirical evidence in their quest to further research work.

The study might also be of significance to curriculum planners and Nigerian Educational Research and Development Council (NERDC) on how to develop a curriculum that might incorporate value education as a core course in all schools. It might be of benefit to religious bodies by engaging their follower with the right values and to shun any form of social vices that can disrupt the peace and progress of the town.

- Prevent Violent Extremism,
- c. Terrorism in Nigeria: Trends and Patterns,
- d. Concept of Banditry
- e. Dimensions and Recent Incidences of Banditry in Nigeria’s Northwest Region

### **The Concept of Terrorism**

The word terrorism derives from the Latin and French words "terrere" and "terrorisme", which mean, respectively, "to scare" and "state rule by terror." There is no widely acknowledged definition of terrorism among professionals, and there is no widely agreed *modus operandi* of terrorists. The definition of "terrorism" in English was first seen in dictionaries in 1798 and stated that it meant "systematic employment of terror as a policy." Terrorism is still defined as "Government by intimidation carried out by the party in power in France between 1789 and 1794" in the Oxford English Dictionary. The contentious problem is that, thanks to media and politicians, the lexicon of terrorism has replaced that of anarchy and communism as the catch-all epithet of contempt. The challenge in developing a definition that eliminates any justification for terrorism is that history offers too many examples of groups and their leaders who were initially labeled as terrorist but afterwards became respected authorities.

Also noteworthy is the adage that "a terrorist to one state is a freedom warrior to another state." This catchphrase has, in fact, been the source of a persistent issue that has prevented the

### **Early Warning and Early Response System to Prevent Violent Extremism**

Early warning and early response systems (EWERS) have been established by nations and international organizations to stop deadly conflicts. Since the 1970s, at least, more academics and policymakers have begun to pay attention to EWERS. However, the inability of the international community to stop the genocide tragedy in Rwanda in 1994 was what spurred the development of a stronger conflict early warning and early response system (Nyheim, 2018). Early warning is defined differently by academics and professionals, as is its use. An early warning system (EWS) is described as "any initiative that focuses on systematic data collection, analysis, and/or formulation of recommendations, including risk assessment and information sharing, regardless of topic,

### **Terrorism in Nigeria: Trends and Patterns**

Growing worry has been expressed recently regarding the rise in violent crimes and terrorist attacks, particularly the usage of improvised explosive devices by criminal elements (Attoh, 2012). For astute observers and perceptive minds, terrorism is pervasive in Nigeria and is not a recent trend. It is carried out by those who hold power, whether legitimately or illegitimately, at various times and in various locations. Government agents and private citizens both commit terrorism-related crimes in homes, public and private offices, and on the highways. Many terrorist attacks go unreported, and

adoption of a generally recognized definition of terrorism. In addition, it is blatantly deceptive. When terrorism commits an act, it evaluates the viability of the cause. Even with the most noble of causes, committing terrorist activities still counts as terrorism. There isn't a single, accepted definition of terrorism as of yet. Actually, none of the 13 main multilateral conventions on terrorism contained a definition of terrorism. Thus, using force or violence against a particular group of people in order to effect change in that group of people is the main purpose of terrorism, both as it is practiced and as it is justified by terrorists themselves (Garrison, 2004). An exhaustive definition of terrorism, according to renowned terrorism expert Walter Laqueur, neither exists nor will be discovered anytime soon. In order to force a target group bigger than the immediate victims to comply with the political or religious demands of the offenders, terrorism can be defined as the use of violence or the threat of violence by a person or a group, whether operating in opposition to established authority. The key components in this case are violent acts meant to spread fear in order to advance an interest (Wardlaw, 2012).

whether they are quantitative, qualitative, or a blend of both," according to Alexan-der Austin (2011).

An early warning system is described as "those that entail regular and organized collection and analysis of open-source information on violent conflict situations" by Nyheim (2018). They provide a collection of early warning products (based on techniques for qualitative and/or quantitative conflict analysis) that are connected to instruments and/or processes for making a reaction. A functional definition of an early warning system is later put forth by Nyheim (2018). It is described as "one that conducts regular and organized collecting and analysis of information on violent conflicts and prospects for peace." It provides a number of early warning goods, sometimes directly responds to violent confrontations, and has operational ties to instruments and methods for responding.

the victims endure their suffering in silence without being able to respond (Udama, 2013). And Udama (2013) went on to say that just because terrorist activity has increased recently, particularly in the north of the country, does not necessarily suggest that it is concentrated there. Nigeria has seen a long history of terrorism, which has been committed by many people, organizations, places, and times. While some people are the terrorists' primary targets, some victims are merely used as attention-getters for other people. When discussing the history of terrorism and the use of terror throughout time, it is important to keep in mind that societies and governments in

the past were different from those that exist today. Terrorism, which we define as humankind's indifference to other humans, has existed for a very long time in fact, it is as ancient as humanity (Adora, 2010). There is no state in the world where terrorism is absent or new, according to Madunagu (2005).

Over 150 members of the Boko Haram extremist religious group were imprisoned in the northeastern states of Bauchi and Borno in September 2010, but some of them are now thought to be taking part in Boko Haram attacks across the nation. Members of Boko Haram targeted security officers, government buildings, and authority leaders in the states of Bauchi and Borno in October. During Independence Day festivities on October 1, 2010, two car bombs detonated close to Eagle Square in central Abuja, killing 14 people and injuring a large number more. Additionally, on the eve of 2011, a second automobile explosion at the Abuja Army Barracks claimed roughly four lives and critically injured nearly ten others (Attoh, 2012).

Nigeria has recently seen a rise in terrorism, which takes many different forms and manifests itself in various ways. These include bombing, killing people, and focusing on specific people or locations, such as places of worship, residences, commercial buildings, telecommunication towers, government installations, and infrastructure. They also involve kidnapping and denying people of their legal entitlements. These terrorist operations are carried out by non-state actors, which includes government officials and security agencies that are responsible for protecting lives and property (Udama, 2013). It is possible to suggest that the environment in which Nigerians live and

### **Concept of Banditry**

Conceptually, banditry is a derivative of the term bandit meaning an unlawful armed group terrorizing people and confiscating their properties. It is synonymous with the establishment of gang groups who use small and light weapons to carry out attacks against people. In this regard, banditry could mean a set-up criminal activity deliberately designed and carried out for personal gains. Due to the complex nature of bandits' activities, Egwu (2016) in a restricted manner, described banditry as a practice of stealing cattle and animals from herders or raiding of cattle from their ranches. In the same vein, banditry is reflected in criminal escapades like cattle rustling, kidnapping, armed robbery, drug abuse, arson, rape and the brazen and gruesome massacre of people of agrarian communities with sophisticated weapons by suspected herdsmen and reprisal attacks from surviving victims, a development that has been brought to the front burner of national security (Uche & Iwuamadi, 2018).

In his perception, Shalangwa (2013) regards banditry as the practice of raiding and attacking victims by members of an

their encounters with governmental procedures may have influenced the development of terrorism. Due to the view of the Nigerian government as being exploitative, unjust, and humiliating to its citizens, groups have taken the initiative to confront the government. The Nigerian government's failure to fulfill its responsibilities to the populace and the belief that state policies are being enacted to advance individual interests for personal gain have led to a general disillusionment with the Nigerian state.

Even though, the new bombing tendencies were predictable and preventable, they signal peril. In his view, bombing has a repugnant past as a means of retaliation. And from the perspective of terrorists, it continues to be a successful tactic for igniting anarchy and toppling any government. Bombing is directed against a state and results from hatred, malice, and vindictiveness; it is intended to cause damage and mayhem as opposed to robbery and kidnapping, which are focused at individuals and are meant to surgically extract money or material gains from victims (Ebun- Amu, 2010). One of the most difficult challenges facing nations today is the capacity of the government to prevent, defeat, and respond decisively to terrorist attacks. Terrorist attacks in the country have included drive-by shootings, bombings, the use of Improved Explosive Devices (IEDs), as well as suicide attacks. Nigeria is not an exception to this situation, as terrorism has recently emerged as the top national security concern, attracting numerous and varied comments in contemporary national discourse. Government has responded by putting in place a number of passive and active measures to counter this threat.

armed group, whether or not premeditated, using weapons of offence or defense, especially in semi-organized groups for the purpose of overpowering the victim and obtaining loot or achieving some political goals. Such bandits are usually perceived as outlaws, desperate and lawless marauders who do not have a definite residence or destination but roam around the forest and mountains to avoid being identified, detected and arrested.

However, where the term banditry is connected to rural, it implies a group of rural outlawed involved in illicit activities such as raiding of villages, kidnappings and cattle rustling for primitive accumulation of wealth. Thus, bandits are gang groups terrorizing and dispossessing local people or travelers of their valuable items or properties such as merchandise, money, cattle, camel, and sheep, among others. They operate within and along rural borders with the assistance of their local collaborators including in some cases, state agents deployed to work for the safety and security of the people (Abdullahi, 2019).

### **Factors Promoting Banditry in Nigeria's Northwest Region:**

Several factors have been adduced as the driving forces of banditry in Nigeria and most especially in the northwest region of the country. Drivers of banditry in northwestern Nigeria consist in some socio-existential conditions that characterize the interior as well as the frontiers of the region. Prominent among these conditions are the scarcely governed spaces- the hinterlands, forestlands and borderlines of the region. The northwestern hinterlands are marked by extremely dispersed rural settlements, separated by rangelands and farmlands that are susceptible to violent contestations (Gaye, 2018).

They are also interspersed by diverse forested landscapes, some of which are dotted by wetlands, rocks and caves. Apart from being separated from each other, they are equally far separated from the centers of governance at the local and state levels. The forestlands of the region are vast, rugged and hazardous. Most importantly, they are grossly under-policed to the point that makes them conducive for all forms of jungle criminality. In view of this, violent crimes, such as banditry, have festered and thrived in such forested areas. Most attacks occur in remote villages, close to forested regions in the northwest where there is little security presence (Gaye, 2018).

In likewise manner, banditry occurs in large swathes of forest reserves that are generally out of the reach of the Nigerian security operatives. Most of the bandit activities take place in state-owned reserves such as the Kamuku, Kuyanbana, and Falgore forests in Northern Nigeria. The forests offer perfect locations as hide outs for the criminals to evade arrest from security forces. The reluctance of the Nigerian security operatives to enter these forest areas seems to be largely due to inefficiency, connivance of the local people, lack of sophisticated equipment and poor motivation of the Nigerian security forces (Olaniyan & Yahaya, 2016).

Another factor that promotes banditry in Nigeria is the high level of unemployment rate. The National Bureau of Statistics (NBS) in 2019 puts Nigeria's unemployment rate at 23.1%, of which youth unemployment is 55.4%. Equally, the poverty index in the Northwest is 77.7% (NBS, 2012; Rosenje & Moliki, 2016). These figures have continued to drastically increase

### **Dimensions and Recent Incidences of Banditry in Nigeria's Northwest Region**

Okoli and Ugwu, (2019) claimed that there are four dimensions of armed banditry which will be adopted for this study. These dimensions are village raids, highway robbery, kidnapping and cattle rustling. Village raids are the invasion and marauding of rural communities with severe casualties on the people. In most village raid, household, shops and markets are looting targets. While some time, it is seen as reprisals attack on a rivalry village (Yaro & Tobias, 2019). The second dimension of armed banditry

yearly as Nigerian institutions keep graduating batches of youths with the prior impression of getting better jobs and opportunities after graduation (Adegoke, 2019). The anxiety from Nigerian graduates that later turn to frustration, and then to aggression on the government is what has fueled the emergence of most of these bandit attacks and security threats in the country (Suleiman, 2017; Mustapha, 2019).

Moreover, poverty as well poor governance contributed significantly to the rising wave of banditry in Nigeria. Adeolu (2018) noted that the failure of successive administrations in Nigeria to address the challenges of poverty bedeviling the nation has made life burdensome and only the fittest survive. In concurrence with Adebayo (2018) perception, Adeolu, (2018) noted that Nigeria has overtaken India as the country with the largest number of people living in extreme poverty, with an estimated 87 million Nigerians, or around half of the country's population, estimated to be living on less than \$1.90 a day. Alao, Atere and Alao (2015) linked banditry, terrorism and other criminal acts to poverty. Although not all forms of criminal acts could be linked to poverty, it has been contended that economic deprivation influences people to resort to illegal means of meeting their daily needs. It was discovered that because of the attractive benefits accruing from banditry activity, most people, especially the youths tend to join the bandit gangs in the Northwest of Nigeria (Epron, 2014; Adegoke, 2019).

Another driving factor of banditry in northwestern Nigeria worthy of mentioning is the issue of arms proliferation. There has been an incremental influx of small arms and light weapons (SALWs) into Nigeria from the Sahel since the fall of Ghadaffi's regime in Libya (Gaye, 2018). These arms and weapons end up in the hands of non-state actors like terrorists, militants and bandits, who use them to terrorise individuals and communities. In September 2018, military troops in joint operations with personnel of the Department of State Service (DSS) arrested two suspected illicit arms dealers along Funtua-Gusau road with 1,479 rounds of 7.62mm (special) ammunition, on their way to deliver the weapons to armed bandits (Adeniyi 2018). Incidents such as this have been prevalent in the various states of northwestern Nigeria where banditry has become the order of the day (Okoli & Ugwu, 2019).

is highway robbery, which is a phenomenon in the State. This occurred by the interception of motorists with travelers on the various highways along Abuja-Kaduna-Zaria axis (Okoli & Okpaleke, 2014).

Kidnapping is a crime committed for ransom. Victims of the crime are often those perceived by the perpetrators to possess money which will be paid as ransom based on individual socio-economic status. Kidnapping in Kaduna State involves highway-armed abduction whereby travelers are ambushed and abducted by bandits and then taken to a hideout in the forest

where their relatives or associates are contacted for ransom payment (Okoli & Okpaleke, 2014). The last dimension of banditry in Northwest region of Nigeria is cattle rustling. This is a form of organized cattle theft driven by allied accumulative or profiteering inclinations. In other word, they are criminal gangs engaging in organized rural banditry to profit from livestock theft (Gadzama, Saddiq, Oduehe & Dariya, 2018; Asmau & Abdulrasheed, 2020).

### **Theoretical Framework**

A theory is a group of propositions that explains something. Therefore, a theory consists of some fundamental ideas and propositions, and it also considers the connections between particular ideas. Theories aid in both the organization of already known knowledge and the formulation of predictions for observed events. A body of ideas known as a theory explains human society (Haralambos & Holborn, 2004). Therefore, it is necessary to evaluate pertinent theories in order to explain early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria. The frustration and aggression theory are the theories that were examined in this study. The theory of frustration and aggression was used in this investigation. The works of Dollard, Doob, Miller,

### **Research Methodology**

The research procedures to be employed for this study. These procedures were discussed under the following sub-headings:

1. Research Design;
2. Population, Sample and Sampling Techniques;

### **Research Design**

The research design that was adopted for this study is a descriptive research design. According to Olayiwola (2007), the goal of collecting and analyzing data for descriptive research is to describe, evaluate, or compare current happenings or prevalent practices, events, or occurrences. According to Abiri (2006), descriptive research uses questionnaires and/or interviews as a method to find out what the person the researcher is interested in thinks, feels, prefers, and thinks about. To Osuala (2013), survey research enables the researcher to gather data from a representative sample of the community to explain current circumstances. The objective of this study is to identify and be able to describe the properties of the variable of interest, hence a descriptive research design is acceptable.

### **Population, Sample and Sampling Techniques**

The population for this study comprises all residents of Kaduna State. Purposive sampling technique was used to select three Local Government Area of Chukun, Igabi and

Mowrer, and Sears are related with the theory of frustration-aggression (1939). This theory's central tenet is that "violence is always a result of dissatisfaction. According to the authors, people are driven to fulfill their destiny and achieve their life goals, but when these expectations are not met, frustration sets in. According to their perspective, the presence of violent behavior implies the presence of frustration, and dissatisfaction "always leads to some form of hostility" (Dollard, et. al., 1939; cited in Dibia, 2021).

It is crucial to remember that dissatisfaction can have other effects besides violence, thus it is not a given that frustration always results in aggression. Frustration and aggression go hand in hand, which is why the idea of using them as a strategy to combat terrorism makes sense. Societal sciences believe it to be the root of social unrest brought on by the government's divisive policies (Berkowiz, 1989). This theory contends that the common people are not only denied their basic civil rights but also the means to further those rights, rendering them powerless to respond to those violations. The powerful in society or the established system, which controls the overall situation, are responsible for this blocking. In this situation, the oppressed, marginalized, and frustrated people or groups try to communicate their irritation and frustration.

3. Instrumentation;
4. Procedure for Data Collection; and
5. Data Analysis Techniques

Birnin Gwari, the choice of the three Local Government Area was because among the LGA in Kaduna State, terrorist attack was more seen there compared to other LGA's. There were 5,860,182 people (2,988,693 male and 28,711,489 female) residing in Kaduna State which constituted the population for the study (National Bureau of Statistics, 2006). While stratified sampling was used to determine the senatorial districts to be sampled, then a simple random sampling technique was utilized in selecting the Local Government areas from each of the sampled senatorial districts for the study and finally, 3 communities were purposively selected from the sampled Local Governments areas to select respondents for the study.

In order to get the sample for this study, purposive sampling technique called linear snowball sampling techniques was adopted. According to Vogt (1999) snowball sampling technique is a technique for finding research subjects, where one subject gives the researcher the name of another subject, who in turn provides the name of a third, and so on. Purposive sampling technique was used in this study because

the researcher is only interested in those that are residing in Kaduna State, this technique is the most appropriate. In total 400 residents of Kaduna State were sampled for this study.

### **Instrumentation**

A researcher-design questionnaire tagged “Early Warning Signals as a Panacea to Combat Terrorist Activities Questionnaire (EWSPCTAQ)” was used for data collection. The questionnaire was divided into sections A, B, C, D and E. The section A was used to obtain demographic data of the respondents, while the section B addressed information on the causes of terrorism, Section C: was used to elicit information on motivating factors for recruiting terrorists, while Section D: was used assessment of early warning signals as panacea to combat terrorist activities in Kaduna State, Nigeria. finally, Section E: was used recommend workable early warning signals to combat terrorism. The EWSPCTAQ used a four- point Likert scale, that is; Strongly Disagree (SD = 1 point), Disagree (D = 2 points), Agree (A = 3 points), and Strongly Agree (SA = 4 points), while EWSPCTAQ consisted of 15 items.

Therefore, the instruments were given to the researcher supervisor and other experts for face and content validity. They scrutinized the items and make alterations and suggestions and these were effected by the researcher in order to make the instrument more standard for eliciting information from the respondents. The researcher tested for reliability of the questionnaire use through test re-test method. The researcher administered the instrument on sub-set of the population who were not part of the population of this study within the intervals of three weeks. The two set of data obtained were correlated using Cronbach’s Alpha and found to have reliability index of 0.78. This indicates that the instrument was reliable.

### **Procedure for Data Collection**

The google form was used for the data collection. The instrument that was used for data collection in this study was designed by the researcher. The respondents were informed of the exercise and on the need to be honest in terms of giving objective response. Also, the consent of the respondents was sought and their identity were made anonymous. The

### **Data Analysis Techniques**

Percentage was used in describing the demographic characteristics of the respondents, and mean rating and percentage were also used to answer the research questions raised, while the independent t-test was used to test the formulated hypotheses at 0.05 level of significant, using SPSS 25 version.

researcher with the help of a research assistance administered the questionnaires by sharing the google for to the respondents.

### **Ethical Consideration**

The researcher adhered strictly to the best practices obtainable during research of this nature. Firstly, in seeking the consent of the participants of this research, the researcher through a note on consent was clearly informed the participants of the purpose, benefits, risks (if any) and as well as the alternatives regarding their involvement in the research. This in addition to assuring participants of treating whatever information derived from them with utmost confidentiality. In other words, the participants were not deceived into the study. Rather, it was made known to them from the beginning of the research that their participation in the study is voluntary and anyone is free to withdraw. The assessment was conducted with adherence to informed consent, confidentiality, and anonymity. All individuals for the data collection were provided with information about the purpose, risks, and benefits of the assessment so they could make an informed decision whether to participate in the evaluation.

In addition, the information shared by the respondents was kept confidential. At no point the names of any respondent or other identifying information used in the data analysis, presentation of findings and report of the evaluation. Training was provided to data collectors to ensure they understand the ethical principles. Upon completion of evaluation activities in the field, the data were maintained in a way that adheres to ethical principles. The mode of analysis adhered to standards for survey research, the aim of which was to make general claims about the participant populations, not specific claims about identifiable individuals. Where qualitative analysis was used to provide further insight on the general claims, any individual or household identifiers and reference were excluded. Instead, the characteristics or factors that support or refute the general claim was addressed. Lastly, all the consulted sources were duly referenced and acknowledged, and in the same vein, the research work subjected to plagiarism test to ascertain the level of originality of the work.

### **Data Analysis and Result**

This chapter deals with data analysis and the interpretation of the results obtained. Demographic characteristics of the respondents were described using percentage.

**Demographic Description of the Respondents**

The data presented in Tables 1 was based on the demographic characteristics of the respondents’ percentage or pie chart.

The tables were based on respondents’ gender and school type.

**Table 1:** Percentage Distribution of Respondents by Gender and Status

Variables		Frequency	Percent
<b>Gender</b>	Male	259	64.8
	Female	141	35.2
	<b>Total</b>	<b>400</b>	<b>100.0</b>
<b>Status</b>	Civilian	284	71.0
	Security personnel	116	29.0
	<b>Total</b>	<b>400</b>	<b>100.0</b>

Results in Table 1 indicates that 400 respondents participated in the study out of which 259, (64.8%) were male, while 141 (35.2%) were female. This shows that there were more male respondents than female respondents in this study. Also, Table 1 further reveals that, 284 (71.0%) of the respondents were

civilians, while 116 (29.0%) of the respondents were security personnel (*soldier*, police, Civil Defence etc.). This implies that there are more civilians than uniform personnel in this study.

**Answering of Research Questions**

Four research questions were raised and research question 1 was answered in this study.

The outcomes of the analysis are reported in Tables 2.

**Research Question 1:** *What are the early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria?*

In order to answer this research question, participants’ responses on the early warning signals as a panacea to combat terrorist activities were analysed using the mean and the summary of the results is presented in Table 2

**Table 2:** Mean Rating of Early Warning Signals as a Panacea to Combat Terrorist Activities in Kaduna State, Nigeria

Perception of people in early warning signals to curtail terrorist activities			
The following are some of the early warning signals to curtail terrorist activities		Mean	Ranking
<b>5</b>	With the use of technology such as improved data sharing	3.33	<b>1<sup>st</sup></b>
<b>4</b>	Going on social media to pass necessary information	3.33	<b>1<sup>st</sup></b>
<b>3</b>	Sending of bulk messages as alert to the people living around the area	3.32	<b>3<sup>rd</sup></b>
<b>19</b>	Ensure regular notifications to inter agency partners and neighboring jurisdictions to provide shared operational picture of possible diversionary attacks	3.20	<b>4<sup>th</sup></b>

20	Plan and train for identified vulnerabilities	3.27	5 <sup>th</sup>
11	Concerns reported to the police by members of the public	3.17	6 <sup>th</sup>
1	Proper governance for all	3.12	7 <sup>th</sup>
7	Smart visas and improved border security	3.11	8 <sup>th</sup>
6	Smart ID cards with biometric identifiers	3.08	9 <sup>th</sup>
8	Digital surveillance, and face recognition technology	3.08	10 <sup>th</sup>
13	Review of the quantity and quality of information publicly available and how accessible it is	2.99	11 <sup>th</sup>
10	Statistics on the number of suspicious situations	2.80	12 <sup>th</sup>
14	Meetings with communities and other community outreach activities organized by the police	2.69	13 <sup>th</sup>
9	Analysis of public statements by community representatives	2.29	14 <sup>th</sup>
15	Communication of evaluation findings to the public	2.23	15 <sup>th</sup>
16	Awareness-raising initiatives on combat terrorist activities	2.17	16 <sup>th</sup>
17	Protocols are established within the police to govern information exchange with communities	2.15	17 <sup>th</sup>
12	Reductions in the number of complaints against the police	1.99	18 <sup>th</sup>
18	The existence of formal and informal engagement opportunities	1.94	19 <sup>th</sup>
2	Proper administration of laws and order	1.84	20 <sup>th</sup>

From Table 2, the three most likely early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria were “With the use of technology such as improved data sharing” and “Going on social media to pass necessary information” which had a mean score of 3.33 (1<sup>st</sup>) respectively, followed by “Sending of bulk messages as alert to the people living around the area” with a mean score of 3.32 (3<sup>rd</sup>). The three least likely early warning signals as a panacea to combat terrorist activities were “Reductions in the number of complaints against the police” which had mean score of 1.99 (18<sup>th</sup>) and “The existence of formal and informal engagement opportunities” with a mean score of 1.94 (19<sup>th</sup>), while “Proper

administration of laws and order” with a mean score of 1.84 came last.

**Research Question 2:** *What are the causes of terrorism in Kaduna State, Nigeria?*

In order to answer this research question, participants’ responses on the causes of terrorism were analysed using the mean and the summary of the results is presented in Table 3.

**Table 3:** Mean Rating of Causes of Terrorism in Kaduna State, Nigeria

Causes of Terrorism			
S/N	The following are some of the causes of terrorism	Mean	Ranking
1	poverty	3.55	1 <sup>st</sup>
3	lack of employment opportunities for young Nigerians	3.49	2 <sup>nd</sup>
9	relative deprivation and inequality	3.44	3 <sup>rd</sup>
10	generally bad governance	3.43	4 <sup>th</sup>
2	religious factor	3.41	5 <sup>th</sup>
6	ethnicity	3.38	6 <sup>th</sup>
8	insensitivity	3.19	7 <sup>th</sup>
7	arrogance by official corruption	3.11	8 <sup>th</sup>
4	frustration	3.11	8 <sup>th</sup>
5	influences from established terrorist organizations	2.62	10 <sup>th</sup>

From Table 3, the three most likely causes of terrorism in Kaduna State, Nigeria were “poverty” which had a mean score of 3.55 (1<sup>st</sup>), followed by “lack of employment opportunities for young Nigerians” with a mean score of 3.49 (2<sup>nd</sup>), “relative deprivation and inequality” with a mean score of 3.44 came 3<sup>rd</sup>. The three least likely causes of terrorism in Kaduna State, Nigeria were “arrogance by official corruption” and “frustration” with a mean score of 3.11 (8<sup>th</sup>) respectively, while “influences from established terrorist organizations” with a mean score of 2.62 came last.

**Research Question 3:** *What are the motivating factors for recruiting terrorists in Kaduna State?*

In order to answer this research question, participants’ responses on the motivating factors for recruiting terrorists were analysed using the mean and the summary of the results is presented in Table 4.

**Table 4:** Mean Rating of motivating factors for recruiting terrorists in Kaduna State

Motivating Factors for Recruiting Terrorists			
S/N	The following are some of the motivating factors for recruiting terrorists	Mean	Ranking
4	Belongingness	3.39	1 <sup>st</sup>
6	Heroism	3.36	2 <sup>nd</sup>
7	Autonomy	3.30	3 <sup>rd</sup>
5	Political repression	3.13	4 <sup>th</sup>
2	Religion	3.12	5 <sup>th</sup>
3	Identities	3.07	6 <sup>th</sup>
1	Perception as victims of social injustice	2.87	7 <sup>th</sup>

Table 4 indicates that 400 respondents participated in this study. The three main motivating factors for recruiting terrorists in Kaduna State were that: “Belongingness”; “Heroism”; and “Autonomy” which had a means of 3.39 (1<sup>st</sup>), 3.36 (2<sup>nd</sup>), 3.30 (3<sup>rd</sup>) respectively. The three least motivating factors for recruiting terrorists were that: “Identities”; “Autonomy”; and “Perception as victims of social injustice” with mean scores of 3.12 (5<sup>th</sup>); 3.07 (6<sup>th</sup>); and 2.87 (7<sup>th</sup>) respectively.

**Hypotheses Testing**

Having considered the demographical data of the respondents, the researcher proceeded to test the null hypotheses generated in the study. The two research

hypotheses postulated for this study were tested using the independent t-test statistics at 0.05 level of significance.

**H<sub>01</sub>:** *There is no significant difference in the male and female assessment of early warning signals as panacea to combat terrorist activities in Kaduna State, Nigeria.*

In order to test this research hypothesis, participants’ responses to the early warning signals as panacea to combat terrorist activities were collated based on gender. The data collected from the study was analyzed as shown in Table 5.

**Table 5:** t-test Analysis of Difference in the Male and Female Assessment of Early Warning Signals as Panacea to Combat Terrorist Activities in Kaduna State, Nigeria

Variables	N	Mean	SD.	df	Cal.t	Sig. (2-tailed)	Decision
Male	259	55.00	5.76	398	.47	.64	<b>H<sub>01</sub> Not Rejected</b>
Female	141	55.28	5.87				

$\rho > 0.05$

Results in Table 5 show that caculate t .47 with df of 398 that is not significant at .64. The researcher therefore accepted the null hypothesis that stated that: there is no significant difference in the male and female assessment of early warning signals as panacea to combat terrorist activities in Kaduna State, Nigeria. The reason was that the calculated significance value (.64) was greater than 0.05 alpha level ( $\rho > 0.05$ ). This means that their gender did not affect the assessment of early warning signals as panacea to combat terrorist activities in Kaduna State, Nigeria.

**H<sub>02</sub>:** *There is no significant difference in the civilians and security agencies assess early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria.*

In order to test this research hypothesis, participants’ responses to the early warning signals as panacea to combat terrorist activities were collated based on status. The data collected from the study was analyzed as shown in Table 6.

**Table 6:** t-test Analysis of Difference in the Civilians and Security Agencies Assess Early Warning Signals as a Panacea to Combat Terrorist Activities in Kaduna State, Nigeria

Variables	N	Mean	SD.	df	Cal.t	Sig. (2-tailed)	Decision
Civilian	284	55.09	5.66	398	.05	.99	<b>H<sub>02</sub> Not Rejected</b>
Security Personnel	116	55.12	6.15				

$\rho > 0.05$

Results in Table 6 show that caculate t .05 with df of 398 that is not significant at .99. The researcher therefore accepted the null hypothesis that stated that: there is no significant difference in the civilians and security agencies assess early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria. The reason was that the calculated significance value (.99) was greater than 0.05 alpha level ( $\rho >$

0.05). This means that their status (civilian and security personnel) did not affect the assessment of early warning signals as panacea to combat terrorist activities in Kaduna State, Nigeria.

## Findings

Based on the data collected, analysed and interpreted, the following findings were obtained:

1. Three most likely early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria were “the use of technology such as improved data sharing” and “Going on social media to pass necessary information”, and “Sending of bulk messages as alert to the people living around the area”.
2. The three most likely causes of terrorism in Kaduna State, Nigeria were “poverty”; “lack of employment

## Discussion of the Findings

### Early Warning Signals as a Panacea to Combat Terrorist Activities in Kaduna State, Nigeria

The finding revealed that three most likely early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria where “the use of technology such as improved data sharing” and “Going on social media to pass necessary information”, and “Sending of bulk messages as alert to the people living around the area”. The results of this study may be due to the perception of technology as an easy means of information sharing and the assumption that most of the respondents to this study were technologically savvy. This finding is in line with that of Subramanyam (2018) who reported that perceived injustice, religion, identity, belonging, political activity, heroism and autonomy can be seen as strong influence, real causes and psychological motivation for an individual joining and staying with the terrorist groups. Post (2017) argues that “individuals become terrorists in order to join terrorist groups and commit acts of terrorism.” Joining a terrorist group gives them a sense of revolutionary heroism and self-importance that they previously lacked as individuals.

## Conclusions

If a research project does not have some significant educational ramifications, it cannot be deemed worthwhile. Some of the study's findings are anticipated to serve as a wake-up call to Nigeria's government at all levels, security agencies, and many other stakeholders, urging them to always watch out for the early warning signals of terrorist activity and respond to it.

Terrorism creates feeling of frustration in the society with the main objective of destruction. The urgent need is to fight against terrorism. It cannot be wiped out by few hands or by force of arms. It has to be by combination of government governance, stringent laws, and a quick and

opportunities for young Nigerians” and “relative deprivation and inequality”.

3. The three main motivating factors for recruiting terrorists in Kaduna State were that: “Belongingness”; “Heroism”; and “Autonomy”.
4. There is no significant difference in the male and female assessment of early warning signals as panacea to combat terrorist activities in Kaduna State, Nigeria.
5. There is no significant difference in the civilians and security agencies assess early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria.

firm system of justice. The state has a responsibility towards public safety, justice dispensation and prevention of crime as compelling state interest. Terrorism in general has many motivations depending on the special interests of the individual. In conclusion, the main causes of terrorism are poverty and the major factor motivating people to join terrorist group is because they want to feel belong and revenge of their loved ones.

## Recommendations

The following recommendations are proffered for managing early warning signals as panacea to combat terrorist activities:

1. Since the finding revealed that the main causes of terrorist activities is poverty, it was therefore, recommended that instead of relying mainly on military actions against Boko Haram, the Nigerian government has to redirect more of its resources in the fight against terrorism towards economic and social empowerment of the local people who are easily lured by the financial inducement tactics used by terrorists. Such empowerment would provide safe alternatives for the teeming youth population and make terrorism less attractive to them. This in effect will deny terrorists of the support and fighters who are easily recruited because of poor socio-economic conditions.
2. Social and economic interventions of government should be designed in consultation with the locals, especially the youths, to effectively analyze and understand the drivers of social support for terrorists. This will enable the Nigerian government and state authorities to implement soft approach policies or measures that address the often-misdiagnosed reason why youths in the north decide to join terrorism and what they need to thrive.
3. Also, the government of Nigeria needs to collaborate with religious authorities and traditional leaders in the local communities where terrorists operate, to design effective counter narratives and appropriate communication tools that will help to disabuse the religious narratives used by the

terrorist group in mobilizing for support. In this regard, influential local religious and traditional leaders should be well trained and resourced to deliver resounding anti-violence messages and appropriate interpretation of religious prescriptions. Local NGOs and the media would also be of great service when their efforts are coordinated and directed.

4. Finally, government must extend governance and state structures to areas which are usually seen as far detached from

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state control. Government must support and protect poor communities, especially border towns, and work with local authorities to gain the trust of the people to ensure that they contribute to intelligence gathering efforts in identifying people with extremist and radical views, as well as those who are exploiting local conditions to recruit people for terrorist groups.

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**Appendix**

**AN ASSESSMENT OF EARLY WARNING SIGNALS AS A PANACEA TO COMBAT TERRORIST ACTIVITIES IN KADUNA STATE, NIGERIA**

Dear Respondent,

This research on an assessment of early warning signals as a panacea to combat terrorist activities in Kaduna State, Nigeria. Please, kindly respond honestly to the items in the questionnaire. Your responses will be treated with utmost confidentiality and they would be used for the purpose of research only.

Thank you,

**Instruction:** Please provide answers to the items in the spaces provided or make a tick (√) in the appropriate column.

**Demographic Characteristics of the Respondents**

**Gender:** Male ( ) Female ( )

**Status:** Civilian( ) Uniform Personnel ( )

**Key:** SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

Section B: Causes of Terrorism					
S/N	The following are some of the causes of terrorism	SA	A	D	SD
1	poverty				
2	religious factor				

3	lack of employment opportunities for young Nigerians				
4	frustration				
5	influences from established terrorist organizations				
6	ethnicity				
7	arrogance by official corruption				
8	insensitivity				
9	relative deprivation and inequality				
10	generally bad governance				

**Section C: Motivating Factors for Recruiting Terrorists**

The following are some of the motivating factors for recruiting terrorists

		SA	A	D	SD
1	Perception as victims of social injustice				
2	Religion				
3	Identities				
4	Belongingness				
5	Political repression				
6	Heroism				
7	Autonomy				

**Section D: Perception of people in early warning signals to curtail terrorist activities**

The following are some of the early warning signals to curtail terrorist activities

		SA	A	D	SD
1	Proper governance for all				
2	Proper administration of laws and order				
3	Sending of bulk messages as alert to the people living around the area				
4	Going on social media to pass necessary information				
5	With the use of technology such as improved data sharing				
6	Smart ID cards with biometric identifiers				

7	Smart visas and improved border security				
8	Digital surveillance, and face recognition technology				
9	Analysis of public statements by community representatives				
10	Statistics on the number of suspicious situations				
11	Concerns reported to the police by members of the public				
12	Reductions in the number of complaints against the police				
13	Review of the quantity and quality of information publicly available and how accessible it is				
14	Meetings with communities and other community outreach activities organized by the police				
15	Communication of evaluation findings to the public				
16	Awareness-raising initiatives on combat terrorist activities				
17	Protocols are established within the police to govern information exchange with communities				
18	The existence of formal and informal engagement opportunities				
19	Ensure regular notifications to inter agency partners and neighboring jurisdictions to provide shared operational picture of possible diversionary attacks				
20	Plan and train for identified vulnerabilities				
<b>Section E: Recommend Workable Early Warning Signals to Combat Terrorism</b>					
Please recommend workable early warning signals to combat terrorism					
1					
2					
3					
4					
5					

## ENTREPRENEURSHIP EDUCATION AND TECHNOLOGY: CATALYSTS FOR EDUCATIONAL DEVELOPMENT IN NIGERIA (AN EMPIRICAL PERSPECTIVE)

JONATHAN ISHAYA

Department Of Business Administration And Management, School Of Business And Management Studies, Nigerian Army College Of Environmental Science And Technology  
Contact Phone: 08030533665  
email: jonathanishya@gmail.com

### Abstract

*Entrepreneurship education and technology have been identified as crucial factors that can enhance educational development in Nigeria. The purpose of this research paper is to examine the impact of entrepreneurship education and technology on educational development in Nigeria. The paper employed a qualitative research approach focusing mainly on empirical analysis. The findings revealed that entrepreneurship education can enhance students' creativity and innovation, increase their employability, and improve their entrepreneurial skills. The paper also revealed that there is a positive relationship between entrepreneurship education and technology, which served as catalysts for educational development in Nigeria. The paper recommended that Policymakers should encourage innovation and entrepreneurship by providing funding opportunities for startups and entrepreneurs. This will help to create a vibrant entrepreneurial ecosystem in Nigeria and promote economic growth and development. And Policymakers should also prioritize providing access to technology for students and entrepreneurs. Finally it was recommended that Policymakers, educators, and stakeholders should continuously evaluate and improve entrepreneurship education and technology programs in Nigeria.*

**Keywords:** Entrepreneurship education, Technology, Educational development, Nigeria.

### INTRODUCTION

Entrepreneurship education and technology have been identified as critical factors that can enhance educational development in Nigeria. Entrepreneurship education is designed to equip individuals with the necessary skills and knowledge to start and manage a business successfully (Ihuoma and Olofin, 2018). Technology, on the other hand, involves the use of tools, techniques, and processes to solve problems and create new products and services. The combination of entrepreneurship education and technology can enhance educational development in Nigeria by providing students with the necessary skills to succeed in a rapidly changing and increasingly globalized world. Entrepreneurship education and technology have emerged as critical catalysts for educational development in Nigeria, particularly in recent years.

According to Ojo & Abiodun, (2019), entrepreneurship education and technology are two critical tools that can drive educational development and economic growth in Nigeria. Entrepreneurship education has become an essential strategy for addressing the problem of youth unemployment in the country, while technology has

revolutionized the way education is delivered and accessed. The combination of entrepreneurship education and technology have the potential to enhance educational development and promote economic growth in Nigeria.

In recent years, the Nigerian government has taken steps to promote entrepreneurship education and the use of technology in education. For example, entrepreneurship education has been included in the curriculum of primary and secondary schools, while initiatives like the YouWiN! program have been launched to support young entrepreneurs. The government has also launched the Nigerian Education Sector Information and Communication Technology (NESICT) initiative to provide ICT infrastructure in schools across the country. Several studies have examined the impact of entrepreneurship education and technology on educational development in Nigeria. The findings suggest that a combination of entrepreneurship education and technology can significantly improve the entrepreneurial intentions, mindset, and performance of Nigerian university students and micro, small, and medium

enterprises. The use of technology in entrepreneurship education can facilitate access to educational materials, mentorship, funding, and connection to mentors, investors, and customers.

Therefore, this paper aimed to examine the role of entrepreneurship education and technology as a catalyst

### **Statement to the Problem**

Nigeria is a developing country with a rapidly growing population and endowed with human and natural resources, yet its plague with high unemployment rates, and Limited access to advanced technology in teaching and learning, as such many students in Nigeria do not have access to technology due to financial constraints, which limits their ability to participate in entrepreneurship education. There is also the problem of inadequate infrastructures such as power supply, internet connectivity, and computer systems which hinders the effective use of technology in entrepreneurship education. Furthermore, there is Limited understanding

### **Objectives of the Study:**

The primary objective of this paper is to examine the impact of entrepreneurship education and technology on educational development in Nigeria. The specific objectives are as follows:

i. To assess the impact of entrepreneurship education on educational development in Nigeria.

### **Literature Review**

#### **Conceptual Framework**

#### **Entrepreneurship Education**

Entrepreneurship education refers to the formal or informal instruction provided to individuals to develop entrepreneurial competencies and skills, which include identifying and evaluating business opportunities, developing a business plan, and launching and managing a successful business. Technology, on the other hand, encompasses various tools and techniques, such as computers, mobile phones, the internet, and social media, which can be used to enhance teaching and learning processes (Ayodeji, Oloyede, & Adeyanju, 2017).

Entrepreneurship education has gained significant attention globally as a tool for economic development

for educational development in Nigeria. It will review relevant literature on entrepreneurship education, technology, and their combination, and provide insights into the potential impact of these tools on educational development and economic growth in Nigeria.

of the effectiveness of technology-enhanced entrepreneurship education programs in Nigeria despite evidence that entrepreneurship education can be effective in developing entrepreneurial skills and attitudes, thereby promoting educational development in Nigeria. Perhaps, more research is needed to understand the potential benefits and drawbacks of incorporating technology and entrepreneurship education into educational programs in Nigeria. However, addressing these challenges is crucial to promoting entrepreneurship education and technology as a catalyst for educational development in Nigeria. It's against this background that the paper explores the intersection of entrepreneurship education, technology, and educational development in Nigeria.

ii. To evaluate the impact of technology on educational development in Nigeria.

iii. To determine the relationship between entrepreneurship education and technology and their impact on educational development in Nigeria.

and poverty reduction. In Nigeria, where youth unemployment is a significant challenge, entrepreneurship education is seen as a crucial strategy for addressing the problem. Technology, on the other hand, has revolutionized the way education is delivered and accessed. In recent years, technology has been used to enhance entrepreneurship education, leading to increased educational development in Nigeria.

#### **Entrepreneurship Education in Nigeria**

Entrepreneurship education has become a vital tool for economic growth in Nigeria. The government recognizes the importance of entrepreneurship education and has taken various steps to promote it. In 2013, the Federal Ministry of Education included entrepreneurship

education in the curriculum of primary and secondary schools in Nigeria. In 2015, the government launched the YouWiN! (Youth Enterprise with Innovation in Nigeria) program, which aimed to empower young entrepreneurs with funding, training, and mentorship (Ayodeji, Oloyede, & Adeyanju, 2017).

Several studies have examined the impact of entrepreneurship education on the Nigerian economy. For instance, a study by Adeyemo et al. (2019) found that entrepreneurship education positively impacts the entrepreneurial intentions of Nigerian university students. Another study by Ogbebor et al. (2020) showed that entrepreneurship education has a positive impact on the performance of micro, small, and medium enterprises in Nigeria.

### **Technology and Educational Development in Nigeria**

Technology has significantly impacted the Nigerian education system. The introduction of Information and Communication Technology (ICT) in schools has improved the delivery and accessibility of education in Nigeria. For instance, the introduction of e-learning has made it possible for students to access educational materials from anywhere and at any time. The government has also taken steps to promote the use of ICT in education. In 2011, the government launched the Nigerian Education Sector Information and Communication Technology (NESICT) initiative, which aimed to provide ICT infrastructure in schools across the country (Oluwatayo et al., 2021).

Several studies have examined the impact of technology on educational development in Nigeria. For instance, a study by Adeoye and Adeoye (2019) found that the use of ICT has significantly improved the quality of education in Nigeria. Another study by Yusuf (2018) showed that the use of e-learning has improved the academic performance of students in Nigeria. Furthermore, a study by Adebayo and Adebayo (2020) found that the use of technology in entrepreneurship education significantly improves the entrepreneurial intentions of Nigerian university students. Lastly, a study by Oluwatayo et al. (2021) showed that the use of e-learning in entrepreneurship education positively impacts the entrepreneurial mindset of Nigerian university students.

### **The relationship between entrepreneurship education and technology and their impact on educational development in Nigeria.**

The combination of entrepreneurship education and technology has the potential to enhance educational development in Nigeria. The use of technology in entrepreneurship education can improve the delivery of training, mentorship, and funding for entrepreneurs. For instance, the use of e-learning can provide entrepreneurs with access to educational materials from anywhere and at any time. Technology can also facilitate the connection between entrepreneurs and mentors, investors, and customers (Ogueri, 2013).

Firstly, entrepreneurship education can play a significant role in promoting economic growth and development in Nigeria. By teaching individuals how to identify business opportunities and create value, entrepreneurship education can help to reduce unemployment and poverty levels, which are major challenges facing Nigeria. Furthermore, entrepreneurship education can help to promote innovation and creativity, which are essential for the development of new products and services that can meet the needs of consumers.

Secondly, technology can be a powerful tool for enhancing the quality of education in Nigeria. Technology can provide access to educational resources and tools that were previously unavailable, making it easier for individuals to acquire knowledge and skills. Additionally, technology can be used to enhance the delivery of education, making it more engaging and interactive for students.

The impact of entrepreneurship education and technology on educational development in Nigeria can be significant. By combining entrepreneurship education and technology, individuals can acquire the skills and knowledge needed to create innovative solutions to challenges facing the education sector. For example, entrepreneurs can develop educational technologies that can be used to improve the quality of education in Nigeria, while also generating income and creating jobs. Conclusively, the relationship between entrepreneurship education and technology is crucial for educational development in Nigeria. By leveraging these two factors, Nigeria can build a strong, innovative, and

dynamic education system that can drive economic growth and development.

### **Empirical Review**

Several studies have shown that entrepreneurship education can positively impact educational development in Nigeria.

For instance, a study conducted by Ihuoma and Olofin (2018) found that entrepreneurship education can improve the employability of graduates, promote innovation and creativity, and enhance economic development. The study also revealed that entrepreneurship education can help to bridge the gap between the theory taught in the classroom and the practical skills required in the job market.

Another study conducted by Adegbite, Adegbite, and Olaoye (2019) examined the impact of entrepreneurship education on the entrepreneurial intentions of university students in Nigeria. The study found that entrepreneurship education positively influenced the entrepreneurial intentions of students, indicating that entrepreneurship education can help to foster an entrepreneurial culture in Nigeria.

Study conducted by Afolabi, Aremu, and Oluwole (2019) examined the impact of mobile technology on the academic performance of secondary school students in Nigeria. The study found that the use of mobile technology, such as smartphones and tablets, positively impacted the academic performance of students, indicating that technology can enhance learning outcomes in Nigeria.

Similarly, a study conducted by Oyekanmi, Okedele, and Adeniji (2019) investigated the use of social media

in higher education in Nigeria. The study found that social media can be used to enhance teaching and learning processes, promote student engagement, and facilitate communication between students and teachers. Adegbenjo & Adegbenjo, (2021). This study investigated the impact of entrepreneurship education and technology on sustainable development in Nigeria. The findings revealed that entrepreneurship education and technology have significant positive effects on sustainable development in Nigeria.

Ogunsiji, Oyeleye, & Ayeni, (2019). This study examined the role of entrepreneurship education and technology in driving educational development in Nigeria. The results showed that entrepreneurship education and technology play important roles in promoting educational development in Nigeria.

Adekunle, Adekunle, & Adegoke, (2018). Carried out a study which investigated the impact of entrepreneurship education and technology on youth empowerment and economic development in Nigeria. The findings revealed that entrepreneurship education and technology have significant positive effects on youth empowerment and economic development in Nigeria.

According to a study conducted by Abubakar, (2020) which examined the role of entrepreneurship education and technology in promoting sustainable development in Nigeria. The results showed that entrepreneurship education and technology are important catalysts for sustainable development in Nigeria.

Overall, these studies demonstrate the importance of entrepreneurship education and technology in promoting educational development and sustainable development in Nigeria.

### **Theoretical Framework**

Several approaches were developed and put forward by scholars to explain the concept of entrepreneurship education and technology. These theories contribute significantly to the field of entrepreneurship education. Although this paper is anchored on human capital theory, few other theories are stated.

**i. Human Capital Theory:** Human Capital Theory suggests that investing in education and training, particularly in entrepreneurship education and technology, increases individuals' skills and knowledge, which in turn leads to increased productivity and

economic growth. This theory provides a framework for understanding the role of entrepreneurship education and technology in the development of human capital in Nigeria. The propounder of Human Capital Theory is economist Gary Becker. He first introduced the concept in his book "Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education" which was published in 1964.

**ii. Resource-Based View Theory:** The Resource-Based View (RBV) theory was developed by a number of scholars in the field of strategic management. However, two of the most influential scholars in the

development of RBV are Jay Barney and Wernerfelt. Jay Barney, a professor of strategic management at the Fisher College of Business at The Ohio State University, is widely recognized as one of the foremost scholars in the field of RBV. His seminal 1991 article, "Firm Resources and Sustained Competitive Advantage," published in the *Journal of Management*, is considered one of the foundational pieces of RBV theory. The Resource-Based View Theory argues that resources such as knowledge, skills, and technology are key determinants of a firm's competitive advantage. In the context of entrepreneurship education, this theory suggests that the acquisition of knowledge and skills through entrepreneurship education and the use of technology can give entrepreneurs a competitive advantage in the marketplace.

**iii. Social Learning Theory:** The Social Learning Theory was developed by Albert Bandura, a renowned psychologist and professor at Stanford University. Bandura proposed this theory in the mid-20th century,

### Implications.

The theoretical frameworks above have several implications for the development of entrepreneurship education and technology in Nigeria:

This paper adopted human capital theory, as a result investments in entrepreneurship education and technology can lead to increased human capital development, which can in turn lead to increased productivity and economic growth. The use of technology can provide entrepreneurs with a competitive advantage in the marketplace. Entrepreneurs can learn from successful entrepreneurs and use technology to acquire knowledge and skills necessary for business success. The perceived usefulness and ease of use of technology can influence the adoption and effectiveness of entrepreneurship education programs.

### Results

The findings of the paper revealed that entrepreneurship education and technology have significant impact on educational development in Nigeria. The paper revealed that entrepreneurship education can enhance students' creativity and innovation, increase their employability, and improve their entrepreneurial skills. Additionally, the paper discovered that technology can enhance

and it has since become one of the most influential theories of learning and development. Social Learning Theory posits that learning occurs through observation and imitation of others. In the context of entrepreneurship education and technology, this theory suggests that entrepreneurs can learn from successful entrepreneurs and use technology to acquire knowledge and skills necessary for business success.

**iv. Technology Acceptance Model:** The Technology Acceptance Model (TAM) was originally proposed by Fred Davis in 1986. Davis was a professor of Management Information Systems (MIS) at the University of Michigan. The Technology Acceptance Model (TAM) posits that the perceived usefulness and ease of use of technology are key determinants of its adoption. In the context of entrepreneurship education, this theory suggests that the perceived usefulness and ease of use of technology can influence the adoption and effectiveness of entrepreneurship education programs.

teaching and learning, improve access to educational resources, and promote collaborative learning. Furthermore, the paper revealed that there is a positive relationship between entrepreneurship education and technology, and their impact on educational development in Nigeria.

### Conclusion

The paper concludes that entrepreneurship education and technology are two critical catalysts that can drive educational development in Nigeria. These two factors have the potential to address the challenges of unemployment and enhance the quality of education in Nigeria. Therefore, there is a need for policymakers, educators, and stakeholders to prioritize entrepreneurship education and technology in the educational sector, to create a conducive environment for economic growth and development in Nigeria.

### Recommendations

Based on the findings, this paper recommends the following:

1. Policymakers should encourage innovation and entrepreneurship by providing funding opportunities for startups and entrepreneurs. This will help to create a

vibrant entrepreneurial ecosystem in Nigeria and promote economic growth and development.

2. Policymakers should also prioritize providing access to technology for students and entrepreneurs. This includes providing access to e-learning platforms, online courses, and virtual mentorship programs, as well as providing access to market information, funding opportunities, and potential customers and partners.

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3. Policymakers, educators, and stakeholders should continuously evaluate and improve entrepreneurship education and technology programs in Nigeria. This includes monitoring program outcomes, identifying areas for improvement, and making necessary adjustments to ensure that these programs are effective in enhancing educational development in Nigeria.

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## PSYCHOSOCIAL CORRELATES OF CANNABIS USE AMONG A SAMPLE OF NIGERIAN UNIVERSITY STUDENTS

<sup>1</sup>**ANONGO Fredrick Sonter, Ph.D**

Department of Psychology, Nigerian Army University, Biu.

<sup>2</sup>**Atuh Obisike, Ph.D, CLN, JP.**

College Librarian, Nigerian Army College of Environmental Science and Technology, Makurdi.  
0703128889 email: [atuhobisike99@yahoo.com](mailto:atuhobisike99@yahoo.com)

<sup>3</sup>**Ebiai Augustine Ejiroghene, PhD**

Department of Psychology, Dennis Osadabay University, Asaba, Delta State Nigeria  
email: [ebiaiaustin2013@gmail.com](mailto:ebiaiaustin2013@gmail.com)

<sup>4</sup>**Mgbeanuli Chibuike Chinonso**

Department of Psychology, Nigerian Army University, Biu.  
email: [chibecks@gmail.com](mailto:chibecks@gmail.com)

### Abstract

*Cannabis use among undergraduates is increasingly becoming a serious problem in Nigerian universities, with empirical reports showing its potential effects on academic performance and psychosocial health. There are however, paucity of research on possible psychosocial factors that influencing cannabis consumption among Nigerian university students. This research examined parenting styles, self-esteem and peer pressure as correlates of cannabis use among undergraduates of Nigerian Army University Biu. The study adopted a cross-sectional research design, using snowballing technique to recruit 106 students across all the Departments of the university. Standardised instruments were utilised to assess demographic information, parenting styles, self-esteem, peer pressure and cannabis use behaviour of the participants. Multiple regression was used to analyse the data, in line with research objective. Result indicated that authoritarian parenting and peer pressure are significant correlates of students' cannabis use, while authoritative, permissive and self-esteem were not significantly related with students' cannabis use. However, results further showed a significant joint influence of parenting styles, self-esteem and peer pressure on cannabis use, accounting for 13% of its variance. These results indicate that parenting, particularly strict and over controlling parenting and peer influences are the major reasons why university students indulge in cannabis use. It is recommended that university authority and parents should take cognizance of these factors to reduce cannabis use among undergraduates in Nigerian universities.*

### INTRODUCTION

Cannabis used among undergraduates has assumed a worrisome dimension and thus attracted the attention of researchers, policy makers and other relevant stakeholders. Globally, cannabis is one of the second most used illicit substance (United Nations Office on Drugs and Crime, UNODC, 2022), typically occurring between late adolescent and early adulthood (Degenhardt & Hall, 2012), which coincidentally corresponds with university age. Previous statistics have indicated that, after alcohol and tobacco, cannabis is one of the most commonly used substance by university students (Arbour-Nicitopoulos, 2010). A recent World Drug Report (2020) indicated that more than 35.6

million people suffer from substance use related disorders which corresponds approximately to 5.2% of the total prevalence in Africa alone.

In Nigerian, rates of cannabis consumption among university students has been consistently high. Previous literature on the lifetime prevalence of cannabis use among university students in Nigeria ranged 1.4% in 1992, 20% in 2010 and 39.8% in 2017 (Ekwueme, & Chukwunke, 2010; Akindutire & Adegboyega, 2012; Obi, Adayonfo, Iwueze & Ekwe, 2017), cutting across the three geo-political zones in the south (i.e. south-east, south-west and south-south) respectively. This trend in

reported in the northern Nigeria where rates of cannabis consumption is relatively higher. Report by Ahmed, (2012) apart from cigarette and tramadol, cannabis is the most commonly abused drug in northern Nigeria. Accordingly, existing findings have reported steady progression in use of cannabis among northern Nigerian youths, ranging from 7.3%, 19.7% and 43.6% respectively (Idris & Sambo, 2009; Mohammed, 2014; Yunusa, Bello, Idris, Haddad, & Adamu, 2017).

At the Nigerian Army University Bui, there are many indicators and anecdotal evidences suggesting high cannabis use and dependence among university students. This has become more precarious with the co-existence of civilian and military population which previous research in Nigeria have associated with high cannabis use (Kazeem & Abdulkarim, 2014). Thus, a co-existence of military and civilian students could increase vulnerability due to imitative and social learning possibilities that are imminent. This portends a danger and thus requires urgent research attention considering that increased cannabis use could affect memory, concentration, attention, induce mental laziness, which will ultimately affect academic performance and progress. Cannabis use among university students can also promote social vices, including but not limited to cultism, examination misconduct and malpractice, risky sexual behavior and gangsterism. Clearly, this indicates that cannabis consumption is a problem and justifies continuous research to unravel risk factors and new patterns, especially in high prevalent environments.

Suffice to say that there are existing research on correlates of cannabis use. In this regard, many factors such as sexual enhancement, conformity and coping (Renata, Ighes & Ivan, 2013), family background, attendance of social events, peer pressure (Shehu & Idris, 2008), reading at night and attempt to relieve stress (Oshodi, Aina, Onajole, 2010) have been implicated. It is worthy to note that, aside these factors, there are other salient variables that can make university students to indulge in cannabis use. Prior parental influences, students' evaluation of self-worth and peer influences are other germane factors that can influence cannabis use particularly among university students.

Parenting styles are various techniques that parents employ in bringing up their children. According Baumrind (1997) three basic parenting styles exist, namely authoritative, authoritarian and permissive parenting style. Authoritative parenting which is the best style of parenting because it involves punishing the child when needed and pampering the

child when needed; the child knows the consequences of his actions described and knows why rules are set. The authoritarian parenting on the other hand is also known as strict parenting because the child has no decision of his or her own and he or she is constantly under the shadow of his parents. In this kind of parenting, parents are usually over strict and never allow their children to express themselves. Permissive parenting is a parenting style in which parents provide excessive freedom, love and care to their children. Documented research has shown that exposure to different parenting styles leads to different psychosocial and physical outcomes in both adolescents and youths (Darling & Steinberg, 1993; Arria, Kuhn, Caldeira, Grady, Vincent & Wish, 2018). Therefore, early parental experiences may influence current cannabis use in Nigerian university students, but this has not been well understood.

Self-esteem is another factor that may influence cannabis use in university students. This is defined as the evaluation of self-worth, in terms of ability or value that people place on themselves, in which low evaluation may positively influence thoughts and behaviours concerning cannabis use. According to Adewumi (2017), adolescents' substance abuse starts when they begin to grow-up and are confronted with low self-esteem that hinders social adjustment and promote worry about being loved in a positive way. In a university environment where opportunities for social interaction are imminent, social comparison is likely to occur amongst students. In such comparison and evaluation, students who show feelings of low self-worth may become more disposed to cannabis use.

Another crucial factor that could influence cannabis use among university students is peer influence. Peer pressure or influence is formulated as a subjective experience of feeling pressured, urged or dared by others to do certain things (Santor, Messervey, & Kusumaker, 2000; Westling et al., 2008). It is a pressure, planned or unplanned, exerted by peers to influence others behaviour. The freedom associated with university environment makes peer influence a potential risk factor for cannabis use. Peer influence may become even more potent in an environment co-habiting two highly prevalent groups, as it provides increased opportunity for social learning. Although, previous research among Nigerian university students have associated peer influence to substance use (Abikoye, et al., 2015), the

role that this crucial variable play in cannabis among university students remains seriously understudied.

Therefore, given that current rates of cannabis use among university students are high, and with lack of domestic research to identify risks, this research was

## Method

### Design and Setting

The design for this research is a cross-sectional survey that examines psychosocial correlates of cannabis use among undergraduates of Nigerian university Biu. The Nigerian Army University Biu is a conventional military-owned institution established in 2018 with the mandate to provide excellent intellectual and moral training to civilian and military students. The choice of the setting was informed by the researchers' observations and anecdotal evidences showing astronomical rise in cannabis consumption among the students of the university.

### Participants and procedure

Participants comprised 106 eligible and well-consented students who met research criteria. Eligibility criteria required students to be cannabis users who were willing to participate in the research. The research adhered strictly with the ethical declaration of Helsinki. Informed consent was sought and obtained from all participants before administering the questionnaire. We also ensured voluntary and anonymous participation and treated information provided to us with utmost confidentiality. Participants were aged 18 to 50. A total of 69.2% profess Islam, while 30.2% are Christians. Most of the participants representing 88.6% are male, while 9.34% are female students. Concerning students' ethnic affiliation, 43% are Hausas, 30.8% are Yoruba, 9.3% are Ibos, while 16.8% are students from other ethnic groups. Majority of the cannabis users are students in 200L, with the total percentage of 33.6%.

We also obtained approval from the school authority and consent from each participant before embarking on the data collection. Due to the sensitivity of study, we utilised snowball sampling technique, which provided much security and comfort to the study participants and also ensured valid data gathering. Participants responded to a 72-item questionnaire, comprising measures of demographics, parenting styles, self-esteem, peer

designed to examine the influence of early parenting styles, self-esteem and peer influence on cannabis use among undergraduates of Nigerian Army University, Biu.

influence and cannabis use. Each questionnaire took approximately 10 minutes of the respondent's time. In all, data collection lasted for approximately two weeks, beginning from 15<sup>th</sup> to 31<sup>st</sup> December, 2022. At the end of approximately two-week data collection period, (106) fully filled questionnaires (out of the 140 administered) were returned, representing 75.7% return rate.

### Measures

**Parenting Styles:** Parenting style were assessed using Baumrind parenting style scale (Baumrind, 1991). This is a 32-item, self-report questionnaire based on Baumrind's conceptualization of Authoritative, Authoritarian, and Permissive parenting styles. Participants retrospectively responded to the instrument about the various ways in which they were raised by their parents. Each item was rated on a 5-point Likert scoring format: 1 = Never to 5 = Always, with higher scores indicating more frequent use of the described behavior. In a review of the psychometric properties of the scale, Robinson, Mandleco, Olsen, (2001) reports the reliabilities as follows: authoritative ( $\alpha = .86$ ), authoritarian ( $\alpha = .82$ ), and permissive ( $\alpha = .64$ ). The scale has been widely used among youths and found to be an excellent measure of parenting style (Robinson, Mandleco, Olsen, & Hart, 2013).

**Self-esteem:** Self-esteem was measured using the 10-item Rosenberg Self-esteem scale (Rosenberg, 1965). This is a widely used and standardized instrument that assess the level of self-esteem in diverse populations. Participants responded to the scale on a 4-point Likert format: 1=strongly disagree to 4= strongly agree. Previous studies have reported good psychometric properties (high reliability and validity with Guttman scale coefficient of reproducibility of 0.92 (Hatcher, Jennifer; Lynne & Hall, 2009).

**Peer influence:** We assessed peer influence using Armsden and Greenberg's peer influence scale (Armsden & Greenberg, 1987) which is a 24-item standardised

measure of peer influence among adolescents and youths. Peer influence scale (PIS) was developed mainly for the reason that youth problems are increasing day by day and peer pressure is one of the major factors influencing such problems among them. The response categories ranged from (1) Almost never or never true (2) Not very true (3) Sometimes true (4) Often true (5) Almost always or always true. High scores indicate higher level of peer pressure and low scores indicate lower level of peer pressure. On psychometric properties, the internal consistency of the Armsden and Greenberg 24-item scale was established by using cronbach’s alpha coefficient and a reliability of 0.92 was obtained for the final 24 items. Also, high test-retest reliability ( $r=0.33^{**}$ ,  $p<.01$ ) and internal consistency ( $r=0.77^{**}$ ) was reported for the scale (Armsden& Greenberg (1987).

**Cannabis Use:** Students’ cannabis use was assessed using Cannabis Use Identification Test-Revised (CUDIT-R), which is a brief cannabis misuse-screening tool that has widely been used to identify cannabis problems among adolescents and young people (Adamson et al., 2010). The scale is generally accepted as a psychometrically reliable measure and has been extensively been utilised in students research. Sample

**Results**

**Table 1: Multiple linear regression showing independent and joint influence of parenting styles, self-esteem and peer influence on cannabis use among undergraduates.**

Variable	R	R <sup>2</sup>	df	F	β	t	P
Constant					.26	4.6	
Authoritative parenting					.02	.21	>.05
Authoritarian parenting	.35	.13*	5,100	2.893	.17	1.82	<.05
Permissive parenting					-.06	-.63	>.05
Self-esteem					-.14	-1.4	>.05
Peer influence					.26	2.63	<.05

As presented in table 1, authoritarian parenting emerged as a significant factor influencing cannabis use among students of Nigerian Army University, Biu ( $\beta = .17$ ,  $t =$

questions include; How often do you use cannabis? 2) How many hours were you “stoned” on a typical day when you were using cannabis?. Response options vary from question to question. Most questions use the following: Never (0), less than monthly (1), monthly (2), weekly (3), daily or almost daily (4). A cut-off of 8 or above is considered positive for hazardous use, while 12 or above is considered positive for possible cannabis use disorder (Adamson et al., 2010).CUDIT-R has been used extensively among students and found to have good psychometric properties , with Cronbach alpha of 0.78 (Adamson et al., 2010; Gyepesi, et al., 2012). In our study, we found cronbach’s alpha of 0.92, which is considered acceptable.

**Data Analysis**

We used Statistical Package for Social Sciences (SPSS Version-23) to analyse research data. Demographic data were analysed with the use simple percentages, frequencies, mean and standard deviation. Multiple linear regression was utilised to analyse result of the main variables, which aimed at examining the independent and joint influence of parenting styles, self-esteem and peer influence on cannabis use among the participants.

1.82,  $p<.05$ ). However, authoritative ( $\beta = .02$ ,  $t = .21$ ;  $P>.05$ ) and permissive parenting ( $\beta = -.06$ ,  $t = -.63$ ,  $P>.05$ ) do not significant influence on students’ cannabis use.

This result means that students who are received authoritarian parental practices during early years are more vulnerable to cannabis use. This implies also that when parents are very strict, uncompromising, highly disciplined and show excessive control over their children, such harsh practices could temporarily suppress negative emotions and desires. However, coming to the university environment which offers much freedom, these suppressed impulses and desires may begin to manifest through substance use.

Self-esteem has no significant influence on undergraduates' cannabis use ( $\beta = -.14$ ,  $t = -1.4$ ;  $p > .05$ ). This result means that the way NAUB students evaluate themselves in terms of personal or academic worthiness does not significantly influence their indulgence in cannabis use. However, peer influence has significant influence on cannabis use among the participants ( $\beta = .26$ ,  $t = 2.63$ ;  $p < .05$ ).

The results as presented in table 1 also revealed a significant joint influence of parenting styles (authoritative, authoritarian, permissive), self-esteem and peer influence on cannabis use among students of Nigerian Army University, Biu [ $R = .35$ ,  $R^2 = .13$ ,  $F(5,100) = 2.893$ ,  $P < .05$ ]. The three independent variables jointly accounted for 13% in the variance of students' cannabis use. This result implies that different styles in which students are nurtured, their perception and evaluation about self and pressure they get from peers contributed at least 13% in explaining why NAUB students take cannabis. This finding strongly supported our objective that parenting styles, self-esteem and peer influence would influence cannabis use among university students in Nigeria.

### Discussion

This research examined parenting styles, self-esteem and peer pressure as influencing factors to cannabis use among undergraduates of Nigerian Army University Biu. Analysis of students' scores on CUDIT-R indicated that, out of the total population of 106, 34.9% scored positive for hazardous cannabis use, while 19.8% had scores considered as possible cannabis use disorder. This means that, more than 50% of these students currently indulge in problematic cannabis use, to which a significant number are in need of intervention. Indeed, this portends a serious problem that needs urgent attention from

parents, school management, government and other concerned individuals and groups. The high prevalence found in this research is not surprising as previous research have already established that more than 30% of Nigerian university students indulge in substance use (Ekwueme et al. 2010; Akindutire et al., 2017). Therefore, with the coexistence of the two highly indulgent groups, hazardous cannabis use is expected.

Our research findings on the study main objectives indicated that only authoritarian parenting is significantly an influential factor in students' cannabis use behaviour. This finding is consistent with the findings of Schucksmith and Garcia (2009) whose research have associated authoritarian parenting with alcohol and other substance use among adolescents. The result implies that, when students encounter harsh and domineering parenting during childhood, they may repress their pleasure impulses and desires, apparently for fear of punishment. However, the express freedom common in the university environment makes it easy for repressed desires, impulses and feelings to manifest through cannabis use.

Our results have implication for parenting; it can guide parents to adopt flexible parenting that prevent repression of desires, which have negative effects on future behaviour. The findings on self-esteem and cannabis use is insignificant and therefore implies that students' feeling of self-worth has no independent role in cannabis use, thus contradicting previous studies (e.g. Barone, 2019; Bolakale, & Boman, 2015). We however, we found significant influence of peer influence on cannabis use. This result corroborates previous findings (e.g. Lai et al. 2013; Jenkins, 2021) associating peer influence with substance use in University students. This implies that having a cluster of social networks, especially substance abusing friends can encourage students to indulge in cannabis use. The university environment provides more opportunity for social relationship which makes students to learn through social interaction. Finally, this research found significant joint influence of parenting styles, self-esteem and peer influence on cannabis, implying that a combination of these factors could significantly influence students' cannabis use.

This study has found a very high and disturbing prevalence of cannabis use among university students in Nigeria. This prevalence is linked to problematic

parenting and social influences that are related to peer influence on campus. Consequently, our study recommends very strongly that, the university through the counselling unit, should thoroughly initiate and implement drug counselling for youths, making them to understand the risks and consequences associated with continuous usage. The study also recommend for best parental practices that as a way of reducing problematic parenting that propels cannabis use. A little way from our

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findings, we also recommend for the university management to adopt punitive measures against negative peer influences and students who indulge in this undesirable behaviour, to serve as deterrent. . Given the dearth of empirical work on this very important issue, it is also recommended that more research be carried out to fully explore the problem of cannabis use among university students, especially in this location.

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## ASSESSMENT OF SCHOOL RECORDS KEEPING ON THE ADMINISTRATION OF PUBLIC SECONDARY SCHOOLS IN KOGI STATE.

**OKINO Momoh Hajara**

Joseph Sarwuan Tarkaa University, Makurdi

+2348060045808

### Abstract

*This study investigated the assessment of school records keeping on the administration of public secondary schools in Kogi State. The study focused on continuous assessment records, administrative records. Two research questions and two null hypotheses guided the study. This study adopted survey research design. The population of the study was 1,399 while the sample was 311 respondents. Taro Yamen was used to determine the sample size of 311 respondents. The instrument for data collection was a 14 items self-structured questionnaire tagged "School Records Keeping and Administration of Secondary Schools Questionnaire (SRKASSQ)". Three experts validated the instrument used for the study, the reliability estimate and the overall reliability coefficient of 0.82 was obtained. Mean and standard deviation were used to answer the research questions while Chi-square statistic was used to test the null hypotheses formulated for the study at 0.05 level of significance. The findings of the study were that continuous assessment records, administrative records, influence the administration of public secondary schools in Kogi State.*

### INTRODUCTION

#### Background to the Study

The goals of Nigerian education as highlighted in the National Policy on Education (FRN 2013) include: the inculcation of national consciousness and national unity; the inculcation of the type of values and attitudes for the survival of the individual and the Nigerian society; the training of the mind in the understanding of the world around; and the acquisition of appropriate skills and the development of mental, physical, social abilities and competencies as equipment for the individual to live in and contribute to the development of the society. Education at secondary school level is defined by Federal

Government of Nigeria (FGN, 2013), as the form of education children receive after primary education and before the tertiary stage. The aim of secondary education is to prepare the individuals for useful living within the society; and for higher education. School is one of the very most important establishments in human societies. The purpose for which the school is established can only be achieved through effective administration. Effective administration therefore is that administration that helps to bring about optimum achievement of any organization/establishment and in this case, the school.

The influence of record keeping in an organization set-up like school cannot be overemphasized. This is because its continuity depends on availability of useful records of the past activities. Onweh, Etim and Eniang (2018) maintain that for accountability to be worthwhile in the school, school records are mandatory for educational institutions to be kept on regular basis. Usman in Alabi (2017) observes that secondary school records are important because they contain vital information which aids the running of the school which

contains vital information. They serve administrative, supervisory, professional development and historical purposes. Usman further itemized four purposes of school record keeping which are: assist in monitoring the progress of the members in the school, assist in administration by assisting the school in planning its activities and researches, Record keeping provides a guide for school supervision and inspection and helps successive administration in the schools as historical base among others.

Personnel records are also another important school records that can influence the administration of secondary schools. Personnel records are records pertaining to staff of a school. These records are accumulated, factual and comprehensive information. All information with effect to human resources in the school is kept in a systematic order. Such records are helpful to school administrators in various decision-making area. Paseda in Erima and Wamukoya (2017). The author further states that those personnel records are maintained for formulating and reviewing personnel policies and procedures. Complete details about all

One of the major school records which influence secondary school administration is financial records. Financial records have to do with the management of the schools' finance. The records show the total amount that the school has and how much has been expended for the development of the school. Accurate records of all school fees collected are kept by the school head. Financial records provide information for checks and balances as well as guiding against loss of confidence in the school by parents/guardians (Agbe, 2015). A strong emphasis has made that financial records keeping is very

This Unfortunately the researcher has observed that in many of the educational institutions, particularly the secondary schools in Kogi State, it is the general trend to find that, either records are not kept at all or they are kept in the most haphazard manner. This is because people that are saddled with the responsibility of records keeping in secondary schools in Kogi State most often appear to neglect it because they under-estimate the

### **Statement to the Problem**

Records management is one of the basic functions of school administrators and cannot be over emphasized in any way. The continuity of any school organization depends on available and accessible useful records of past activities. Records constitute a storehouse of useful information to students, parents, teachers, school heads and employers on the background activities and progress of staff and students. The keeping of records furnishes not only parents but teachers, principals with data on the activities, problems and achievement of their students. Unfortunately, the researcher observed that despite the

employees are maintained in personnel records, such as, name, date of birth, marital status, academic qualifications, professional qualifications, previous employment details, among others. Nwagwu (2018) unfolds that on regular basis information on personnel service, and students are kept properly for references purposes. To enable the school administrator identify students who attend classes regularly there is need for proper records keeping. Effective personnel records keeping can also enable a teacher or school administrator to identify a student who is a truant.

essential in an organization and school administration in order to maintain administrative effectiveness, academic excellence and development. It is essential that modern records keeping technology be involved in financial records keeping because that would make financial calculations to be accurate. Through computer, accurate and better reports would be made possible in the school for effective administration. It is therefore important for an administrator to appoint a financial expert or an accountant who has been trained to keep financial records.

importance of these records. Sometimes they may feel that some of these records could affect them or serve as a hindrance for the achievement of their selfish agenda. It is against this background that the researcher intends to investigate the influence of school records keeping on the administration of public secondary schools in Kogi Central Senatorial District.

importance of school records in the achievement of educational objectives, these records do not seem to be adequately managed in terms of provision, utilization and maintenance by school administrators. From observation, it becomes obvious that accurate, reliable, and trustworthy records that fulfill evidential requirement are been created but not properly managed in public secondary schools in Kogi State. It must therefore be emphasized that when school records are not properly kept, this may hinder efficient and effective monitoring of teachers' activities, which can in turn affect the

determination of students' academic performance in the schools as well as the administration of schools. Based on this, it can be said that problems exist as regards management of school records which may include insufficient skilled and experienced record management personnel and possibly low priority attention to records management in the scheme of things, which may in turn affect or influence effective administration of schools.

### **Objectives of the Study**

1. determine the influence of personnel services records keeping on the administration of public secondary schools.

### **Research Questions**

The following research questions were raised to guide the study:

1. What is the influence of personnel services records keeping on the administration of public secondary schools?

### **Statement of Hypotheses**

The following null hypotheses were formulated and tested at 0.05 level of significance.

## **LITERATURE REVIEW**

### **Systems Theory by Ludwing Von Bertalanffy (1950)**

The System Theory was propounded by a Biologist; Ludwing Von Bertalanffy in 1950, who stated that, a general systems model is used as managing techniques that would allow managers to relate different specialties and parts of the company (organization) to one another, as well as to external environmental factors. The theory assumes that, a system is a set of different independent parts working together in interrelated manner to accomplish a whole. The system theory puts forth the premise that organizations, like living organism, are made up of numerous components that must work together in harmony for the larger system to succeed. In fact, systems are goal-oriented and engage in feedback in order to meet the goal of the organization and every

From the forgoing, it is clear that problems exist concerning school records keeping that invariably affect proper administration of secondary schools in Kogi State. It is against this backdrop that this research seeks to investigate the influence of school records keeping on the administration of public secondary schools in Kogi State.

2. ascertain the influence of financial records keeping on the administration of public secondary schools.

2. What is the influence of financial records keeping on the administration of public secondary schools?

1. Personnel Services records keeping do not significantly influence the administration of public secondary schools.

2. Financial records keeping do not significantly influence administration of public secondary schools.

part of the system is interdependent with each other working together towards the goal. It states that organizational success relies on synergy, interrelations and interdependence between different subsystems. The relationship between the system theory and subject of this work is the emphases made on the organization which is made up of numerous components that must work together in harmony for the larger system (whole) to succeed. Its holistic approach is necessary to understand the influence of records keeping on school administration in secondary school. In summary, a system then, is a set of things that affect one another within an environment and form a larger pattern that is different from any of the parts.

### Review of related empirical studies

Vincent, Veronica and Okon (2015) conducted a study on the relationship between record keeping and administrative effectiveness in Secondary Schools in Akwa-Ibom State. The purpose of this study was to find out the relationship between record keeping and administrative effectiveness in Secondary Schools in Akwa-Ibom State. Two research questions and two

Austin and Mark (2015) investigated the Effects of Records Keeping on the Management of Secondary Education in Otukpo Local Government Area of Benue State. The study examined the effects of records keeping on the management of secondary education in Otukpo Local Government Area of Benue State. Two research questions and two hypotheses guided the

Omoha (2013) conducted a study on the management of school records in secondary schools in Otukpo Education Zone of Benue State. The purpose of the study was to assess the management of school records in secondary schools in Otukpo Education Zone of Benue State. Four (4) research questions guided the study and three (3) hypotheses were formulated and tested at 0.05 level of significance. The findings of the study revealed that there are many problems associated with records keeping management in secondary school system in Otukpo and that through various ideal administrative practices and strategies, there will be

### METHODOLOGY

Survey Research design was adopted for the study. The study was carried out in Kogi State. The population of the study comprised 1,399 respondents out of which 47 are clerical staff, 45 are principals and 1,307 are teachers in all public secondary schools in Kogi Central Senatorial District of Kogi State. The sample size for the study is 311 respondents. The sample size was determined using Taro Yamen formula. The sample comprised 10 Clerical staff, 10 school principals, and 291 teachers. Multi-stage sampling procedure was used to select the sample size. The instrument for data collection is a self-structured questionnaire tagged "School Records Keeping and Administration of

null hypotheses were used for the study. The major findings of the study were that there is a relationship between academic record keeping and administrative effectiveness and the relationship between adequate financial records keeping administrative effectiveness. The study also found out that there is a relationship between academic record keeping and administrative effectiveness.

study. The findings of the study were that appraisal and decision-making records keeping significantly affect the management of secondary schools in Otukpo Local Government Area of Benue State. Also, the result revealed that appraisal and decision-making records keeping significantly affect the management of Osecondary schools.

holistic improvement on records keeping in school system. The result revealed that administrative records keeping practices that which include; principals delegating the keeping of day-to-day school records to teachers recording event as they occur in the appropriate record booklet, keeping accurate custody of record materials and books in the principals offices, monitoring of teachers adherence to instructions on the keeping of records, checking every item of information in the records before appending signatures by principals enhance the management of school records.

Secondary Schools Questionnaire (SRKASSQ)". The instrument was subjected to face and content validation by three experts. To ensure the reliability of the instrument, 30 copies of the instrument were trial tested on 6 school principals, 6 clerical officer and 18 teachers in Kabba L.G.A of Kogi State which is not part of the sampled local government area to test the internal consistency of the instrument. The result showed reliability co-efficient of, 0.75 and 0.84 respectively for the two clusters and overall average of 0.82 was obtained. The data collected were analyzed using mean and standard deviation (SD) to answer the research questions. Very High Influence (VHI), 2.50-3.49 High

Influence (HI), 1.50-2.49 Low Influence (LI), while 0.50-1.49 was considered as No Influence (NI). The null hypotheses were tested using Chi-square statistical tool at 0.05 level of significance. The decision rule for the rejection or acceptance of each hypothesis was based on

the set value of 0.05, where the P-value was equal to or greater than the set value of 0.05( $P > 0.05$ ) the hypothesis was accepted but was rejected where the P-value was less than the set value of 0.05( $P < 0.05$ ).

**RESULTS AND DISCUSSION**

**Research question one:** What is the influence of personnel services records keeping on the administration of public secondary schools?

**Table one: Mean and Standard Deviation of the respondents on the influence of personnel services records keeping on the administration of public secondary schools**

S/No	Item	VHI	HI	LI	NI	Mean	SD	Decision
1	Staff record book influence school administration	175 (56.3%)	103 (33.1%)	21 (6.8%)	11 (3.5%)	3.42	.77	High influence
2	Staff movement book influence school administration on staff supervision	86 (27.7%)	189 (60.8%)	30 (9.7%)	5 (1.6%)	3.14	.64	High influence
3	Staff personnel file influence staff information on emergency	86 (27.7%)	169 (54.3%)	50 (16.1%)	6 (1.9%)	3.09	.73	High influence
4	Student personnel file influence ease of information of student background	73 (23.8%)	167 (54.4%)	61 (19.9%)	6 (2.0%)	3.07	.71	High influence
5	Staff nominal roll influence school administration	100 (32.2%)	152 (48.9%)	54 (17.4%)	5 (1.6%)	3.00	.71	High influence
6	Staff development record influence effective school administration	90 (29.9%)	165 (53.1%)	50 (16.1%)	6 (1.9%)	3.11	.74	High influence
7	Staff appraisal record influence effective school administration	91 (28.5%)	163 (53.2%)	51 (16.3%)	6 (2.0%)	3.09	.72	High influence
<b>Cluster Mean</b>						<b>3.13</b>	<b>0.71</b>	<b>High influence</b>

Data presented on table 1 indicated that items 1-7 had a mean rating of 3.42, 3.14, 3.11, 3.09, 3.07 and 3.00 with corresponding standard deviation of 0.77, 0.64, 0.74, 0.72 and 0.71 respectively and a cluster mean of 3.13 and S D of 0.71, the result shows that personnel service records keeping has high influence on the administration

of public secondary schools. On the basis of the decision for accepting or rejecting mean value based on the criteria, the table shows that the respondents accepted all the items on the table as personnel services activities that as personnel services administration of public secondary schools in Kogi State.

**Research question two:** What is the influence of financial records keeping on the administration of public secondary schools?

**Research 2: Mean and Standard Deviation of the respondents on the influence of financial records keeping on the administration of public secondary schools**

S/No	Item	VHI	HI	LI	NI	Mean	SD	Decision
1	Cash book records influence useful information on financial	106 (34.1%)	160 (51.4%)	36 (11.6%)	9 (2.9%)	3.16	.73	High influence

transactions of the school								
2	Financial records influence school administration	89 (29.0%)	162 (52.8%)	53 (17.3%)	3 (1.0%)	3.09	.70	High influence
3	The school budget influence school heads to identify sources revenue for effective administration	94 (30.2%)	152 (48.9%)	56 (18.0%)	9 (2.9%)	3.06	.77	High influence
4	The school fee register influence proper accountability on the part of school head	98 (31.5%)	135 (43.4%)	62 (19.9%)	16 (5.1%)	3.01	.84	High influence
5	The imprest account influence the ease of preparation of school budget	116 (37.4%)	150 (48.4%)	42 (13.5%)	2 (.6%)	3.22	.69	High influence
6	Financial records influence information concerning expenditure of the school administration	105 (33.8%)	160 (51.4%)	37 (11.9%)	9 (2.9%)	3.16	.74	High influence
7	The school cash book influence needed information in budget	111 (35.7%)	144 (46.3%)	44 (14.01%)	12 (3.9%)	3.13	.79	High influence
<b>Cluster Mean</b>						<b>3.11</b>	<b>0.75</b>	<b>High influence</b>

Table 2 revealed the responses of respondents on the influence of financial record keeping on the administration of public secondary schools in kogi state. The data presented on table 2 shows the mean values of 3.22, 3.16, 3.13, 3.09, 3.06 and 3.01 with a corresponding standard deviation of 0.69, 0.74, 0.79, 0.70, 0.77 and 0.84 respectively and cluster mean of 3.11 and SD of 0.75 the result shows that the financial record keeping has high influence on the administration

of public secondary schools. On the basis of the criteria set for decision making, any item with a mean score of 2.50 implies that the respondents responded positively that financial record influence the administration of public secondary school. The summary of the analysis on table 4 revealed that all the items are financial related records that influences the administration of public secondary schools in kogi state.

**Hypotheses Testing**

The hypotheses of the study are tested using chi-square at 0.05 level of significance.

**Hypothesis 1:** Personnel Services records keeping do not significantly influence the administration of public secondary schools.

**Table 3: chi-square test of significance of personnel services records keeping on administration of public secondary schools**

	Df	$\chi^2$	P	Sig level	Decision
Chi-square	15	336.69	0.00	0.05	Rejected
No valid Cases	311				

P<0.05

**Table 3** shows that the P- value of 0.00 is less than alpha-value of 0.05 (P<0.05) at df =15. Therefore, the null hypothesis which states that Personnel Services records keeping do not significantly influence the administration of public secondary schools. is therefore

rejected. This implies that Personnel records keeping have significant influence on administration of public secondary school in Kogi Central Senatorial district of Kogi State.

**Hypothesis 2:** Financial records keeping do not significantly influence administration of public secondary schools

**Table 4:** chi-square test of significance of financial records keeping on administration of public secondary schools

	Df	$\chi^2$	P	Sig level	Decision
<b>Chi-square</b>	15	230.02	0.00	0.05	Rejected
<b>No valid Cases</b>	311				

P<0.05

**Table 4** shows that the P- value of 0.00 is less than alpha-value of 0.05 (P<0.05) at df =15. Therefore, the null hypothesis which states that financial records keeping do not significantly influence administration of

public secondary schools is therefore rejected. This implies that financial records keeping have significant influence on administration of public secondary school in Kogi Central Senatorial district of Kogi State.

**Discussion of Findings**

Based on the findings of the study, the following discussions were made;

Result on table one which was buttress by hypotheses three that personnel services records keeping influence the administration of public secondary schools in Kogi Central Senatorial District. This finding agreed with the finding of Austin and Mark (2015) who found

that personnel records are helpful to school administrators in various decision-making areas. Also, the finding corroborate with the finding of Omoha (2013) who asserts that good personnel records keeping are used for formulating and reviewing personnel policies and procedures in the administration of school.

The result of the major findings two revealed that financial records keeping influence the administration of public secondary schools in Kogi Central Senatorial District. The finding corroborate with the study of Vincent, Veronica and Okon (2015) who found out that the information in the school fees register helps the school administrator to avoid sending a learner home in error when they have paid their school fees and also make the process of accountability easier. On the influence of personnel service records on the

administration of public secondary schools in kogi state, the major findings reveals staff record book, staff movement books and staff development records. These findings are in line with the finding of Ogbonnaya (2012) who revealed that every personnel employed in a school have a personnel file. This file contains details information about the individual. This implies that the personnel service records influence the administration of public secondary schools in Kogi State.

The major findings on the influence of financial records on school administration indicates, impress account, cash book records and financial records as documents that influence the administration of public secondary schools in Kogi State. This finding is in line with Agbe and Odeh (2015), that financial records keeping is very

essential in an organization and in school administration. Financial record is used for maintaining effective monitoring of financial transaction that goes on within the school system. Financial record would enable the school administration to arrive at a better financial decision.

## CONCLUSION AND RECOMMENDATIONS

Based on the results of the study, it was concluded that records such continuous assessment record, administrative records, personnel services records and financial records keeping have significant influence on the administration of public secondary schools in Kogi Central Senatorial District. Based on the findings of this study, the following recommendations were made: The school administration should imbibe the culture and practice of contains assessment records of students. This will facilitate quick retrieval of information for future

purposes. The school principal should specifically delegate the responsibility of keeping staff records books to non-teaching staff. Non-academic staff should be train and re-train on staff school record keeping process and Financial records are sensitive documents. Therefore, the school principal should ensure that documents relating to financial transaction are kept appropriately. Safety of financial records guarantee accountability and transparency.

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# EVALUATING THE PERFORMANCE OF EGM- 2008 MODEL IN ORTHOMETRIC HEIGHT MEASUREMENTS

## - A CASE STUDY OF LOBI AREA, MAKURDI, BENUE STATE, NIGERIA

AGBO, JOSEPH AGBAJI  
AMEH, BENJAMIN MGBEDE

### Abstract

*In various real-life situations, the knowledge of heights is crucial for understanding the relative vertical positions of neighboring entities in a common reference system called datum. Classical levelling, over the years, is the known technique used in determining relative heights of points, which are commonly called Orthometric Heights. This technique is laborious and time consuming. The recent success in the determination of reliable global geoid model gave opportunities to the rapid determination of Orthometric heights of stations. The global Geopotential Earth Model, can be applied to the Ellipsoidal heights obtained from GPS survey in determining orthometric heights. The study evaluates the performance of the Earth Geopotential Model (EGM 2008) in determining the Orthometric Heights from GPS survey and Geodetic Levelling (Geometric Technique) within Makurdi, Benue State. The separation between the Orthometric heights obtained using the classical levelling ( $H_{LEVEL}$ ) and the Orthometric heights obtained by applying the global model ( $H_{EGM2008}$ ) is fairly parallel, with a mean separation between the two of 1.234m. Analysis of the results obtained, shows a maximum and minimum residuals from EGM 2008 model are -1.723 m and -1.215 m respectively, and a standard error value as 1.036 m which is considered insignificant for the satisfactory accuracy of orthometric height within the study area. using Geometric Method.*

**Keywords:** Geometric technique, EGM 2008, Orthometric Height, Ellipsoidal Height, Geoid Undulation, GNSS.

### 1.0 INTRODUCTION

In real life situations, height data is needed for various purposes which include infrastructural development such as: construction of building, skyscrapers, roads, bridges, dams, drainages, airports, tunnels, pipelines, disaster monitoring and remediation, subsidence monitoring, study of sea level variation, monitoring of high rise buildings and all other environmental and engineering works.

There are several methods of height determination of which levelling is the most common. Levelling is the process of determining the difference in elevation between points with reference to a known datum using an instrument called "Level". The datum usually adopted is the Geoid, which in practical terms coincides with the average surface of the ocean and can be referred to as the Mean Sea Level (MSL) (Aleem, 2014).

Determination of geoid has been one of the main research areas in the science of Geodesy for decades. As a result of the wide spread use of GPS in geodetic applications, great attention is been paid to the precise

determination of local/regional geoid with an aim to replace geometric levelling, which is a very burdensome measurement work, with GPS surveys. GPS technique provides the surveyor with three-dimensional coordinates including ellipsoidal heights (h) with respect to its reference ellipsoid, the geocentric WGS84 (World Geodetic System 1984).

The advent of the Satellite-based positioning systems such as the Global Navigation Satellite System (GNSS) has brought about changes in point's position and point's velocity determinations. One of the advantages of the GNSS system is its suitability of determining the Orthometric heights of points from the Ellipsoidal heights obtained from the system, by applying geoidal undulation (N). The GPS gives elevations above a reference Ellipsoid, World Geodetic System 1984 (WGS84) (Isioye et al., 2011); thus, it provides this Ellipsoidal height, which can be transformed into Orthometric height if the geoidal height normally derived from a Gravimetric geoid of the area is known (Abdullah, 2010).

To accomplish this transformation between the ellipsoidal heights and orthometric heights, the undulation or separation of the geoid from the ellipsoid (N) must be known. Basically a WGS84 ellipsoidal height (h) is transformed to an Orthometric height (H) by subtracting the geoid- ellipsoid separation (N), (or the geoid undulation). Depending on data availability and accuracy requirements, there are two principal approaches for determining geoid models, which are utilized to transform GPS ellipsoidal heights to Orthometric heights. These approaches include gravimetric method and interpolation between geometrically derived geoid heights using the benchmarks of which three dimensional coordinates and Orthometric heights have been determined according to GPS and leveling measurements. The separation between ellipsoidal and geoidal surfaces is known as Geoidal Undulation (N). The relationship between the three geodetic surfaces (Figure 1.1) is mathematically represented by Equation 1.1 (Bomford G., 1980):

$$N = h - H \cos \varepsilon \quad (1.1)$$

where;

N = Geoidal Undulation

h = Ellipsoidal height

H = Orthometric Height

$\varepsilon$  = deflection angle

This deflection angle is usually small; and given the assumption of small and gently rolling geographic area, the angle,  $\varepsilon$ , can be taken to be negligible (Bomford G., 1980).

Neglecting the deviation of the vertical ( $\varepsilon$ ), Equation (1.1) can be written as:

$$N = h - H \quad (1-2)$$

The reference datum for Orthometric heights, the geoid, is approximated by Means Sea Level (MSL). The relationship between the Orthometric height obtained from geodetic leveling and GPS derived ellipsoidal heights using a common reference datum, is shown in equation (1-2), which is employed in the determination of the geoid undulation. The technique is often called geometrical approach for “height basis” estimation (Seker, Yildirim, 2002).

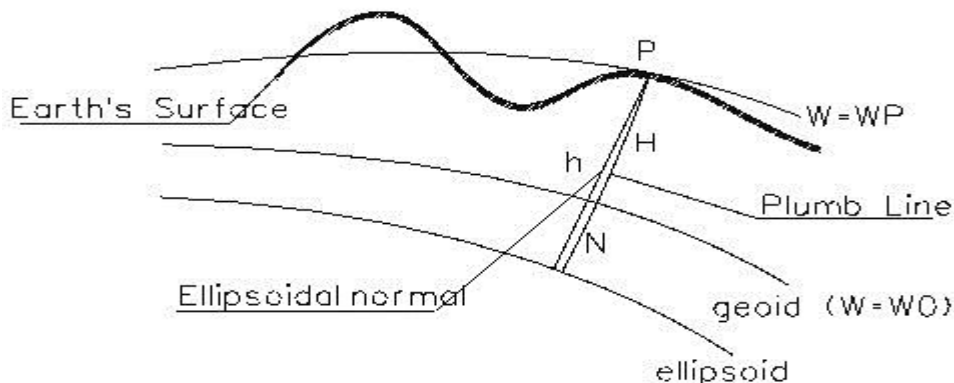


Figure 1.1: The Relationship between Orthometric, geoid and Ellipsoidal Heights.

It is evident that one must know geoid undulations to compute orthometric heights from GPS observed ellipsoidal heights. Geoid models, which describe the pattern of geoid undulations over the earth, provide the link between orthometric and ellipsoidal heights.

Numerous geoid models have been produced by Geodesist by combining scientific theory and various types of gravity measurements. With a geoid model, given a specific latitude and longitude, one can look up or interpolate the geoid undulation.

Therefore, it is easier, cost effective and less tedious to use the satellite GPS technique to determine Orthometric heights of survey stations using Global Earth Models. This is especially where the distance to be covered is longer, where the use of spirit levelling might take relatively longer period.

The reference datum for orthometric heights is the geoid, and is approximated to the Means Sea Level (MSL), which is the reference datum for Lagos, and along some section of the Nigerian coastline.

**2.0 The Study Area**

The study area is Lobi area of Makurdi, Benue State. See figure 1.2. This area also known as the Government Reservation Area (GRA) is a low density, modern high status facility neighborhood. The onset of colonial administration saw the development of well established housing estates at Lobi for the predominantly high-class European residents. It lies between latitude 07° 42' 59''N and 07°44'00''N of the equator and between longitude 08°31'23''E and 08°32'21''E of the Greenwich Meridian. Lobi covers an area of about 15.71 square kilometers.

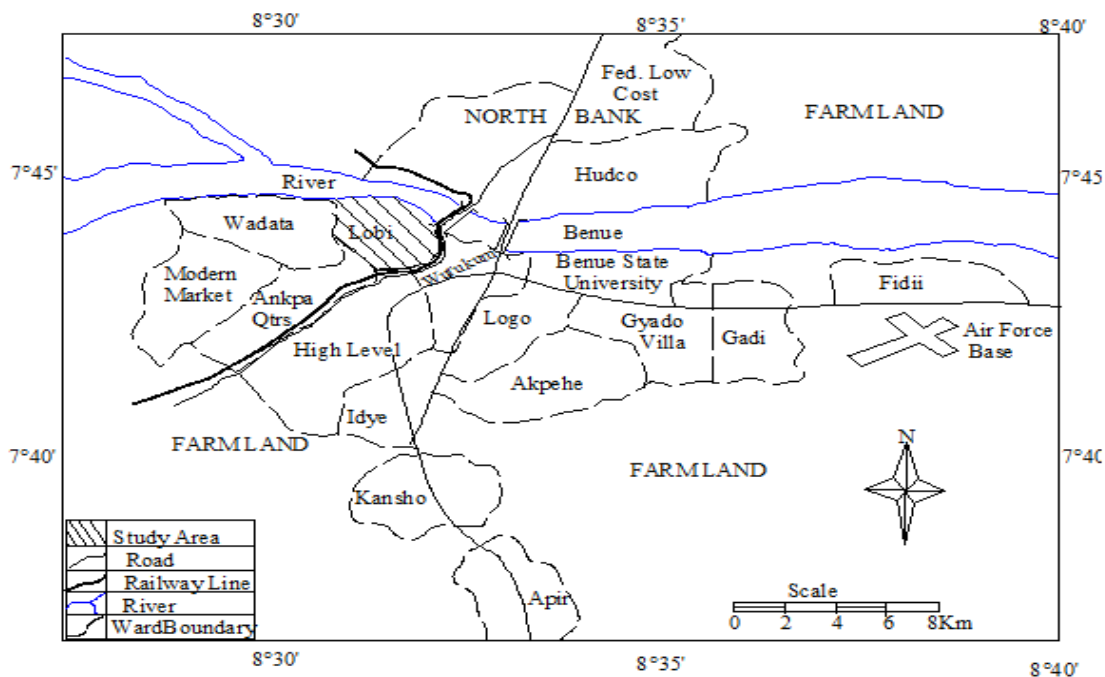


Figure 1.2: Map of Makurdi showing the Study Area (Source: Ministry of Lands & Survey, Makurdi)

**3.0 FIELD METHOD**

The field operations undertaken to obtain coordinates and heights of the established controls was through the combination of Global positioning system and Geodetic leveling observations. The survey was based on a first order control station (FBM MKD), with origin referenced to the mean sea level (MSL). The station was established by the Federal Surveys (now the Office of the Surveyor General of the Federation).

**3.1 RECOMMENDATION**

This involves taking a general over- view of the project at hand and obtaining information about project area, so as to adequately plan the best ways to accomplish the desired goal and objectives of the project. Reconnaissance for this project was categorized into two: Office recce (planning), and Field recce.

**3.2 GPS OBSERVATION**

The locational data (x,y,z,) was obtained using differential GPS (GNSS High Target GPS) which makes use of L1 and L2 dual frequency. It eliminates satellite

and receiver's clock error and ++atmospheric delays. The GPS receiver was placed on the known control point to establish the relationship of an unknown point to a known point. Another receiver was placed on the point whose position is to be established. Data were collected at both points simultaneously from the satellite for about several minutes. This established a vector base line between the two points. The latitude, longitude and

### **3.3 OBSERVATION PROCEDURES FOR PRECISE LEVELLING**

The leveling observations were carried out in loops from the fundamental benchmark. The first loop commenced from FBM Makurdi and continued through ABM 1S, ABM 2S, ABM 14A and then close back on FBM

### **3.4 DATA PROCESSING AND PRESENTATION**

GPS observations and Geodetic Levelling Operations were carried out on all the 17 Stations in the Network. The Data processing involves analysis and computations of the observations. The GNSS data were processed using the Hi-target Geomatics Office (HGO), where the obtained raw coordinates in RINEX format were processed to produce the provisional coordinate of all the stations observed. The Heights of the stations from

### **3.5 THE EGM2008 MODEL AND METHOD OF GEOID HEIGHTS EXTRACTION**

One of the methods of determining the orthometric height from GPS measurement is the use of the Earth Gravitational Models (EGMs). Different data sets are used to determine the ++coefficients of these models, ranging from satellite observations (which give the so-called satellite only solutions) to models which incorporate satellite altimetry and surface gravity data, thus usually containing more coefficients (Sideris et al, 1992).

elevation of the unknown point were established to a great degree of accuracy and the transmitted information were related to the WGS84 rectangular coordinate system. The mode of operation employed was static GPS surveying where the observations for a period of about 30 minutes are required. This period provided enough time for the satellite to change position significantly to allow resolution of the integer ambiguity.

Makurdi. The second loop also started FBM Makurdi and continued through ABM 1S, ABM 3S through to ABM 15S and then closed on FBM Makurdi.

Observations were conducted when refraction is low (between 0600hrs to 1120hrs and 1545hrs to 1845hrs).

the GNSS observation were computed with referenced to the Ellipsoid and are referred to as the Ellipsoidal Heights, while the heights of the stations obtained from the Geodetic Levelling are the Orthometric Heights.

These processes include downloading of GPS observation, sorting of data, leveling computation, estimation of geoid undulations and statistical analysis, etc.

The official Gravitational Earth Model (EGM 2008) has been publicly released by the United States National Geospatial Intelligence Agency (NGA) EGM Development Team. This gravitational model is complete to spherical harmonic degree and order 2159, and contain additional coefficients extending to degree 2190 and order 2159. This model represents a very significant improvement in precision over earlier Geoid Model. It is available in 1, 2.5 and 10 minutes grids. To obtain geoidal undulations for the coastal stations that are established along the coastline , Alltrans calculator (an online program) can be downloaded from softpedia website (<http://www.alltrans.soft112.com/>). (Softpedia, 2009).

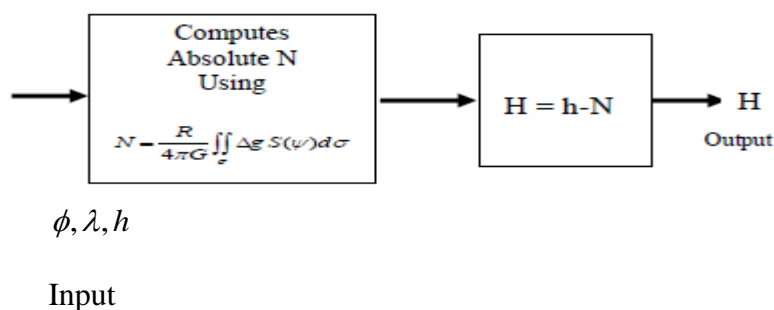


Figure 1.3: Input/ Output Procedure for Computation of Absolute Geoidal Undulation (Source: Aleem, K. F., 2011)

## 4.0 RESULTS AND DISCUSSIONS

### 4.1 Results

The WGS84 Coordinates of all the stations, including the Ellipsoidal heights and Orthometric Heights obtained from GPS and Levelling measurements, respectively, are shown in table 1.

TABLE 1: WGS84 Coordinates and orthometric heights of Survey Stations in the Network from Field Observations.

S/N	STATION	NORTHINGS (m)	EASTINGS (m)	LATITUDE			LONGITUDE			ELLIP. HEIGHT (h)(m)	ORTHO. HEIGHT (H <sub>LEVEL</sub> ) (m)
				°	'	"	°	'	"		
1	FBM MKD	855788.8656	448718.992	7	44	34.60768N	8	32	03.30899E	92.219	72.846548
2	ABM 1S	856068.8426	448124.9663	7	44	43.70334N	8	31	43.90565E	94.527	74.676793
3	ABM 2S	855964.4466	447908.1118	7	44	40.29602N	8	31	36.82978E	99.883	80.035373
4	ABM 3S	855976.0725	447360.3244	7	44	40.65465N	8	31	18.94575E	89.273	69.431598
5	ABM 4S	855537.7902	446939.9527	7	44	26.36731N	8	31	05.23810E	95.387	75.541601
6	ABM 5S	854991.1391	447192.7695	7	44	08.57588N	8	31	13.51184E	99.367	79.516096
7	ABM 6S	855401.4076	447389.8016	7	44	21.94277N	8	31	19.92917E	96.926	77.071563
8	ABM 7S	855485.0422	447873.9673	7	44	24.68381N	8	31	35.73249E	112.394	92.518681
9	ABM 8S	854863.8312	447754.0491	7	44	04.45080N	8	31	31.84018E	114.877	95.013531
10	ABM 9S	854563.0231	448166.0269	7	43	54.67038N	8	31	45.30056E	119.581	99.713606
11	ABM 10S	854289.6495	448768.4514	7	43	45.79000N	8	32	04.97708E	118.807	98.932499
12	ABM 11S	854402.017	449092.5511	7	43	49.46054N	8	32	15.55361E	111.799	91.931239
13	ABM 12S	854687.3869	448884.2937	7	43	58.74576N	8	32	08.74470E	117.690	97.810347
14	ABM 13S	854731.0664	449286.1344	7	44	00.18232N	8	32	21.86170E	107.5822	87.703517
15	ABM 14S	855038.1919	448616.9364	7	44	10.15961N	8	32	00.00397E	134.7212	114.8586
16	ABM 14A	855704.7792	448207.5237	7	44	31.85122N	8	31	46.61406E	119.293	99.461968
17	ABM 15S	855421.7638	448982.6546	7	44	22.66301N	8	32	11.92970E	102.471	83.1049

The EGM 2008 geoid values for all the stations were computed using the Alltrans calculator (an online program). The Orthometric Heights, with the application

of the EGM 2008 geoid values, of the respective stations were obtained using Equation (1-2), and the results obtained are shown in table 2.

TABLE 2: EGM 2008-Derived Orthometric Heights of the of survey stations in the Network

S/N	STATION	WGS 84 ELLIPSOIDAL HEIGHTS (h) (m)	EGM 2008 VALUES (N) (m)	ORTHOMETRIC HEIGHT (H) ( $H_{EGM08}$ ) M	REMARKS
1	FBM MKD	92.219		72.8465	Control Station
2	ABM 1S	94.527	21.0812	73.4458	
3	ABM 2S	99.883	21.0836	78.7994	
4	ABM 3S	89.273	21.0845	68.1885	
5	ABM 4S	95.387	21.0781	74.3089	
6	ABM 5S	99.367	21.0988	78.2682	
7	ABM 6S	96.926	21.0928	75.8332	
8	ABM 7S	112.394	21.0902	91.3038	
9	ABM 8S	114.877	21.0998	93.7772	
10	ABM 9S	119.581	21.1030	98.478	
11	ABM 10S	118.807	21.1059	97.7011	
12	ABM 11S	111.799	21.1041	90.6949	
13	ABM 12S	117.690	21.0998	96.5902	
14	ABM 13S	107.5822	21.0987	86.4835	
15	ABM 14S	134.7212	21.0961	113.6251	
16	ABM 14A	119.293	21.0863	98.2067	
17	ABM 15S	102.471	21.0890	81.382	

The residuals of the geoidal undulations derived from the EGM2008 model and the geoidal undulations computed from the geometric survey technique is shown in table 3.

Table 3: Residuals of the geoidal undulations derived from the EGM2008 model and the geoidal undulations computed from the geometric survey technique.

S/N	STATION	N(EGM2008)	N(LEVEL)	DIFF. (m)	REMARKS
1	FBM MKD				Control Station
2	ABM 1S	21.0812	19.850	1.231	
3	ABM 2S	21.0836	19.848	1.236	
4	ABM 3S	21.0845	19.841	1.243	
5	ABM 4S	21.0781	19.845	1.233	
6	ABM 5S	21.0988	19.851	1.248	
7	ABM 6S	21.0928	19.854	1.238	
8	ABM 7S	21.0902	19.875	1.215	
9	ABM 8S	21.0998	19.863	1.236	
10	ABM 9S	21.103	19.867	1.236	
11	ABM 10S	21.1059	19.875	1.231	
12	ABM 11S	21.1041	19.868	1.236	
13	ABM 12S	21.0998	19.880	1.220	
14	ABM 13S	21.0987	19.879	1.220	
15	ABM 14S	21.0961	19.863	1.233	
16	ABM 14A	21.0863	19.831	1.255	
17	ABM 15S	21.089	19.366	1.723	

The residuals of the Orthometric Heights derived by applying the EGM2008 model ( $H_{EGM2008}$ ) and the

Orthometric Heights of all the stations in the Network obtained from the geodetic levelling work ( $H_{LEVEL}$ ) is tabulated in table 4.

Table 4: Residuals of the Orthometric Heights derived from the classical levelling work and the Orthometric Heights derived by applying EGM 2008 model

S/N	STATION	H(EGM2008)	H(LEVEL)	DIFF.	REMARKS
1	FBM MKD		72.847		Control Station
2	ABM 1S	73.4458	74.677	-1.231	
3	ABM 2S	78.7994	80.035	-1.236	
4	ABM 3S	68.1885	69.432	-1.243	
5	ABM 4S	74.3089	75.542	-1.233	
6	ABM 5S	78.2682	79.516	-1.248	
7	ABM 6S	75.8332	77.072	-1.238	
8	ABM 7S	91.3038	92.519	-1.215	
9	ABM 8S	93.7772	95.014	-1.236	
10	ABM 9S	98.478	99.714	-1.236	
11	ABM 10S	97.7011	98.932	-1.231	
12	ABM 11S	90.6949	91.931	-1.236	
13	ABM 12S	96.5902	97.810	-1.220	
14	ABM 13S	86.4835	87.704	-1.220	
15	ABM 14S	113.6251	114.859	-1.233	
16	ABM 14A	98.2067	99.462	-1.255	
17	ABM 15S	81.382	83.105	-1.723	

The standard error of residuals was computed using SPSS 15.0 for windows; this is shown in table 5 (the residual statistics).

Table 5: Residual Statistics

	Number of Points	Minimum	Maximum	Std. Error
	16	-1.723	-1.215	1.036

## 4.2 Discussions

Different geoid models have been developed by different authors in different locality using different approaches with their various advantages and disadvantages. Also, the fact that, there is no geoid model for Nigeria has made the Nigerian geodetic coordinates undefined uniquely. The EGM 2008 is the latest global model in use today.

The study tested the performance of the EGM 2008 within the study area. The summary of the observations and analysis of the results is shown in tables 1 to 4. From the numerical evaluations and the table of results (table 1 to 4) displayed above, it could be seen from the residuals in tables 4 and 5 that the maximum and minimum residuals from EGM 2008 model are -1.723 m and -1.215 m respectively, and a standard error value as 1.036 m. The results are obtained as a result of direct comparison of EGM2008-derived orthometric heights ( $H_{EGM2008}$ ) with their spirit level equivalent ( $H_{level}$ ). The FBM MKD was adopted as the datum for the survey and the computations.

## 4.3 Conclusions

The study shows the practicality of determining orthometric heights of survey stations using Global Model (EGM 2008). The performance of this global

model was evaluated by carrying out GPS surveys and Geodetic Levelling on same survey stations. The ellipsoidal heights ( $h_{GPS}$ ) of the stations were obtained from the processed GPS observations using GNSS processing software and the Orthometric heights ( $H_{LEVEL}$ ) were determined through classic levelling. Subsequently, the orthometric heights ( $H_{EGM2008}$ ) were derived by applying the model (EGM 2008) to the Ellipsoidal heights of the station using the mathematical model given in (Bomford, G., 1980). The separation between the orthometric heights obtained using the classical levelling ( $H_{LEVEL}$ ) and the orthometric heights obtained by applying the global model ( $H_{EGM2008}$ ) is fairly parallel, with a mean separation between the two of 1.234m (excluding the out-lier at station ABM 15S) Analysis of the results obtained, shows a maximum and minimum residuals from EGM 2008 model are -1.723 m and -1.215 m respectively, and a standard error value as 1.036 m which is considered insignificant for the satisfactory accuracy of orthometric height within the study area.

The study also demonstrate the feasibility of developing geoid model for GPS users community by GNSS/Levelling in Makurdi as an alternative approach to conventional spirit leveling in orthometric height determination.

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## AIR POLLUTANTS ANALYSIS: AN APPLICATION OF GIS TO MAPPING NORTH BANK POLLUTANTS' EMISSIONS, MAKURDI LGA, BENUE STATE, NIGERIA

<sup>1</sup>DACHUNG, I. <sup>2</sup>KWAGHBO, B. <sup>3</sup>SULEIMAN, A.

Department of Urban and Regional Planning  
Nigerian Army College Environmental Science and Technology  
(NACEST), Makurdi, Benue State, Nigeria.  
email: dachungiliyajohn@gmail.com  
Tel: <sup>1</sup>+2347060845488 <sup>2</sup>+2348036739103, <sup>3</sup>+2348036173909,

### Abstract

*More than 75 percent of the sources of air pollution in Makurdi metropolis and in most Nigerian cities according to statistics from available data and published literature, come from biomass burning and mobile sources (automobiles). Hence the need for a research in line with this environmental challenge to help the decision-makers to find the best and most practical solutions. Initially, we have identified the anthropogenic sources of air pollution and their respective shares. This paper presents a preparatory study for the evaluation of transport-related air pollution situation in North-Bank Makurdi. A Geographic Information System (GIS) integrated with a vehicle's emission model, pollutant dispersion model and related databases to estimate the emissions and spatial distribution of traffic pollutants in North-Bank was used. The model was not only able to analyse the current pollution situations, but also able to predict the emissions influenced by changes in specific traffic conditions. The results show that there was a higher concentration of carbon monoxide (CO) emissions around selected locations within the study area (SRS Junction along, Old Bridge, New Bridge, Lafia Garage Junction and NASME Junction) than the concentration of NO<sub>x</sub> pollution. The generation and spread of CO over the selected areas by buses, private cars, trucks and motor cycle/tricycle were much more than that of NO<sub>x</sub> in general.*

**Keywords:** Automobiles, air quality, geographic information system, traffic pollution, vehicle emission.

## 1.0 INTRODUCTION

### 1.1 Background of Information

Mario and Molina (2010) opined that air pollution emissions are released from both natural and anthropogenic sources. Human-driven activities aimed at providing necessary goods and services to society are responsible for the anthropogenic share of air pollution. Air pollution emissions occur at many stages in the life cycles of products and services, that is, from raw material extraction, energy acquisition, production and manufacturing, use, reuse, recycling, through to ultimate disposal.

The resulting emissions undergo several types of physical and chemical transformations and contribute to a wide range of health and environmental impacts, including deterioration of air quality, toxicological stress on human

health and ecosystems, photo-oxidant formation (smog), stratospheric ozone (O<sub>3</sub>) depletion, climate change, degradation of air resources, and noise, among others (Pennington et al., 2004).

According to Seinfeld and Pandis (2016), air is one of the five basic elements of human life. Every individual breathes in around 22,000 times each day, and needs almost 15 kilograms of air. Humans can survive without food for about 5 weeks and without water for 5 days but cannot live without air more than 5 minutes. From the first decades of the twentieth century, observing the relationship between air pollution and environmental degradation, many developing countries, began conducting researches and extensive scientific programs to control harmful emissions.

Air pollution can be seen as the introduction of chemicals, particulate matter or biological materials into the atmosphere that causes damage to human health and the natural environment (EPA, 1997). The introduction may be natural or anthropogenic. There are natural changes that also occur in the atmosphere in the form of volcanic eruption, wildfires and dust storm, many human activities which release tiny amounts of gases or particulates that can result in a variety of impacts on the environment (Clayton and Clayton, 1982; Nriagu and Davidson, 1986).

The anthropogenic activities like the burning of biomass as well as deforestation and various agricultural and industrial practices, have led to the increase in atmospheric concentrations of a number of greenhouse gases, such as carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, and ozone in the lower part of the atmosphere (EPA, 1997).

A vast majority of the urban and suburban areas in the world is exposed to conditions which exceed air quality standards set by WHO. Especially, the large cities in developing countries have the highest air pollution levels. Some researches show that the emissions from Asian cities will rise and this will continue to have an impact on hemispheric background ozone level as well as global climate (Gurjar et al., 2005). In general the cities in developed countries have the concentrations of air pollutants lower than the cities in developing countries. A lot of measurements of air pollutants (such as O<sub>3</sub>, SO<sub>2</sub>, NO<sub>2</sub>, TSP and PM<sub>10</sub>) in the world have been done.

Since motor vehicles are the fastest growing source of carbon dioxide (CO<sub>2</sub>), and contribute a significant

portion of the emissions of carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO<sub>x</sub>) and particulate in urban areas (UNEP/WHO, 1992), emissions from automotive engines are considered as a major source of urban air pollution (Jenson, 1998; Moragues and Alcaide, 1996; Gualtieri and Tartaglia, 1998). In the past research revealed that the estimated contribution of these so called "mobile sources" to global emission of CO<sub>2</sub> varies from 13% to 30%, and accounts for 22% of CO<sub>2</sub>, 87% of CO, 87% of volatile organic compounds (VOC), 57% of NO<sub>x</sub> and 4% of sulfur dioxide (SO<sub>2</sub>) emissions in the European Union (Commission of the European Communities, 1990; Namdeo and Colls, 1996). Although mobile sources have significant impacts on urban air quality, the behavior and fate of the emitted pollutants are still poorly understood, and considerable effort needs to be devoted to this issue.

Exposure to air pollution can cause acute health effects include eye irritation, headaches and nausea; and chronic health effects include decreased lung capacity and lung cancer resulting from long-term exposure to toxic air pollutants (Sunyer, 2001) cited in Babatunde et al., (2013).

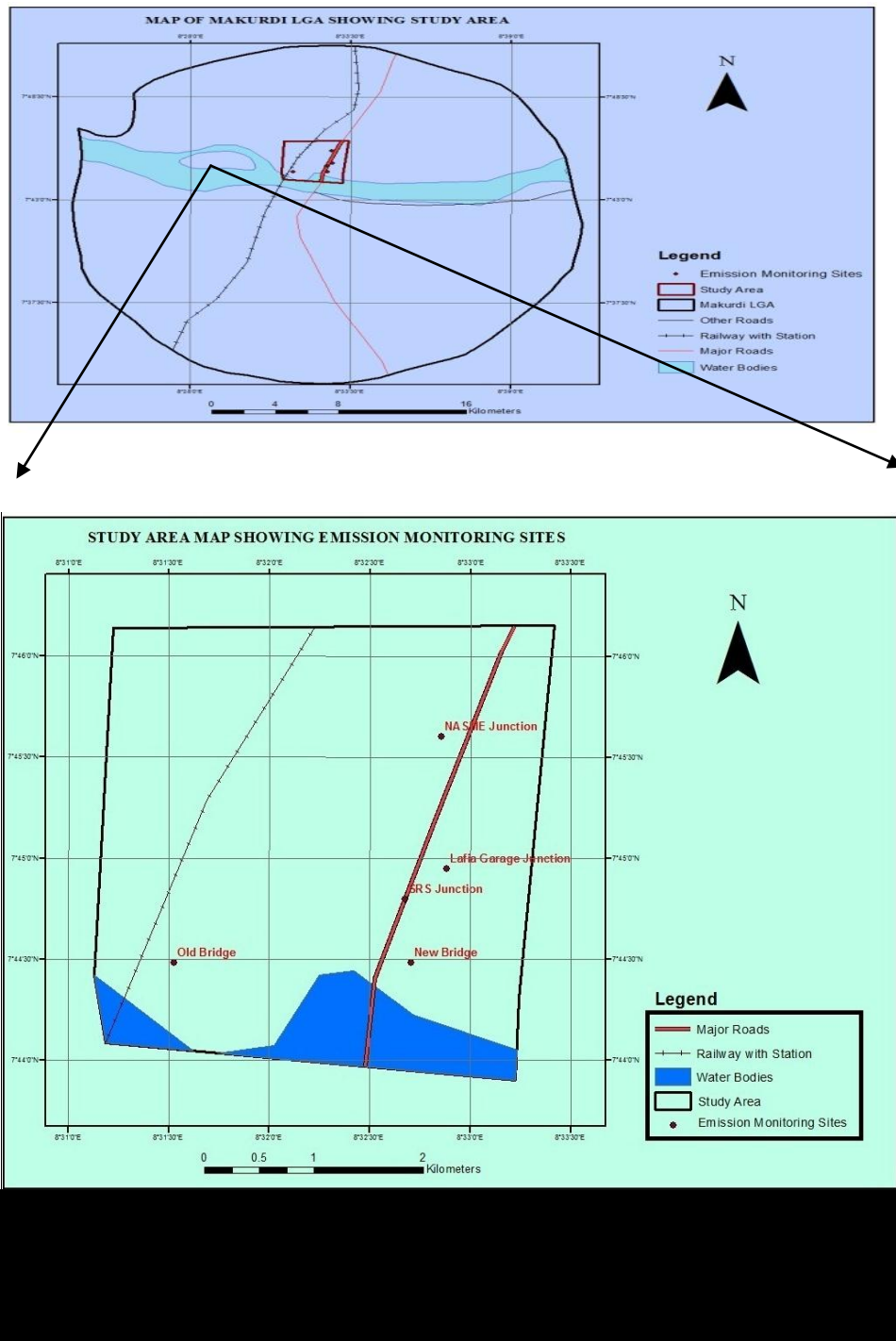
Other aspect that affects the quality of air in an urban area or suburban is the mobile sources of pollution which includes light and heavy vehicles. More than 75 percent of the sources of air pollution in urban centres around the world including Makurdi come from mobile sources.

Therefore, it is necessary to conduct researches in this field to help the decision-makers to find the best and most practical solution.

## 1.2 Study Area

The study area consists of five selected monitoring sites within North Bank of River Benue in Makurdi Local Government Area of Benue State, Nigeria. These five monitoring sites are located at N 7°43'32.574", E

8°32'59.8452" (Station A), N 7°43'43.7664", E 8°32'51.5004" (Station B), N 7°43'55.7472", E 8°32'20.9184" (Station C), N 7°45'0.432", E 8°32'50.586" (Station D) and N 7°45'11.4084", E 8°32'45.8448" (Station E).



**Fig 1.0: Study Area Map**

**2.0 Model description**

The model developed in this research integrates several sub-models such as the emission estimation model, dispersion model and relevant spatial and attribute data in a GIS framework. The entire system is then applied to

estimating emissions from all modes of transportation (Buses, Private Cars, Trucks and motor Cycles/Tricycles) and analyzing the spatial distributions of air pollutants (CO and NOx) within 5 monitoring sites. The GIS platform used in this research is the

ArcGIS 10.2.2 package developed by ESRI which can perform both raster and vector analyses.

The emissions of the entire selected transportation modes fleet were calculated on the basis of emission coefficients. The formula can be shown as:

$$E_i = L \times C_i$$

Where  $E_i$  is the emission of pollutant  $i$  (kg),

$L$  is the vehicle kilometers traveled (VKT) (km), and  $C_i$  is the emission coefficient of pollutant  $i$  (kg/km).

The emission coefficients for five types of transport modes with different distances covered was employed for emission estimation.

**Table 2.1: Emission Coefficient (Cumulative of Monday, Wednesday, Friday and Saturday) from 6am-6pm of CO and NOx**

22/1/18 Mon	Station	CO	NOx
S/N		Kg/Km	Kg/Km
1	Station A	311.02	311.02
2	Station B	347.58	347.58
3	Station C	497.67	147.24
4	Station D	741.36	741.88
5	Station E	326.73	68.54
<b>17/1/18 Wednesday</b>			
		Kg/Km	Kg/Km
1	Station A	241.75	241.75
2	Station B	352.87	359.14
3	Station C	347.54	67.11
4	Station D	402.44	507.45
5	Station E	374.58	77.76
<b>19/1/18 Friday</b>			
		Kg/Km	Kg/Km
1	Station A	300.28	300.30
2	Station B	369.41	369.41
3	Station C	373.69	77.63
4	Station D	617.55	617.55
5	Station E	557.27	116.73
<b>20/1/18 Saturday</b>			
		Kg/Km	Kg/Km
1	Station A	185.26	185.26
2	Station B	383.46	383.5
3	Station C	407.08	90.76
4	Station D	872.19	765.73
5	Station E	403.33	84.45

### 3.0 Field Experiment, Data Collection and Methods

#### 3.1 Field Experiment

The traffic volume data around and along each selected monitoring site and adjoining roads was derived from the traffic survey that was conducted through physical counting of the four selected modes of transport (Buses,

#### 3.2 Data Collection

Data were both collected for this research work from primary and secondary sources. The traffic volumes acquired from four different modes of transport in five monitoring sites to calculate the CO and NO<sub>x</sub> as air

#### 3.3 Methods

The GIS model developed in this research can automatically discretize the digital map and show the results based on user-defined grid sizes, as shown in Fig. 2. The pollutants' emissions within each monitoring site around junctions and all adjoining roads can then be calculated and stored in the database automatically. When the Vehicle Kilometers Traveled (VKT) in relation to their fleet volume are obtained, the emissions of the two (CO and NO<sub>x</sub>) pollutants in five different monitoring sites can be estimated.

The dispersion model used here is Interpolation, an IDW plume dispersion model which was originally used to

### 4.0 RESULTS AND DISCUSSION

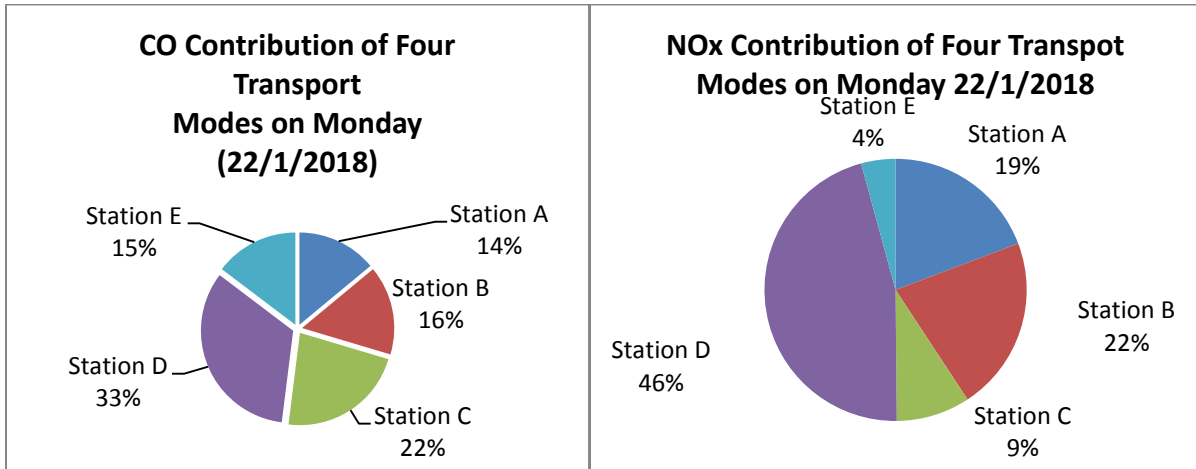
According to the estimated results of the emissions (CO and NO<sub>x</sub>) mentioned in the methods above, the emission contributions of each type of transport modes (Buses, Private cars, Trucks and Motorcycles/Tricycles) were summarized, as shown in Figs.

Private Cars and Motorcycle/Tricycle) from 6am – 6pm of Monday to Sunday. Each transport mode was estimated to have covered from 5-8km distance to be able to reach a monitoring site within the study area.

pollutants while basic data on other layers like the roads, railways and water bodies in the study area within North Bank were sourced from the shapefiles of Administrative Map of Nigeria on a scale of 1: 50,000.

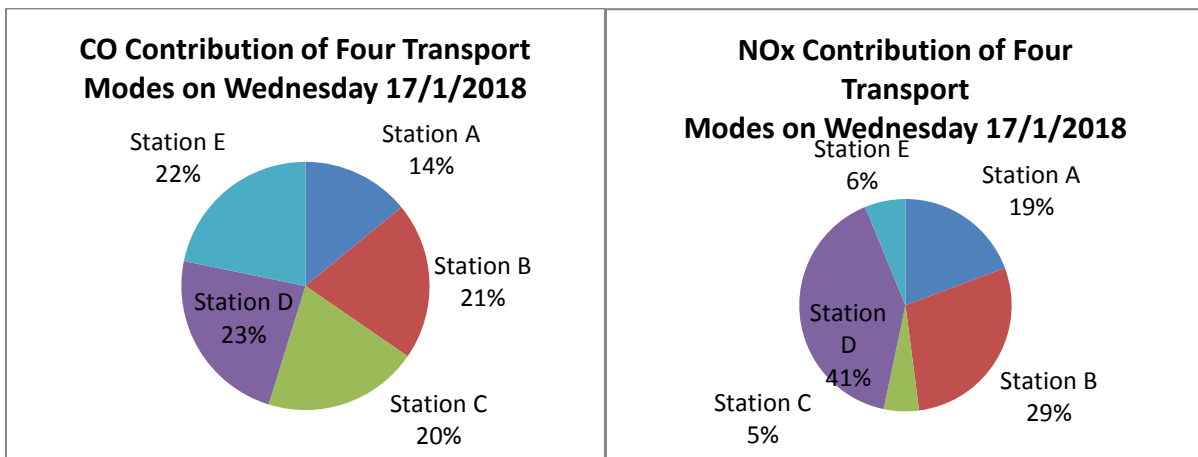
predict the impacts of CO and NO<sub>x</sub> around junctions, along roadways and their surrounding environments. Interpolation predicts values for cells in a raster from a limited number of sample data points. It can be used to predict unknown values for any geographic point data, such as elevation, rainfall, chemical concentrations, noise levels, and so on. The [IDW](#) (Inverse Distance Weighted) tool was used to estimate cell values by averaging the values of emission coefficient of the total volume of the four transport modes at the five monitoring points in the neighborhood of each processing cell. The closer a point is to the center of the cell being estimated, the more influence, or weight it has in the averaging process.

4.1 to 4.8. Monday, Wednesday, Friday and Saturday were selected from the seven days of the week that the traffic survey was conducted in order to evaluate the impacts of pollutants' emissions produced by the four transport modes on the air quality of the five selected monitoring sites and the surrounding environment.



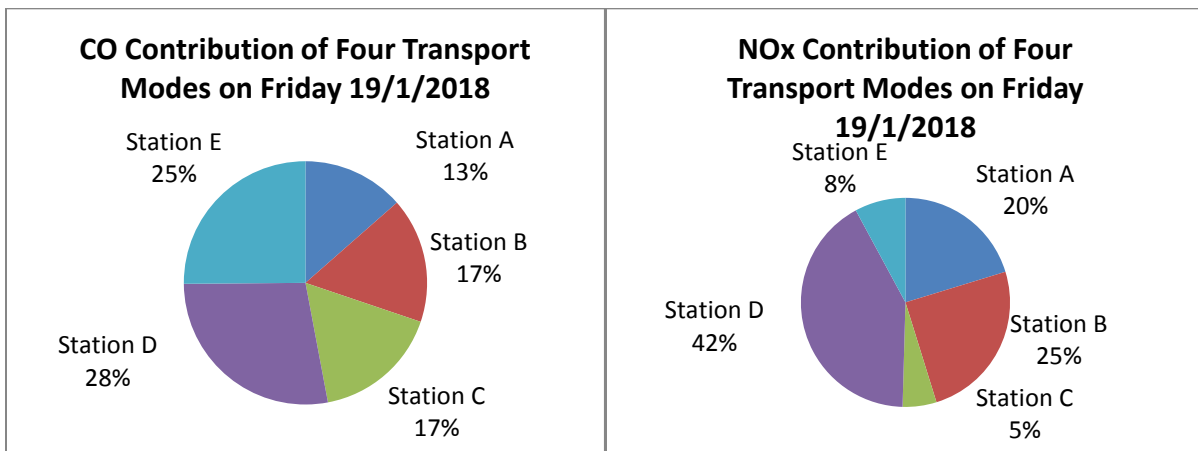
**Fig 4.1: % of CO for each Mode on Mon.**

**Fig 4.2: % of NOx for each Mode on Mon.**



**Fig 4.3: % of CO for each Mode on Wed.**

**Fig 4.4: % of NOx for each Mode on Wed.**



**Fig 4.5: % of CO for each Mode on Fri.**

**Fig 4.6: % of NOx for each Mode on Fri.**

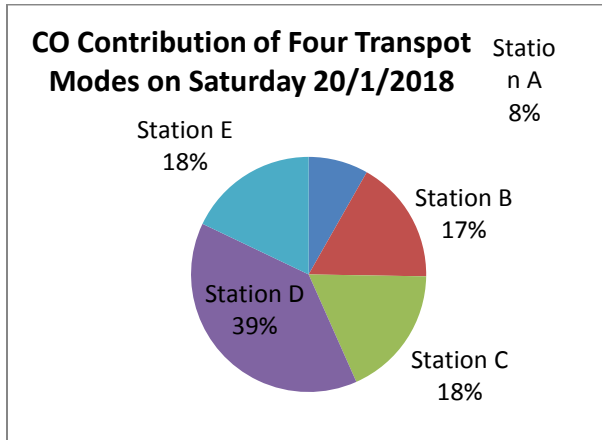


Fig 4.7: % of CO for each Mode on Sat.

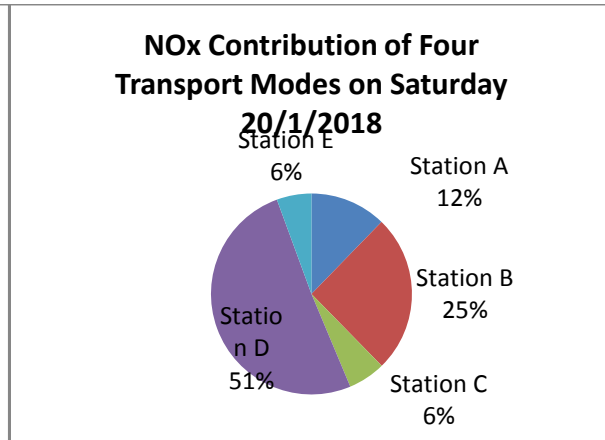


Fig 4.8: % of NOx for each Mode on Sat.

**4.1 Simulation of Emission Distribution for CO and NOx**

The results show that in Monitoring Station A from 6am-6pm of Monday, there was more distribution of CO in Stations C and E (22% and 15% respectively) compared to the distribution of NOx which amounted to 9% and 4%. While NOx distribution in Stations A, B and D was more with 19%, 22% and 46% respectively on Monday. See Fig 4.1a and 4.2b. On Wednesday the CO distribution goes for 20% and 22% as compared to

NOx with 5% and 6% in stations C and E, for NOx, the distribution was also more in stations A, B and D as well. See Fig 4.3c and 4.4d. For the remaining Friday and Saturday, the same higher distribution of CO in both stations C and E than the distribution of NOx in stations A, B and D. The generation and spread of CO over the selected areas by the four listed transportation mode (Bus, Private Car, Truck and Motor Cycle/Tricycle) is much more than that of NOx in general.

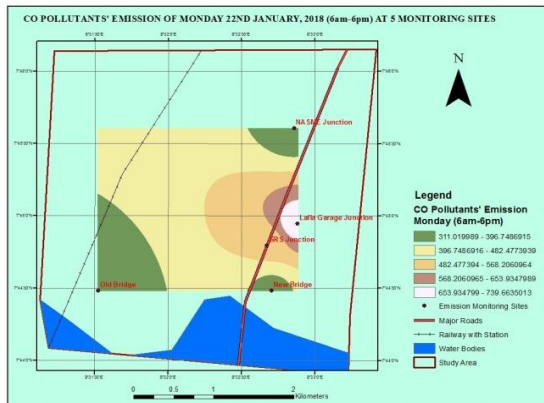


Fig 4.1

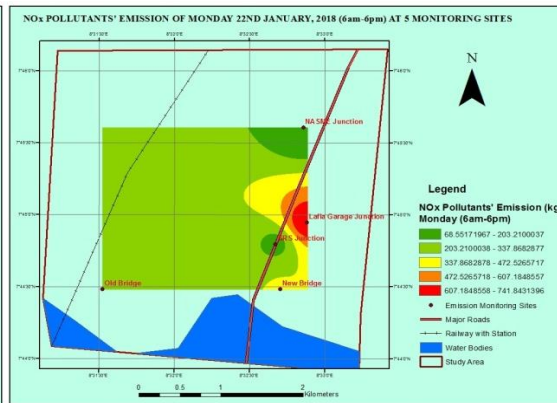


Fig 4.2

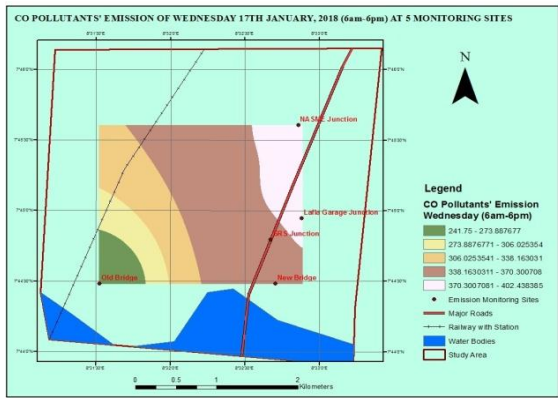


Fig 4.3

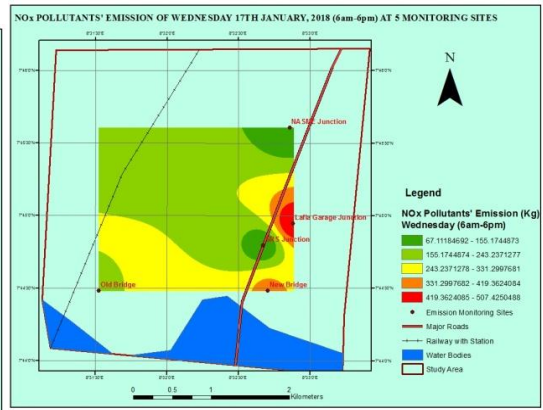


Fig 4.4

Fig 4.1: Simulated CO Emission Distribution for Mon., Fig 4.2: Simulated NOx Emission Distribution for Mon.  
 Fig 4.3: Simulated CO Emission Distribution for Wed., Fig 4.4: Simulated NOx Emission Distribution for Wed.

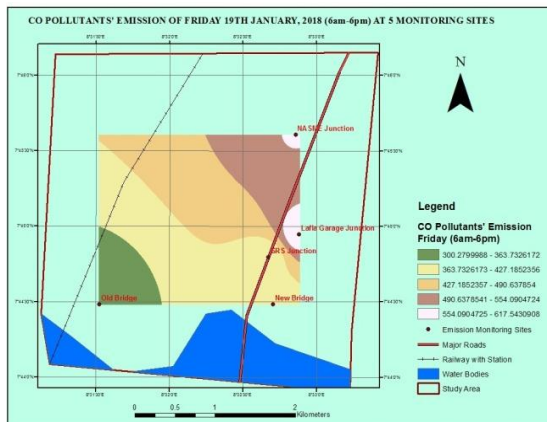


Fig 4.5

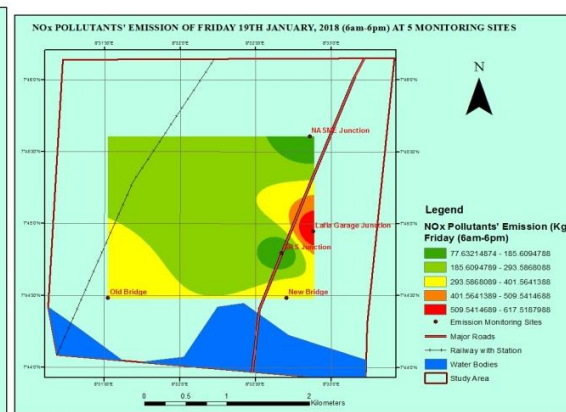


Fig 4.6

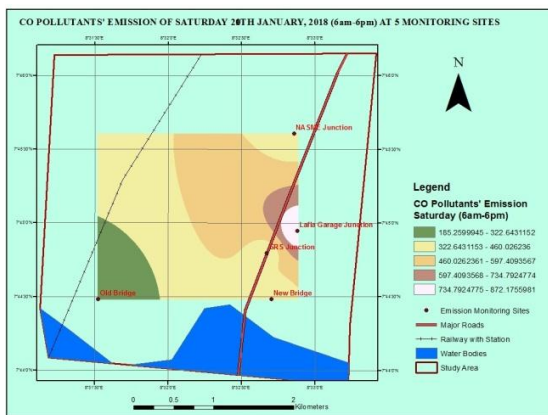


Fig 4.7

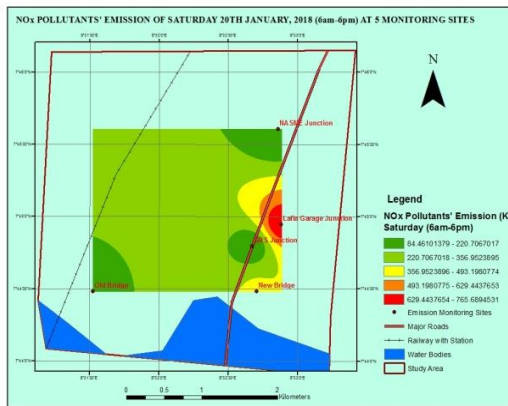


Fig 4.8

Fig 4.5: Simulated CO Emission Distribution for Fri., Fig 4.6: Simulated NOx Emission Distribution for Fri..

Fig 4.7: Simulated CO Emission Distribution for Sat., Fig 4.8: Simulated NOx Emission Distribution for Sat.

**5.0 Conclusion and Recommendations**

Looking at the cause(s) of air pollution which can be traced majorly to road traffic and has become a major concern to urban planners, managers, developers and health officials, it is on this assertion that it is necessary to use any technique to check more frequently on the pollutant emission quantities and their spatial distributions over the living environment and also to evaluate the variation of these situations caused by changes in certain traffic management policies or traffic conditions. Hence, there are every day needs for tools

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that can provide an easy access to obtaining up-to-date mobile source emissions information. The integrated model which combined emission estimating method (Calculation), dispersion model (Interpolation) and databases in a GIS framework. The results of this research show that the visualization and analytical features of GIS would be able to provide more information and be convenient to users in terms of storing, retrieval and disseminating of information.

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# THE PRODUCTION OF BIOGRADABLE PLASTIC FROM BANANA PEEL

**WILKIE Oris Segun**

Department of Minerals and Petroleum Resources Engineering, Edo State Polytechnic, Usen.

email: [ameewilkie@gmail.com](mailto:ameewilkie@gmail.com)

Tel: +2348058232111

**OSASU-IGHODARO meg**

Department of Science Laboratory Technology

**OKE, Osaremen**

Department of Food Science

## Abstract

*Bioplastic from banana peel as an alternative for the petroleum-based plastic is produce from the hydrolysis of the starch present in the peel. The result from the analysis shows that the plastic product is of high tensile strength, the chemicals used played role. Hydrochloric acid is used for hydrolysis, sodium hydroxide was used to neutralise the process, glycerol played the role of plasticizer to increase the flexibility, sodium metabisulphite was used as preservative. Biodegradable plastic from banana peel is of high tensile strength and degradable. This bioplastic is an alternative for petroleum-based plastic.*

**Keywords:** Metabisulphite, Biodegradability, Plastics

## 1.0 INTRODUCTION

Plastics is a widely used materials in our every day live. It usage is wide ranging from food packaging, office, automotives, communication, transportation, pharmaceuticals and packaging

Bioplastics are plastics that are biodegradable, that is that can degenerate easier compared to petroleum-based plastics. This petroleum plastics also known as synthetic plastics causes

Bioplastics is replacing synthetic plastics as the latter is causing environmental pollution because of it non-biodegradable characteristics. The petroleum-based plastics releases harmful by-product and chemicals during its break down process. Moreso, these petroleum-based plastics considering all the negative effect of synthetic plastics, biodegradable plastics is becoming a suitable replacement of the global pressing Banana peel is gotten from the fruit. It is suitable for biodegradable plastics because of it high starch content. The starch consists of two polymer chains

materials in all fields. It is advantageous of being flexible, transparent, low weight, cost efficient, thermal and chemical stability, solar radiant, insulating properties and resistant to microbial degradation (Sofiah et al 2019).

Environmental pollution (Singh 2004, Kalia et al 2004). Bioplastics consists of biopolymers, starch, cellulose and other sources from renewable biomass.

like packaging consumes about 400,000 barrels of oil for its production, beyond the competition it posses with the uses of oil, it creates landfills resulting to blockage of drainage which in turn causes flooding and destroying lives and properties (Ghamande et al 2018).

environmental issues caused by plastic pollution (Parker 2019).

known as amylopectin and amylose made up of adjoined glucose molecules that are bonded together forming the plastic

## 2.0 PREPARATION OF THE BANANA PEEL

The production of bioplastics beginnings with the

### 2.1 STEP 1

The banana was checked for damage, injury and bruises on the peel. After which the peel was removed and chopped into pieces. This chopped peel was treated with sodium metabisulphate (0.2M) solution for 45mins. The sodium metabisulphate acted as the preservative to help increased the life of the plastics from degradation.

## 3.0 PRODUCTION OF THE BIOPLASTIC

The production of the bioplastics started by transferring 25gm of banana paste into a beaker. 3ml of 0.1N HCl was added to the banana puree for the hydrolysis of the amylopectin for the film formation, the mixture was stirred with a glass rod. 2ml of glycerol was added to increase the plasticity

## 4.0 OBSERVATIONS

### 4.1 TENSILE STRENGTH

The tensile strength was measured by using standard machine. The result of the hydrolysis at 15 minutes produced a significant result of 2.05gm

## 5.0 CONCLUSION

A lot of researches have been done in order to find a suitable solution to improve plastic industry by producing plastic which has lower cost and higher efficiency to achieve the main grand challenge. The production of bioplastic from banana peel is achievable and the plastics produced can be used

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treatment and preparation of the peel.

### 2.2 STEP 2.

The soaked banana peel was then boiled for 30 minutes in 800ml of distilled water.

### 2.3 STEP 3

The water was decanted from the beaker and the boiled peel was spread in a filter paper and allowed to dry.

### 2.4 STEP 4

After the peel was dried, it was made into puree using mortar and pestle until a uniform paste was formed.

of the paste and stirred till uniformity was obtained. 0.3N of NaOH was added as a neutralizer to obtain a desired pH. The mixture was then spread on a petri dish and put in the oven to cure at 120<sup>0</sup>C for 30 minutes. After 30 minutes, the puree removed from the oven was bioplastic.

## 4.2 BIODEGRADATION

The sample was buried and on the fifth day black spot was observed due to activities of microorganism. on the buried sample.

as packaging bag. From the analysis, the production of the plastic from banana peel is dependant on the hydrolysis of the starch present in the sample. Biodegradable plastic advantage over petrochemical plastic is they degenerate into the environment without creating any pollution.

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## BIO-PURIFICATION OF RIVER KADUNA WATER USING *MORINGA OLEIFERA* SEED POWDER.

\*Ibuh S.G<sup>1</sup>, Adadu.C.A<sup>2</sup>, Isama S.U<sup>3</sup>.

\*1 Nigerian Army College of Environmental Science and Technology, NASME Barracks Makurdi.

2 Dept. of Vocational and Technical Education, Benue State University;

Dept. of Mechanical Engineering Nigerian Army College of Environmental Science and Technology NACEST, NASME Barracks, Makurdi.comfortadadu2019@gmail.com

3 Ahmadu Bello University, Zaria Nigeria. email: [sherlockholmess20014@gmail.com](mailto:sherlockholmess20014@gmail.com)

### Abstract

The study was designed to investigate the effect of *Moringa oleifera* seed powder in purifying raw water. Water samples were collected in plastic bottles on monthly basis, for six months in the dry and wet season along the Southern axis of river Kaduna (Kakuri). Physicochemical parameters of the water such as Turbidity, DO/BOD, Hardness, pH and Electrical Conductivity were carried out using Standard Methods. Heavy metals of the water such as Copper, Arsenic, Chromium and Lead were analyzed using Atomic Absorption Spectrophotometer. The effect of various concentrations of the seed powder on physicochemical parameters and heavy metals of the water were determined using jar test in the dry and wet seasons. The result of the physicochemical parameters such as turbidity ( $278.00 \pm 38.62$  FAU), BOD ( $204.73 \pm 111.63$  mg/L), E.C ( $2195 \pm 107.39$   $\mu$ mhos/cm) in the wet season indicated a high level of pollution in the water while in the dry season, low levels of turbidity ( $35.00 \pm 6.43$  FAU), BOD ( $0.53 \pm 0.13$  mg/L), and E.C ( $89.33 \pm 14.73$   $\mu$ mhos/cm) showed a low level of pollution. The pH of the water in both seasons was neutral ( $7.07 \pm 0.64$  and  $7.94 \pm 0.59$ ) and within the WHO limits of 6.5-8.5. The result of heavy metals in the dry season; Cu ( $0.015 \pm 0.001$ ), As ( $0.793 \pm 0.001$ ) and wet season, Cr ( $0.019 \pm 0.001$ ) and Pb ( $0.084 \pm 0.001$ ). The result obtained revealed that the extract has high potential to reduce turbidity, improve low DO's, reduce high BOD's in the water, with high antimicrobial properties that can be used in reducing bacteria load.

**Keywords:** *Moringa oleifera*, Water Samples, River Kaduna, Heavy Metals, Turbidity.

\*Corresponding Author: **Ibuh Sewuese Gladys:** Department of Biological Science, Faculty of Science, Nigerian Army College of Environmental Science, NASME Barracks Makurdi. email: [kwase.ibuh@gmail.com](mailto:kwase.ibuh@gmail.com)

### INTRODUCTION.

Water purification is the removal of contaminants such as parasites (*Giardia*, *Cryptosporidium*), bacteria, algae, viruses, fungi, minerals (including toxic metals such as Lead, Copper, Chromium, Arsenic, Iron etc.) from pure water, to produce water that is safe for human consumption and for other industrial purposes ([https://www.sciencedaily.com/terms/water\\_purification.html](https://www.sciencedaily.com/terms/water_purification.html), 2016). The main aim of purifying water is to produce water that is safe for drinking as well as for other domestic needs. Most water sources are treated for human consumption, domestic and industrial uses. However, water may also be purified for different purposes such as fulfilling the requirements of

medicine, pharmacology, chemistry and environmental applications.

The use of plant materials to purify water has been in use for over a hundred years and most of the plants that have been tested over the years, seed powder of *Moringa oleifera* Lam was found to be an effective primary coagulant for water treatment that is similar to alum (Madsen *et al.*, 1987; Oslen, 1987; Post note, 2002). Previous reports have shown that *Moringa* seed powder has antimicrobial properties, it is non-poisonous and non-synthetic. Thus, its use in bio-purification of water is recommended in developing nations (Grabow *et al.*, 1985).

### 1.1 *Moringa oleifera*.

*Moringa oleifera* is a native of India grown widely throughout the tropics. It is also known as “horse radish” tree. It ranges in height from 5- 12m with an open, umbrella-shaped crown, straight trunk and corky, whitish bark with tuberous tap root. The ever green foliage (depending on climate) has leaflets of about 1-2cm in

#### Classification of *Moringa oleifera*

Kingdom	Plantae
Sub-kingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae

### 1.2 Purification Ability of *Moringa oleifera*

*Moringa oleifera* seeds treat water on two levels by acting both as a coagulant and an antimicrobial agent. It is generally accepted that *Moringa* works as a coagulant due to its positively charged water-soluble proteins which bind with negatively charged particles (silt, clay, bacteria, toxins, etc.) allowing the resulting “flocks” to settle to the bottom or be removed by filtration. The antimicrobial

### 1.3 Coagulation Properties of *Moringa oleifera*

The seed kernels contain high quantities of a series of low molecular weight water soluble proteins which in solution, carry an overall positive charge. The proteins act similarly to synthetic, positively charged polymer coagulants. When added to raw water, the proteins bind to the predominant negatively charged particulates that

## 2.0 Comparison between the Mechanism of Water Purification of Alum powder and *Moringa oleifera* seed powder.

Alum, also known as Potassium Aluminium Sulphate has been in water purification for a very long time. Environmental Science Activities for the 21<sup>st</sup> Century Project, stated that purifying water is very important as it produces water that is free of pathogens and fit for drinking. Novak and Watts (2005), pointed out phosphorus as a common contaminant present in water sheds where there has been an accumulation of excess phosphorus in the soil where animal production is

diameter, with white cream colored flowers. The fruits (pods) are initially light green, slim and tender, eventually becoming dark green, firm and tip to 120cm long, depending on the variety. Fully matured, dried seeds are round or triangular, with the kernel surrounded by a lightly, wooded shell with three papery wings (Folkard *et al.*, 1999).

Order	Capparales
Family	Moringaceae
Genus	<i>Moringa</i> Adans
Species	<i>Moringa oleifera</i> Lam

(<https://plants.usda.gov/index.html>, 2016).

property of *Moringa* is however, under investigation. Findings support recombinant proteins both removing microorganisms by coagulation as well as acting directly as growth inhibitors of the microorganisms. While there is ongoing research being conducted on the nature and characteristics of these components, it is accepted that treatments with *Moringa* solutions will remove 90-99.9% of the impurities in water (Akinwore and Jok, 2006).

cause turbidity (raw water, silt, clay, bacteria etc.). Under frequent agitation these bound particulates increase in size and form flocs, which may be left to settle by gravity or be removed by filtration (Folkard *et al.*, 1999). The seed is rich in copper which acts as a Coagulant in raw water and waste water treatment (Folkard *et al.*, 1999).

practiced and is linked to the increasing concentrations of dissolved Phosphorus in rivers and streams.

Alum in its powdered form when added in a vessel of water, is stirred using a stirring stick for a few minutes (5minutes at least) and sedimentation takes place as the phosphorus particles in the water bind with the powdered alum forming flocs. The water is filtered using a filter apparatus that traps the phosphorus and alum mixture while allowing the water to pass through. Although Alum purifies water of its phosphorus content, the water may still be unsafe for drinking and for other domestic uses until it is sterilized by adding a microbe killing agent to

the purified water to disinfect and make it safe for human consumption (Novak and Watts, 2005).

Whereas, *Moringa oleifera* seed powder when used in water purification acts as a coagulant and an antimicrobial agent (disinfectant). The water-soluble proteins with positive charges present in the *M.oleifera* seed bind with the negatively charged particles allowing the resultant “flocs” to settle to at the bottom (Akinwore and Jok, 2006). The phytochemical composition of the

*Moringa oleifera* seed powder such as Flavonoids, Saponins, Steroids, Tannins and Terpenoids are responsible for the antibacterial activity of the seeds on pathogenic organisms in water (Ramawat, 2007; Carson and Hammer, 2010; Savoia, 2012; Shanmugavel *et al.*, 2018). Tannins have been reported to prevent the development of micro-organisms by precipitating microbial protein and making nutritional protein unavailable for them (Clark, 1981).

### 3.0 Study Area

Figure 1a: Map of the study area

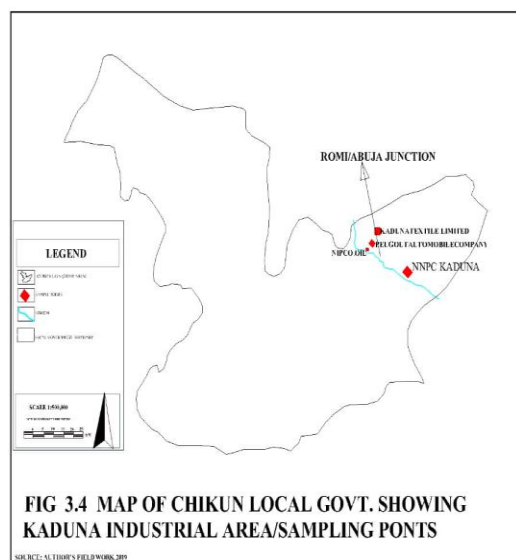
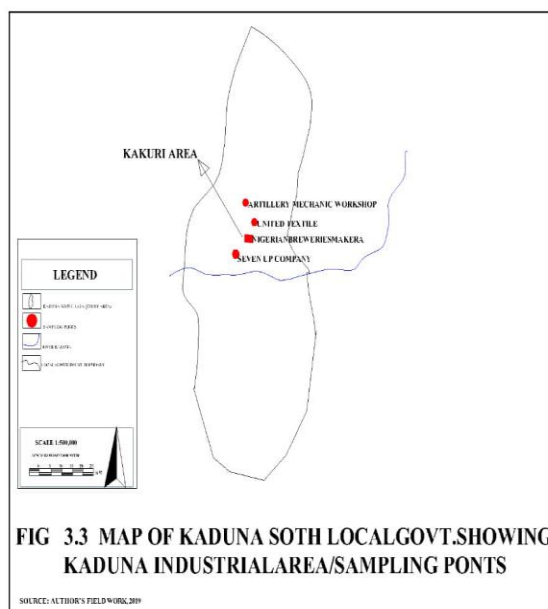


Figure 1b: Study area with sampling points.



The study was carried out in selected locations within Kakuri and Sabon-tasha, southern areas of Kaduna State,

with sampling points properly labelled and demarcated in the maps above.

### 3.1 Water sampling within the study areas

**Sampling point-1:** Along Nigerian Breweries

**Sampling point-2:** Around Romi/Abuja junction

**Sampling point-3:** Around Kaduna textile

**Sampling point-4:** Control (Upstream reach of Kaduna River along Southern Kaduna Axis)

### 3.2 Material (*Moringa oleifera*) Collection and Preparation

*Moringa oleifera* seed pods were purchased from Kasuwan Barchi, Tudun Wada market in Kaduna State

and taken to the Herbarium unit of the Department of Biological Sciences Kaduna State University for

identification. Samples were collected in duplicate from the Southern axis of river Kaduna, for physicochemical parameters/Heavy metal analysis in plastic bottles with screw caps and taken to the laboratory in an ice chest for analysis as used by Zakky *et al.*, (2016), Zakky and

Auta, (2017). *Moringa oleifera* seeds were air-dried on a non-absorbent tray for a week and peeled to obtain nuts. The dried nuts were milled to a fine powder and sieved to a mesh size of 150µm to obtain the seed powder.

### 3.3 Physicochemical Parameters Analysis

#### 3.3.1 Turbidity Determination

Using the Absoptometric Method, a colorimeter with model number DR/890, (Sherwood,USA) was switched on and the stored program number for turbidity 0-1000 FAU “Formazin Attenuation Units” was displayed on the colorimeter. A sample cell was filled with 10ml deionized water and placed into the cell holder and tightly covered with an instrument cap to serve as blank (so as to zero the meter to 0 FAU). After which raw water samples from the southern axis of river Kaduna were

thoroughly mixed. Using a pipette, 10ml was transferred into another sample cell tightly covered with the instrument cap and placed in a cell holder on the colorimeter and the results were taken in FAU. The same procedure was used to determine the turbidity of the treated water samples dosed with varying concentrations of *Moringa oleifera* seed powder from 0.5-180mg/l in the dry season and 200-1000mg/l in the wet season.

#### 3.3.2 BOD and DO Determination

The BOD/DO of the water sample collected from the Southern axis of river Kaduna were tested on the same day the samples were collected (both the untreated and the treated water samples) with varying doses of the *Moringa oleifera* seed powder ranging from 0.5mg/l-180mg/l in the dry season and 200-1000mg/l in the wet season. The samples were initially used to rinse the BOD/DO bottles made by Kimax Company, England were filled up with 300mls of the water, ensuring no air bubble remained in the bottle. Two (2) ml of alkali-iodide-acid reagent was also added. The bottle was capped and shaken vigorously. As a result of this; it formed a brownish to whitish precipitate, which was also allowed to settle then made up to 100ml. Two (2) ml sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) was also added into the bottles.

Two hundred (200) ml of the sample (treated water) were measured into a conical flask and titrated with sodium thiosulphate (0.025N) until a pale yellow colour was formed, titration continued until the sample became colourless. The volume of the sodium thiosulphate used for titration was noted. At this point; D.O was estimated as 1ml of sodium thiosulphate = 1mg per liter of DO. After the test of the first day the BOD bottles were rinsed again and filled with the sample. The samples were then incubated for five (5) days in an incubator at 20°C. On the fifth day, the same DO test was carried out as DO<sub>5</sub> and the BOD is calculated as follows: BOD Difference between DO<sub>1</sub> on the first day, and DO<sub>5</sub> after 5 days.

Therefore,  $BOD = (DO_1 - DO_5) \times \text{volume of BOD Bottle. ml of samples used}$

### 3.4 Determination of the presence of Some Heavy Metals of Water from River Kaduna and the Effects of *Moringa oleifera* Seed Powder Concentrations on the Heavy Metals

The presence of some heavy metals such as Copper, Arsenic, Lead and Chromium in the water were determined using a Buck Scientific 210 Atomic Absorption Spectrophotometer (AAS) made by Agilent Technology,USA using air-acetylene flame at various wavelength for each of the heavy metals in the dry and

wet seasons as described by the Standard Methods of Association of Official Analytical Chemistry (AOAC,1990).The effect of various concentrations of *M.oleifera* seed powder on the heavy metals present of After treatment with varying concentrations of *Moringa* ranging from, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 10.0, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 130, 140, 150, 160, 170 and 180mg/l in the dry season and 200-1000mg/l in the wet season.

### 3.5 Determination of Optimum Dosage Using Jar Test Machine

Jar test was carried out at the Department of Water Resources and Environmental Engineering, Ahmadu Bello University, Zaria, Kaduna State. Jar testing was carried out by the method described by APHA (2005) using a Novatech Jar testing Machine with Model no.F105A0111, FC4S made in USA. Preparation of stock solution was done by weighing one gramme (1g) of the seed powder of *Moringa oleifera* and transferring same quantitatively into a 1000ml flask, made up to 100ml with distill water and shaken vigorously for 10-15mins. This procedure was carried out on monthly basis, in six months (each sample was tested three times to obtain the mean) and grouped in Batches “A, B, C, D, and E” with variations in the gramme of *Moringa oleifera* seed powder measured for the preparation of the stock solution for each batch as shown below; Batch A- one gramme(1g) M.O powder in 100ml distill water for

concentrations 0.5-5.0mg/l, B- 2g M.O powder in 100ml distill water for concentrations 5.5-10mg/l, C-10g M.O powder in 550ml distill water for concentrations 20-100mg/l, D- 50g M.O powder in 1200ml for concentrations 110-180mg/l, E-150g M.O powder in 5400ml distill water for concentrations 200-1000mg/l.

A total of one hundred and fourteen(114) clean beakers labelled with the various concentrations (0.5-5.5 and up to 180mg/L) in the dry season and twenty seven (27) clean beakers labelled with the concentrations 200-1000mg/L (including that of the untreated water) in the wet season were placed on a working bench. A measure of one (1) litre of untreated water was transferred into the beakers labelled with various concentrations of Moringa. A dose of 0.5-5.5 up to 180mg/L of the stock solution during the dry season and a dose of 200-1000mg/L during the wet season were measured and transferred into the beakers respectively.

### 3.6 Statistical Data Analysis and Experimental Design

All data collected from this study were subjected to the analysis of variance (ANOVA) using the general linear model of Statistical Analysis System (SAS, 2001) to analyze the differences among group means in the treated sample. Significant differences among means were

separated using the Duncan multiple range test (Duncan, 1955) in the SAS package. The experimental design for the treatment was a Complete Randomized Design (CRD), replicated three times. The layout (CRD) of the experiment is shown below:

#### Dry Season

Control (0) - T<sub>0</sub>-0

0.5-30- T<sub>1</sub>-1

31-60- T<sub>2</sub>-2

61-90- T<sub>3</sub>-3

91-120- T<sub>4</sub>-4

121-150- T<sub>5</sub>-5

151-180-T<sub>6</sub>-6

#### Wet Season

Control (0) - T<sub>0</sub>-0

181-200 -T<sub>1</sub>-1

201-400- T<sub>2</sub>-2

401-600- T<sub>3</sub>-3

601-800- T<sub>4</sub>-4

801-1000- T<sub>5</sub>-5

#### Model for CRD

The model for CRD was  $y_{ij} = \mu + \alpha_i + e_{ijk}$

Where;

$y_{ij}$  is the Individual observation,

$\mu$  is the overall mean

$\alpha_i$  is the treatment effect

$e_{ijk}$  is the experimental error

#### 4.0 Result and discussion

**Table 4.1 Some Physicochemical Parameters of Water from the Southern Axis of River Kaduna in the Dry/Wet Season.**

Physicochemical Parameters	Turbidity FAU	D.O Mg/L	BOD Mg/L	Hardness Mg/LCaCO <sub>3</sub>	pH	E.C μmhos/cm
WHO limits	5.0	4.0	3-5	300	6.5-8.5	900
Dry Season	35.00±6.43	1.97±0.12	0.53±0.13	128.33±25.83	7.07±0.64	89.33±14.73
Wet Season	278.00±38.62	2.10±0.1	204.73±111.63	80.84±10.06	7.94±0.59	2195±107.39

**Key:** All values in each table are expressed as Mean ± SE (Standard Error).

DO - Dissolve Oxygen, BOD – Biochemical Oxygen Demand, E.C- Electrical Conductivity

Mg/L- Milligram per Liter, FAU- Formazin Attenuation Units, WHO-World Health Organization.

The result of some physicochemical parameters of water from the Southern axis of river Kaduna in the dry/wet season showed low turbidity levels in the dry season (35.00±6.43FAU) and high levels of turbidity in the wet season (278.00±38.62 FAU).The DO levels in the dry

and wet season ranged from 1.97±0.12 to 2.10 ± 0.1,BOD levels in the dry season were lower(0.53±0.13) than the wet season which were extremely high(204.73±111.63).The amount of hardness in the water was higher in the dry season than in the wet season with mean values ranging from 80.84±10.06 to 128.33±25.85.pH mean values of the water in the dry and wet season were in the range of 7.07±0.64 and 7.94±0.59 while the Electrical Conductivity(E.C) of the water was lower in the dry season(89.33±14.71)and significantly high in the wet season(2195±107.39μmhos/cm).

**Table 4.2: Some Heavy Metals of Water from the Southern Axis of River Kaduna in the Dry and Wet Season.**

Heavy Metals	Copper Mg/L	Arsenic Mg/L	Chromium Mg/L	Lead Mg/L
WHO Limits	2.0	0.01	0.05	0.01
Dry Season	0.015±0.001	0.793±0.001	0.012±0.001	0.068±0.001
Wet Season	0.012±0.001	0.062±0.001	0.019±0.001	0.084±0.001

All values in each table are expressed as Mean ± SE (Standard Error).

The result in table 4.2 showed the presence of some heavy metals such as Copper, Arsenic, Chromium and Lead in the water from river Kaduna at higher concentrations in the dry and wet season. The concentrations of Copper in the dry and wet season

ranged from 0.015±0.001 to 0.012±0.001 and the concentrations of Arsenic in the dry and wet seasons were from 0.793±0.001 to 0.062±0.001.While the concentrations of Chromium in the dry and wet season ranged from 0.012± 0.001 to 0.019 ±0.001 and the concentrations of Lead in both seasons were from 0.068±0.001 to 0.084±0.001 respectively.

**Discussion:**

The result of some physicochemical parameters of water from the Southern axis of river Kaduna in the dry/wet season showed low turbidity levels in the dry season (35.00±6.43FAU) and high levels of turbidity in the wet season (278.00±38.62 FAU).Though the turbidity levels

in the dry season were low, they were above the WHO limits of 5.0 FAU. This observation is similar to that of Ogbozie *et al.*, 2017, who recorded high turbidity values in the dry season ranging from 0.6-26.8FAU and 28.9-196.4 FAU in the wet season at different sampling points of the river Kaduna. The high turbidity values in the wet

season, may be due to a high amount of suspended particles and organic matter in the water. The DO levels in the dry and wet season were low ( $1.97 \pm 0.12$  to  $2.10 \pm 0.1$ ) and below the WHO limits of 4.0 mg/l. The low DO levels in the water indicates that the water is polluted and the rate of pollution was more in the dry season as seen in the extremely low DO levels recorded. This may be due to the inflow of phosphorus and nitrogen from farming and industrial activities into the river that enhance the growth of algae and phytoplankton. According to the classifications of McGowan, 2000, the water samples in the dry and wet season were moderately hard. pH mean values of the water in the dry and wet season ( $7.07 \pm 0.64$  to  $7.94 \pm 0.59$ ) were all within the WHO limits of 6.5-8.5 and similar to the reports of Yusuf, Durojaye and Salawudeen (2008), who reported pH values for all the sampling points of the river Kaduna between 7.23-8.32 for the wet season and 6.9-10.1 for the dry season with

the highest pH value of 10.1 at the Nasarawa Bridge sample where effluent from the activities of textile, food and beverage industries are introduced into the Kaduna River. The low Electrical Conductivity (E.C) of the water in the dry season ( $89.33 \pm 14.71$ ) and significantly high E.C in the wet season ( $2195 \pm 107.39 \mu\text{mhos/cm}$ ) observed in the river during the wet season are a measure concern because rain water has low conductivity and the addition of rain water in rivers lowers the conductivity of the river but the reverse was the case in the reports on the study carried out on the southern axis of river Kaduna which may be an indication that the river may be highly polluted. This report is similar to the reports of Ogbozige *et al.*, 2017, who also reported slightly low conductivity values in the dry season ranging from 88-915  $\mu\text{mhos/cm}$  and 87-890  $\mu\text{mhos/cm}$  in the wet season at different sampling points.

The result in table 4.2 showed the presence of some heavy metals such as Arsenic, Chromium and Lead in the water from river Kaduna in concentrations higher than the WHO permissible limits in the dry and wet season except for the concentrations of Copper in the dry and wet season ( $0.015 \pm 0.001$  and  $0.012 \pm 0.001$ ) that were below the WHO limits of 2.0mg/l. This observation is supported by Abui *et al.*, 2017 who also reported higher concentrations of Copper, Arsenic, Chromium and Lead in both the dry and wet season at the southern part of river Kaduna (Kakuri) were all above the WHO limits of 2.0mg/l for Copper, 0.01mg/l for Arsenic, 0.05mg/l for Chromium and 0.01mg/l for Lead. The high concentrations of Arsenic, Chromium and Lead in the dry and wet seasons could be as a result of the activities of industries that manufacture batteries, paint, petroleum refining and spillage that are located in the southern parts of the river Kaduna (Abui *et*

## 5. Conclusion.

*Moringa oleifera* seed powder had significant effect on some of the physicochemical parameters tested. In the dry season, treatment with concentrations 165.5mg/l achieved 56.2% turbidity removal, 18.3% DO and 79.2% BOD improvement. While in the wet season,

*al.*, 2017). This also means that the river is adversely polluted during both seasons but the rate of pollution is less during the wet season due to the heavy rains, as the concentrations of some of the metals such as Copper and Arsenic were lower in the wet season. High concentrations of Arsenic, Chromium and Lead in the river are a source of concern as aquatic lives and aerobic conditions may be affected. This observation is similar to the findings of Abubakar *et al.*, (2015), who reported high concentrations of some heavy metals in the surface waters of the river Kaduna from point A (Kakuri – Makera drain) such as; Chromium (3.72mg/l), Arsenic (2.59mg/l), Iron (5.20mg/l), Copper (3.16mg/l), Lead (3.67mg/l) which were all above the WHO limits of 0.05mg/l for Chromium, 0.01mg/l for Arsenic, 0.3mg/l for Fe, 2.0mg/l for Copper, and 0.01mg/l for Lead, except for Zinc (2.32mg/l) which were within the WHO limits of 5.0mg/l.

concentrations 300.5mg/l achieved 93.6% reduction in BOD. Treatment with *Moringa* seed concentrations (900.5mg/l) improved DO by 21.9% and reduced E.C by 88.0%. Comparatively, it can be said that *M. oleifera* was more effective in the dry season than in the wet season.

## Conflict of interests:

The author (s) declare no conflict of interests arising from this study.

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