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EXPLORING THE IMPACT OF JOB TRAINING ON WORK PERFORMANCE: A COMPARATIVE ANALYSIS OF GENDER DIFFERENCES IN EMPLOYEE OUTCOMES

Ali PrinceEdisemi and Deinmotei Erefaghe Igbe
Department of General Studies, Bayelsa State Polytechnic Aleibiri.
+2348030623197. alprince_edi2002@yahoo.com
+2348063330393. deinmoigbe@gmail.com

Abstract
The performance of employees in the workplace is often influenced by various factors, with job training and gender dynamics playing significant roles. Therefore, this paper explores the impact of job training on work performance, with a comparative analysis of gender differences in employee outcomes. The study adopted a descriptive survey design to gather data on job training and its impact on overall work performance. The target population for this study consisted of employees from both male and female-dominated industries within Lagos State, Nigeria. Participants were selected through a purposive sampling technique, with a focus on those who had undergone formal job training in the last two years. The sample consisted of 182 employees (94 male, 88 female). A structured questionnaire was used in the study. Data was collected through paper surveys. Data was analysed using t-tests and Pearson correlation analytical techniques to examine the relationship between job training and work performance while accounting for gender differences. The result reveals a significant positive relationship between job training and employee work performance ($r = 0.148$, $p < 0.05$). Furthermore, the result indicates no significant gender difference in perceived employee work performance. It recorded $\{t_{(180)} = 14.46, p > 0.05\}$. In conclusion, the findings imply that job training has a positive influence on employee work performance, suggesting that employees who receive regular and effective training are more likely to perform better in their roles. This underscores the importance of implementing robust training programs to enhance workforce productivity and skill development. Conversely, the lack of a significant gender difference in perceived employee work performance suggests that gender may not be a determining factor in how employee contributions are evaluated. This highlights the growing emphasis on equity in workplace performance assessments. These results suggest that organisations should prioritise targeted training initiatives and maintain gender-neutral appraisal systems to foster an inclusive and high-performing work environment.

Keywords: Job Training, Employee Work Performance, Gender Differences, Performance Evaluation, Organisational Productivity

1.0 INTRODUCTION

1.1 Background of the study

The performance of employees in the workplace is often influenced by various factors, with job training and gender dynamics playing significant roles. According to Becker's human capital theory, investment in job training enhances employees' skills and competencies, leading to improved work outcomes (Becker, 1993). However, gender differences in how employees respond to training programs remain a subject of debate. Recent studies suggest that women may face additional workplace challenges, such as gender biases and work-life balance issues, which can moderate the effectiveness of job training (Chen et al., 2022). Conversely, men often benefit from more extensive professional networks and mentorship opportunities, which can amplify the impact of training on their work performance (Kurtz & Keeling, 2023).

Work performance refers to the extent to which employees achieve their work objectives and contribute to organisational success. It encompasses multiple dimensions, including task performance, contextual performance, and adaptability (Van der Klink et al., 2020). Globally, work performance is shaped by factors such as job training, motivation, organisational culture, and individual competencies (Noe, 2021; Park et al., 2019). Structured job training programs have been shown to enhance employees' skills, knowledge, and productivity (Salas & Rosen, 2020). However, disparities in training access and outcomes based on gender persist, with women often reporting fewer opportunities for career advancement and skill development compared to men (Johnson & Salinas, 2023). While some research highlights the positive effects of gender-responsive training initiatives, others suggest that systemic barriers may limit the full potential of these programs for female employees (Smith & Wilson, 2022).

In Nigeria, the relationship between job training and work performance has gained attention, particularly in industries where skill gaps affect productivity (Adeola et al., 2023). Studies indicate that gender differences in workplace dynamics may exacerbate inequalities in training outcomes. Women in Nigerian organisations often face challenges such as limited

access to leadership roles, societal expectations, and discrimination, which can hinder their professional growth (Olawale & Adepoju, 2024). Meanwhile, men are more likely to benefit from informal training and mentorship opportunities, contributing to their enhanced work performance (Adetunji & Oladipo, 2023). The availability of gender-inclusive training programs in Nigeria plays a critical role in bridging these disparities, ensuring that both men and women acquire the skills needed for career progression and organisational success (Ogunyemi & Falade, 2023).

This study focuses on employees across various sectors in Lagos State, Nigeria, a hub of economic and organisational activities. Lagos, as a metropolitan area, represents a diverse workforce where gender dynamics and access to training vary widely. The choice of this location is justified by its representation of both private and public sector employees, providing a suitable context to investigate how job training impacts work performance and how gender differences influence these outcomes. The study also aims to address gaps in the literature, particularly in the Nigerian context, where limited research has explored the intersection of job training, work performance, and gender disparities. By shedding light on these dynamics, the study seeks to advocate for organisational policies and practices that promote equitable training opportunities and foster an inclusive workplace environment. Therefore, we propose the following:

Hypothesis 1: There will be no significant relationship between job training and employee work performance.

Hypothesis 2: There is no significant gender difference in employee work performance

2.0 LITERATURE REVIEW

2.1 Theoretical Review

Human Capital Theory

This study is grounded on Gary Becker's Human Capital Theory (1964), which posits that investments in individuals' education, training, and skills development yield economic benefits by enhancing productivity and work performance. Human capital is conceptualised as the stock of knowledge, abilities, and skills individuals possess, which can be developed through formal education, job training, and experience (Becker, 1964). In organisational contexts, Becker (1993) emphasised that investing in employee training programs equips workers with the competencies needed to perform tasks efficiently, thereby improving organisational outcomes and economic growth.

Becker distinguishes between general and specific training within the Human Capital Theory framework. General training provides skills transferable across multiple jobs or industries, while specific training focuses on competencies applicable to a particular organisation or role (Becker, 1993; Noe et al., 2020). For example, an employee receiving general training in leadership skills may apply these competencies across different employers, whereas training in proprietary software benefits the organisation providing it. The theory underscores that both forms of training contribute to workforce development, though organisations may hesitate to fund general training due to its portability (Blundell et al., 1999).

Furthermore, gender dynamics in the application of Human Capital Theory have garnered scholarly attention. Studies indicate that systemic barriers, such as unequal access to training opportunities and workplace discrimination, may hinder women from fully realising the benefits of human capital investments (Joshi et al., 2015; Ogunyemi et al., 2021). Conversely, male employees often benefit from more substantial professional networks and mentorship, enabling them to leverage human capital investments more effectively (Olawale & Adepoju, 2024).

In the Nigerian context, the theory has been applied to examine the impact of job training on workforce productivity, particularly in skill-intensive industries (Adegbite et al., 2020). Research highlights the critical role of gender-inclusive training programs in mitigating disparities and enhancing human capital development across diverse sectors (Adetunji et al., 2022). Lagos State, as an economic hub, offers a relevant setting to explore how investments in human capital influence employee outcomes, considering the region's diverse workforce and evolving industrial landscape.

By leveraging the principles of Human Capital Theory, this study investigates the intersection of job training, gender differences, and work performance. It aims to provide insights into how equitable training initiatives can enhance organisational efficiency and bridge gender gaps in workplace productivity. Understanding these dynamics is vital for developing policies and interventions that maximise the returns on human capital investments while promoting inclusivity in Nigerian workplaces.

2.2 Review of Empirical Studies and the Development of Hypotheses

Job Training and Work Performance

Job training refers to the process through which employees acquire the knowledge, skills, and competencies needed to perform their tasks effectively, thereby contributing to organizational

success (Becker, 1993; Salas et al., 2012). This targeted investment in human capital is critical for improving work outcomes, as it equips employees to adapt to job demands and technological advancements (Govaerts et al., 2017; Noe et al., 2020). Studies have consistently shown that structured job training programs enhance productivity, increase employee morale, and reduce turnover rates (Salas et al., 2012).

A study by Benson et al. (2021) in the United States revealed that employees who participated in well-designed training programs exhibited improved performance, particularly in task completion and innovation. These programs were found to strengthen employees' problem-solving skills, enabling them to meet organisational goals more efficiently. Similarly, Ogunyemi et al. (2021) observed that in Nigeria, job training significantly boosted employee productivity across various industries. Their findings highlighted the importance of industry-specific training programs tailored to address unique workplace challenges, such as technological skills in the manufacturing sector or customer service competencies in retail.

However, disparities in training access and outcomes based on organisational structure and demographics remain. Joshi et al. (2015) emphasised that systemic barriers, such as gender biases and limited funding, can hinder the equitable distribution of training opportunities. Despite these challenges, evidence from Adegbite et al. (2020) indicates that organisations implementing inclusive training policies often report higher employee satisfaction and performance levels.

Conversely, some studies suggest that the impact of job training on work performance is moderated by contextual factors such as workplace culture, leadership support, and employee motivation (Ogunyemi et al., 2021). Goldner and Ben-Eliyahu (2021) found that while training programs are generally beneficial, their effectiveness can be limited in organisations where employee engagement and leadership commitment are lacking. Similarly, Peduca et al. (2023) observed that employees with low motivation or inadequate post-training support often fail to translate acquired skills into improved job performance.

These findings underscore the complexity of the relationship between job training and work performance. While job training is a critical tool for enhancing workforce efficiency, its success depends on factors such as inclusivity, organisational support, and employee engagement. This study seeks to explore these dynamics further, focusing on how job training influences work performance among employees in Lagos State, Nigeria, and examining the role of gender in moderating these outcomes.

2.3 Conceptual framework

Gender Difference and Employee Work Performance

Gender differences in employee work performance refer to the variations in job-related outcomes that are influenced by gender, and shaped by societal expectations, organisational dynamics, and individual attributes (Eagly & Carli, 2007). These differences often manifest in areas such as task performance, leadership roles, and responses to workplace challenges (Blau & Kahn, 2017; Channar et al., 2021). According to Eagly and Wood (2013), gendered expectations can result in women being disproportionately affected by workplace stereotypes, while men may benefit from greater access to professional networks and mentorship opportunities.

Research has shown that gender differences in work performance are often tied to disparities in job roles and opportunities. A study by Martin et al. (2019) revealed that women in male-dominated industries tend to face higher scrutiny, which can either motivate exceptional performance or contribute to work-related stress. Similarly, in a Nigerian context, Adepoju et al. (2022) found that women often outperform their male counterparts in administrative roles due to their attention to detail and interpersonal skills but are less likely to be promoted to leadership positions. This highlights the intersection of performance outcomes with systemic barriers such as gender bias and unequal opportunities.

However, some studies argue that gender differences in work performance are diminishing in contemporary organisations that prioritise inclusivity. According to Taylor and Mohamed (2020), organisations that implement gender-equity policies report minimal performance differences between male and female employees. Such policies, including flexible work arrangements and equal access to training, enable employees to maximise their potential regardless of gender.

Conversely, research by Zhang et al. (2021) suggests that the persistence of traditional gender norms continues to influence workplace dynamics, particularly in regions where cultural expectations place a heavier burden on women to balance professional and domestic responsibilities. These challenges often limit their availability for career-advancing opportunities, which can subsequently affect their work performance.

These findings underscore the complexity of gender dynamics in the workplace, demonstrating that while progress has been made toward reducing disparities,

significant barriers remain. This study seeks to explore how gender differences influence employee work performance in Lagos State, Nigeria, shedding light on the role of organisational culture, access to resources, and individual coping mechanisms in shaping these outcomes.

3.0 Methods

3.1 Design of the study

The study aimed to explore the impact of job training on work performance, with a particular focus on how gender differences influence employee outcomes. This study was conducted in two phases. The study utilised a descriptive survey design to assess the general impact of job training on employee performance across both male and female employees. The study specifically focused on comparing gender differences in how job training influences work performance. This sub-section detail the methods employed in the study's first phase, including the research design, population, sample, sampling procedure, research instruments, data collection procedure, and data analysis. The study's first phase used a descriptive survey design to gather data on job training and its impact on overall work performance. The focus was identifying whether employees who received job training performed better than those who did not. The survey also explored whether the perceived effectiveness of the training varied across genders.

Population and Sample

The target population for this study consisted of employees from both male- and female-dominated industries within Lagos State, Nigeria. The sample consisted of 182 employees (94 male, 88 female). In the Job status column, 51(48.6%) were senior staff while 54(51.4%) were junior staff. Also 44(41.9%) are single while 51(58.1%) married. It was also observed that 35(33.3%) of the respondents worked in the administrative department,28(26.7%) were supervisors, 17(16.2%) were clerical,5(4.8%) were in the technical department while 20(19.0%) were found in other departments not included in the research instrument.

Sampling Procedure

Participants were selected through a purposive sampling technique, with a focus on those who had undergone formal job training in the last two years. Employees were screened based on their job training experience and willingness to participate in the survey.

Research Instruments

A structured questionnaire was used in both phases of the study. The questionnaire included items designed to measure variables such as training satisfaction, perceived usefulness of training, work performance outcomes, and demographic information. Gender was a key demographic variable in the analysis.

Data Collection Procedure

Data was collected through surveys questionnaire. Participants were asked to complete the questionnaire, which was used to assessed their experiences with respect to job training, their perception of its impact on their performance, and their overall work outcomes. For Phase 2, additional items were added to capture the respondents' views on how gender influences the reception and outcomes of job training.

Data Analysis

Data was analysed using both descriptive and inferential statistics. Descriptive statistics (mean, standard deviation) were used to summarise the general perceptions of job training and work performance. Comparative analysis, using t-tests was employed to explore gender differences in the outcomes of job training. Pearson correlation analysis was also conducted to examine the relationship between job training and work performance while accounting for gender differences.

4.0 RESULTS AND DISCUSSIONS

4.1 Results

Hypothesis Testing

Hypothesis One

There is no significant relationship between job training and employee work performance. To test this hypothesis data collected on job training and employee work performance were subject to the Pearson correlation coefficient analysis test. Table 4.1 presents the summary of the result.

Table 4.1: Statistical analysis of the data

Variable	N	Mean	SD	df	r-cal	r-tab	p-val ≤0.05
Job Training	92	1.045	.218	180	0.148	0.397	<0.05
Work Performance	92	1.069	.247				

Results of the correlation analysis presented in Table 2 reveal a significant positive relationship between job training and employee work performance ($r = 0.148$, $p < 0.05$), indicating that the level of job training provided to employees is not strongly associated with their work performance in this sample. This finding suggests that while job training may contribute to certain aspects of work performance, it does not appear to significantly determine overall employee effectiveness or productivity within the context of this study. The observed weak correlation might imply that other factors, such as job experience, motivation, or workplace environment, could play a more substantial role in influencing work performance than training alone. Furthermore, the non-significant p-value indicates that the null hypothesis, which states that there is no significant relationship between job training and work performance, cannot be rejected. In summary, the findings suggest that while job training is an essential aspect of employee development, its direct impact on work performance in this sample was not statistically significant. Organisations may need to explore a combination of strategies, such as mentoring, performance incentives, and workplace culture improvements, alongside job training, to enhance employee performance more effectively.

Hypothesis Two

There is no significant gender difference in employee work performance. The hypothesis was subjected to t-test analysis as presented in the table below.

Table 4.2: T-test analysis of gender difference on perceived employee work performance.

Group	**N**	**Mean**	**SD**	**Df**	**r-cal**	**r-tab**	**p-val ≤0.05**
Male	94	1.021	0.1450				
Female	88	1.079	0.272	180	14.46	1.658	>0.05

The Table 4.2 above indicates that there is no significant gender difference in perceived employee work performance. It recorded {$t(180) = 14.46$, $p > 0.05$}. The null hypothesis, which states that there will be no (PLS CORRECT IT) significant gender difference in employee work performance, is accepted. This result implies that male and female employees demonstrate similar levels of work performance. The slight variation in mean scores (Males: 1.021, Females: 1.079) does not represent a statistically significant difference, suggesting that gender is not a determining factor in employees' perceived work performance in this sample.

4.2 Discussion

The aim of this study is to explore the impact of job training on work performance, with a comparative analysis of gender differences in employee outcomes. By examining how job training influences work performance across male and female employees, the study sought to provide insights into potential disparities and similarities in employee development and productivity. The findings are discussed in relation to existing literature and their broader implications for workplace training programs and gender inclusivity in professional development initiatives. The study reveals a significant positive relationship between job training and employee work performance. The finding implies that job training equips employees with relevant knowledge, tools, and strategies to perform tasks more efficiently. It also reflects the motivational benefits of training, as employees often feel more valued and confident in their roles when organisations invest in their professional growth. Additionally, consistent training programs may foster adaptability and innovation among employees, contributing to better overall performance. Supporting this finding, Adeyemi and

Ogundele (2019) posited that job-specific training significantly enhances employee productivity, as trained employees are better prepared to handle job challenges. Similarly, Okonkwo et al. (2021) found that organisations with robust training programs reported higher employee efficiency and satisfaction, which positively impacted performance outcomes. Also, Okoro and Enwereji (2020) found that organisations investing in regular training sessions report higher employee satisfaction and productivity levels, aligning with the findings of this study.

Conversely, Ajayi and Ibrahim (2018) argued that while job training is beneficial, its impact on performance may vary depending on the quality and relevance of the training provided. They noted instances where generic or poorly executed training programs did not yield measurable improvements in work performance. In another study, Olatunji (2020) found that employees may underperform if they perceive training as a routine task rather than an opportunity for meaningful growth, suggesting that the perception of training value matters. Eze (2021) contended that poorly structured training programs often result in negligible improvement in performance, indicating that the quality of training is a critical determinant of its effectiveness. The findings highlight the necessity for organisations to prioritise tailored and high-quality training programs that align with job roles and organisational goals. Regular needs assessments should guide training designs to ensure relevance and effectiveness.

The second major finding reveals no significant gender difference in perceived employee work performance. The absence of a significant gender difference implies that organisations may be adopting policies and practices that minimise gender biases in employee performance evaluation. This could also reflect changing societal attitudes towards gender roles, which emphasise equality in capabilities and contributions across genders. However, it may also highlight that factors beyond gender, such as professional training, experience, and individual work ethic, are more critical in shaping perceptions of employee performance. Supporting the findings, Okoye et al. (2020) posited that gender does not influence employee productivity in organisational settings, highlighting that both male and female employees exhibit similar commitment levels to their job responsibilities. Similarly, Afolabi (2018) reported that in organisations where performance evaluations were standardised and objective, gender differences in perceived work performance were negligible. Akintoye and Aluko (2020) posited that gender has little or no impact on employee work performance, as modern workplaces prioritise merit and competence over gendered expectations.

Contrary to this, Oladimeji and Hassan (2017) argued that implicit gender biases still exist in certain industries, where male employees are often rated higher due to entrenched stereotypes about leadership and technical skills. Another study by Onuoha (2019) suggested that gender differences in work performance perceptions might persist in traditional settings, particularly in roles historically dominated by one gender. Okonkwo and Adeoye (2021) reported significant disparities in perceived performance, with male employees often rated higher than their female counterparts in managerial positions, highlighting enduring gender biases in the workplace. The absence of a significant gender difference in this study, suggests progress toward achieving equity in the workplace. However, organisations should remain vigilant against subtle biases that might influence evaluations in contexts not covered by the study.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study investigated the relationship between job training and employee work performance, as well as gender differences in perceived work performance among employees. The findings revealed a significant positive relationship between job training and employee work performance, indicating that training enhances employees' skills and competencies, which subsequently improve their job performance. However, no significant gender difference was found in perceived employee work performance, as indicated by the result. This suggests that gender does not influence the way employee performance is perceived in this context. These results highlight the critical role of job training in fostering employee efficiency, while also emphasising the importance of maintaining gender-neutral appraisal systems in the workplace.

5.2 Recommendation

Based on the findings, the study recommends that as follows:

1. Organizations should design and implement consistent, job-specific training programs to enhance employee skills, knowledge, and performance.
2. Job training should be customized to align with the specific tasks and responsibilities of employees, ensuring relevance and practical applicability.
3. Post-training assessments should be conducted to measure the impact of programs on employee

performance and identify areas for improvement.

4. Workplace culture that values continuous learning and professional development should be promoted to motivate employees to participate actively in training programs.
5. Organizations should establish standardized performance evaluation processes to minimise potential gender biases and ensure equitable assessments of employee contributions.

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LINEAR MIODELS OF SOME PHYSICOCHEMICAL PARAMETERS OF RIVER NUN WATER

[1]Aluku, Azibaye Allison and [2]Egbo Walamam Mansi
Department of Science Laboratory Technology, Bayelsa State Polytecnic, Aleibiri.
09032049325, azibayealuku@gmail.com

ABSTRACT
Availability of water is very crucial for human survival. Surface water such as rivers, Creeks, Sea, lake and ponds has being the major sources of water for the people of the Niger Delta. However, surface water is very vulnerable to pollution from natural and anthropogenic activities. Therefore, in order to protect public health and wellbeing, regular monitoring of water quality. The aim of this work is to establish a linearity relationship among physicochemical parameters or qualities of River Nun water. Five quality parameters which include; pH, EC, TDS, nitrate and Chemical Oxygen demand (COD) of River Nun water were monitored for a period of five days, using standard water quality testing methods. The results show, mean values obtained for pH (8.98 and standard deviation of 0.13), EC (75.1 µS/cm and standard deviation of 7.27), TDS (37.60 mg/L and standard deviation of 3.56) and NO3 (of 0.12 mg/L and standard deviation of 0.01) all fell within the standards set by WHO and EPA, however, the values obtained for COD (110.10 mg and standard deviation of 3.24) was far above the set standard of WHO. The relationship of the parameters was determined using Pearson correlation technical. EC showed a strong negative correlation with pH (r = -0.97), TDS showed strong negative correlation with pH (r = -0.97) and strong positive correlation with EC (r = 0.999), Nitrate showed weak positive correlation with pH (r = 0.31), and negative correlation with EC (r = -0.52) and TDS (r = -0.54), COD showed positive correlation with EC (r = 0.43) and TDS (r = 0.45), COD also showed weak negative correlation with pH (r = -0.21) and strong positive correlation with nitrate (r = 0.995). Conclusively, Linear models has being established for these correlated parameters and the models have proven to be faster method of monitoring water quality.

Keywords: Water quality, pollution, physicochemical parameters, correlation, regression, linear models.

1.0. INTRODUCTION
Water is one of the most abundant substance on planet earth. It is a very important resource for the existence of humans and every other living creature. All living organisms on the earth need water for their survival and growth. The planet Earth is made up of 70% water, however, due to increased human population and civilization that has brought about industries, coupled with other anthropogenic activities, the quality of water bodies has been greatly compromised or impacted with environmental pollutants. The water contaminants are introduced into the water body through impurities naturally (weathered rocks, dissolution of aerosol) and anthropogenically (mining, processing and use of metals).

River water can be polluted by changes to its physical and chemical components. Physicochemical parameters of water refer to the physical and chemical component of the water. Physical components of water includes; temperature, colour, odour, pH, turbidity, total dissolved solids, and total suspended solids. While some chemical components of water are: chemical oxygen demand, biochemical oxygen demand, dissolved oxygen, alkalinity, hardness, chloride, salinity, (Patil, 2012).

Water pH: pH indicates the acidity or basicity of the water. The pH scale is from 0 – 14, a pH less than 7 indicates acidity while a pH above 7 indicates basicity. The standard range of pH for drinking water set by World Health Organization (WHO) and United State Environmental Protection Agency (EPA) is 6.5 – 9.5 (Patil, 2012).

Electrical conductivity (EC): Electrical conductivity of water is its ability to conduct current. This is achieved as salts split into ions and conduct electricity based on concentration. (Aquaread, 2019). United State Environmental Protection Agency (EPA) have set a standard for EC range for portable water as 50 mg/L (Patil, 2012).

Total dissolved solids (TDS): TDS is introduced via sewage disposal, industrial run-off and chemicals used in the water treatment, (Brian, 2019).

Biochemical oxygen demand (BOD): BOD is the amount of dissolved oxygen needed by biological organisms to break down organic materials present in a given water sample at a certain temperature over a specific time. BOD is expressed in milligrams of oxygen consumed per litre of the sample, (WHO, 2019).

Nitrate (NO_3): Nitrates occur naturally in water at a moderate level, nitrate level in a water body is affected by fertilizer runoff and industrial waste, (CDC, 2019). The standard level of nitrate for portable water set by WHO is 45ppm (Patil, 2012).

1.1 Statement of problem

The importance of portable water to human and every living organism cannot be over emphasized, however, with the rate of pollution, it is necessary to ascertain the quality of water before it is consumed. Testing to ascertain the quality of water is determining if the physical, biological and chemical component of the water meet the necessary standard for portable water set by World Health Organisation and other International bodies as these components in larger quantities pose a health risk for consumers. Testing for these individual components is expensive and requires skilled professionals at all times. Hence, the need to establish methods to monitor water quality faster and with less expense.

Due to technological advancement, there are some mobile equipment that can give the values of some component in-situ. These values that can be gotten in-situ should be able to give information about other components of the water. Hence, the need for linear models. Linear models are equations that are formed from closely related components and regression analysis on them. These models are established to make testing of the physicochemical parameters easier, faster and less expensive. With the models, the quality of water can be easily monitored, thus curbing the effects of water borne diseases as the models would be a readily available tool to evaluate water quality for human consumption.

1.2 Aim and objective

The aim of this work is to establish a linearity relationship among physicochemical parameters or qualities of River Nun water. The specific objectives include:

1. To determine the pH, Electrical Conductivity, Total Dissolved Solids, Nitrate and Chemical Oxygen levels of the River Nun water
2. To determine parameters that are closely related by correlation.
3. To establish linear models of correlated parameters through regression analysis.

2.0 MATERIALS AND METHDS

2.1 Area of the study

The water sample was collected at three points along River Nun in Amasoma. The points were Alamiesegha water side jetty (WS1) with geographical co-ordinate of N 04.96792°, E006.10279, market jetty (WS2) with co-ordinate of N 04.96891° E 006.10627°, and sand dump jetty (WS3) with co-ordinate of N 04.96765°, E 006.12212° i

Amasoma is a

2.2**. Sample collection**

The water samples were collected using a 1L plastic bottle. pH and Electrical Conductivity were measured in-situ. Water samples were collected for a period of five (5) days between 5:00 pm to 7:00 pm at three different sampling stations.

2.3. **Methods of determination**

The different physicochemical parameters monitored include pH, Electrical Conductivity, total dissolved solids, chemical oxygen demand and nitrate. These parameters were determined using standard analytical methods

2.4. **Data analysis**

2.4.1**. Correlation analysis**

Pearson correlation analysis was conducted. The formula for correlation coefficient is presented in as equation 2.1 below

$$r = \sqrt{\frac{\Sigma (x - \bar{x})(y - \bar{y})}{\Sigma (x - x)^2 \Sigma (y - y)^2}} \quad (2.1)$$

Using the formula, the relationship between two parameters was determined. A sample correlation coefficient is denoted by r, and it ranges from, -1 to +1 and this indicate the direction and strength of the linear association between two variables. Some parameters showed positive correlation, i.e, as one increases the other increases while some showed negative correlation, i.e, as one increases the other drcreades. A correlation of 0 indicates no correlation.

2.4.2**. REGRESSION ANALYSIS**

Regression analysis was used to establish linear equations amongst parameters in which the association of parameters that are correlated could be best described. One of the correlated parameters becomes a dependent variable and another an independent variable. A simple linear regression equation can be expressed as:

$Y = bo + b_1X$ (2.2)

Where, Y = dependent Variable, X = independent Variable, bo = estimated Y intercept, b_1 = estimated slope

3.0 RESULT AND DISCUSSION

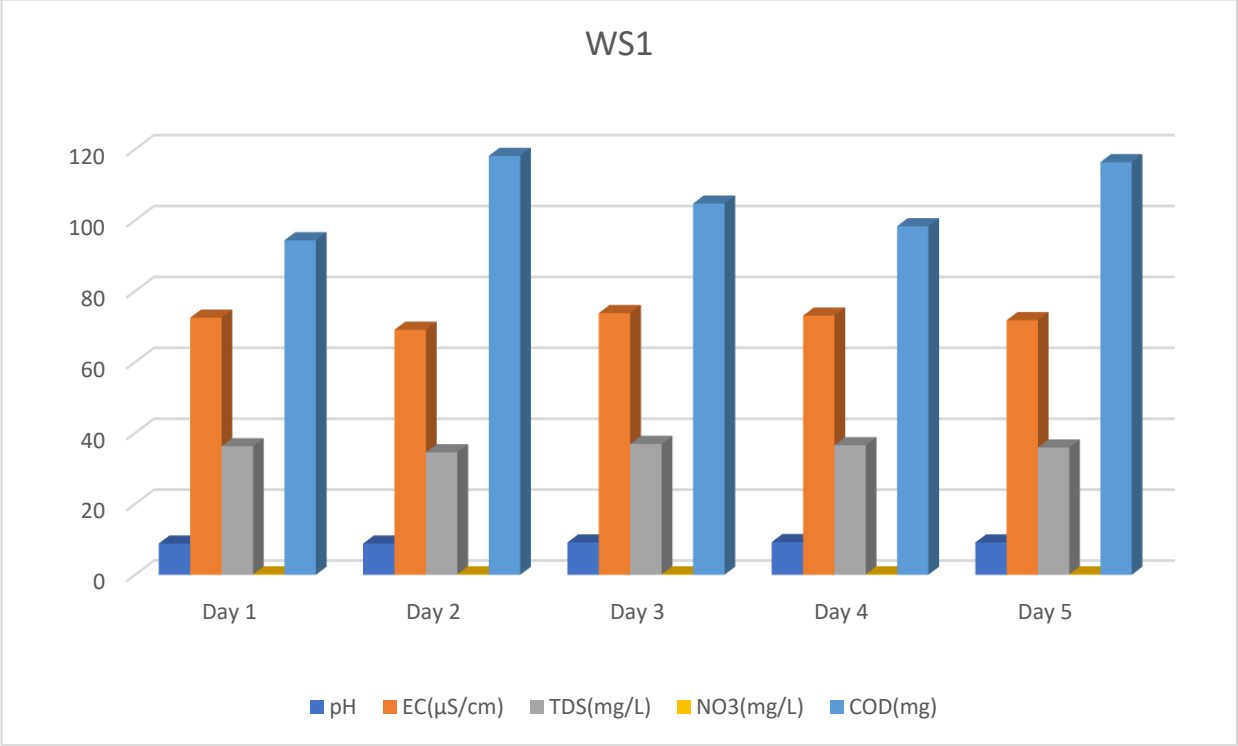


Fig 3.1: Graph of Physicochemical parameter of water samples collected at sampling station 1

In WS1, the pH value ranged from 8.8 to 9.2, EC was in the range of 69.1 to 73.8 µS/cm, TDS was in the range of 34.55 to 36.90 mg/L, NO_3 ranged from 0.125 to 0.137 mg/L, COD ranged from 94.33 to 118.13 mg.

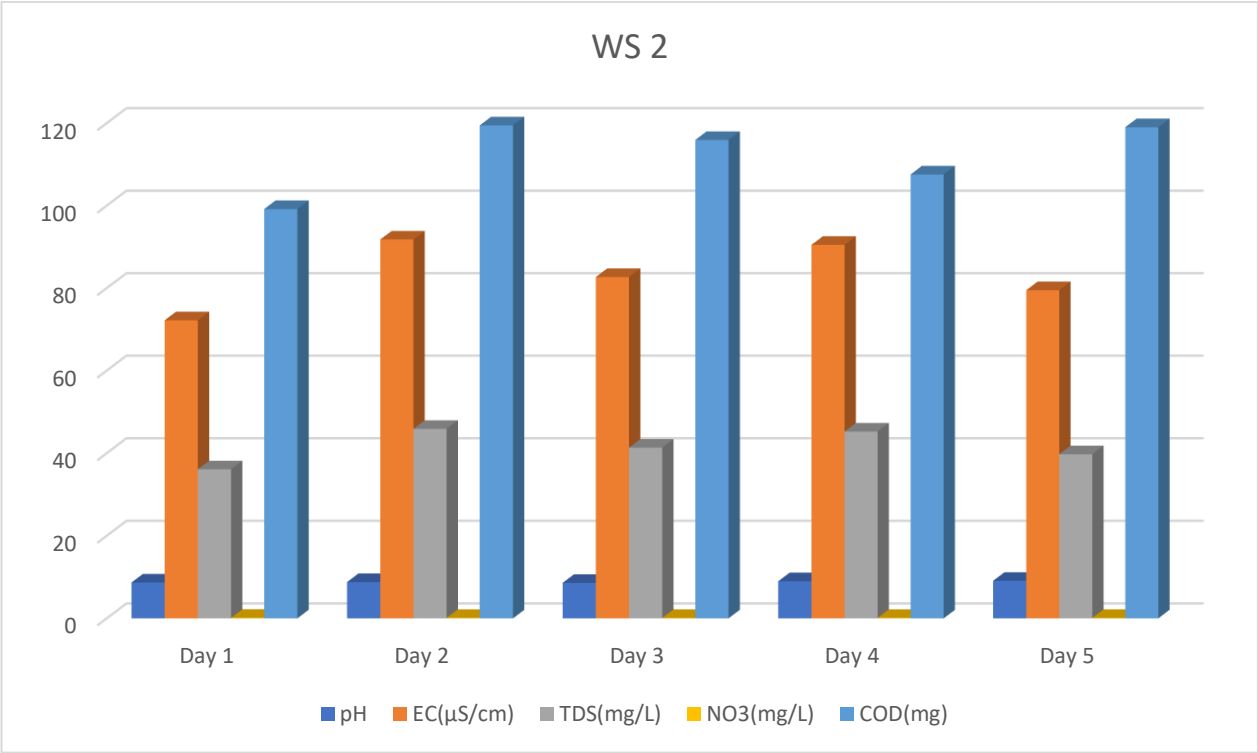


Fig 3.2 : Graph of Physicochemical parameter of water samples collected at sampling station 2

In WS2, the pH value from 8.6 to 9.1, EC ranged from 8.6 to 9.1 µS/cm, TDS ranged from 36.1 to 45.9 mg/L, NO_3 ranged from 0.109 to 0.127 mg/L, COD ranged from 99.18 to 119.46 mg.

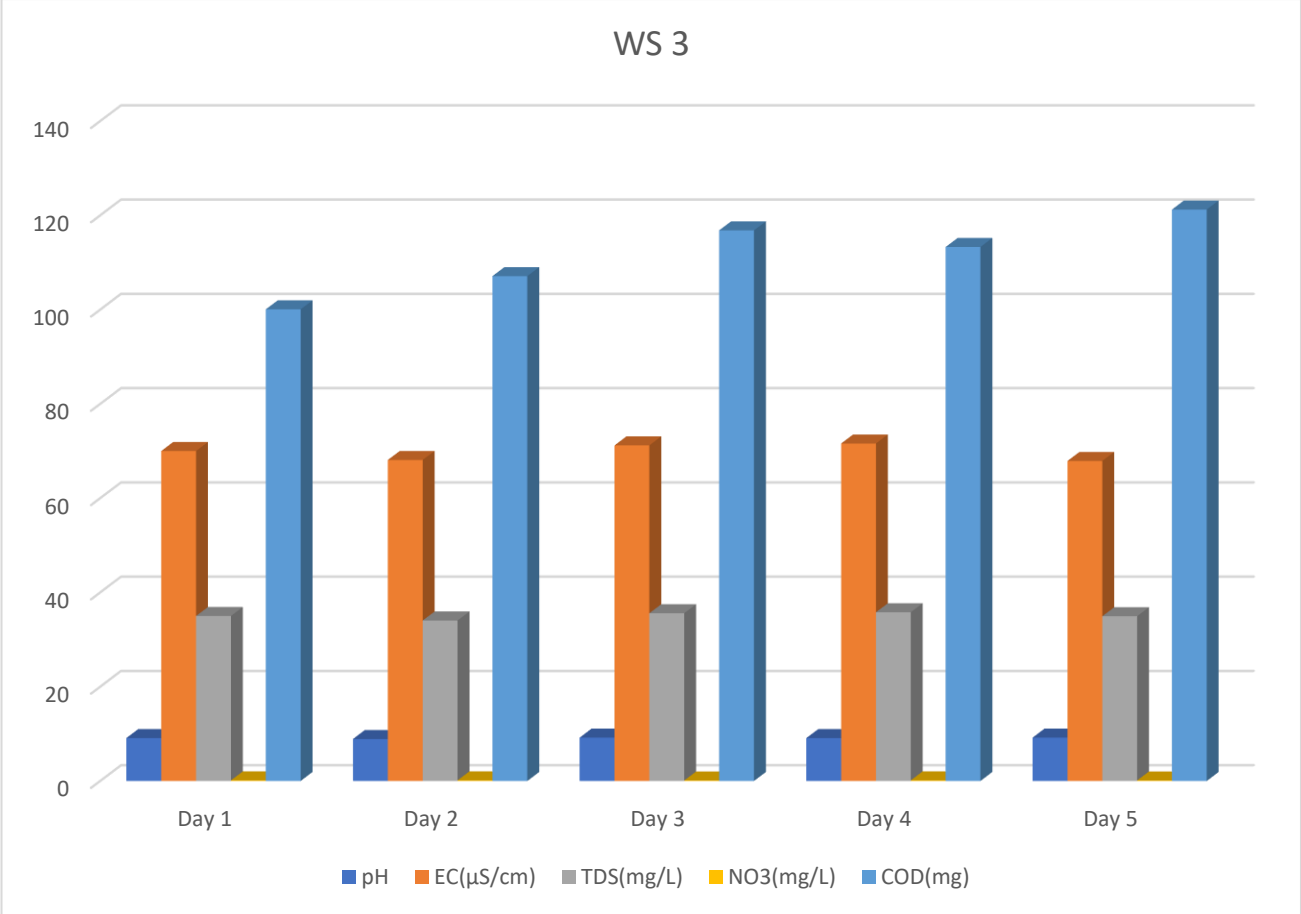


Fig 3.3 : Graph of Physicochemical parameter of water samples collected at sampling station 3

In WS3, pH ranged from 8.9 to 9.2, EC ranged from 67.9 to 71.6 µS/cm, TDS ranged from 34.05 to 35.8 mg/L, NO_3 ranged from 0.11 to 0.13 mg/L, COD ranged from 100.06 to 121.22 mg/L.

Generally, in the study, pH ranges between 8.8 and 9.1, EC was in the range of 69.76 and 83.34 µS/cm, TDS was in the range of 35.08 and 41.67 mg/L, NO_3 was in the range between 0.117 and 0.1296 mg/L, COD was in the range of 106.364 and 112.23 mg. The pH measurement range are within the standard limit set by WHO and EPA (6.5 – 9.5), the measured value for TDS fell within the set standard of portable water by WHO (500mg/L), the EC value was within the standard by EPA (2500 µS/cm), COD value was above the standard set by WHO (10), the Nitrate content was within the standard set by EPA (50 mg/L).

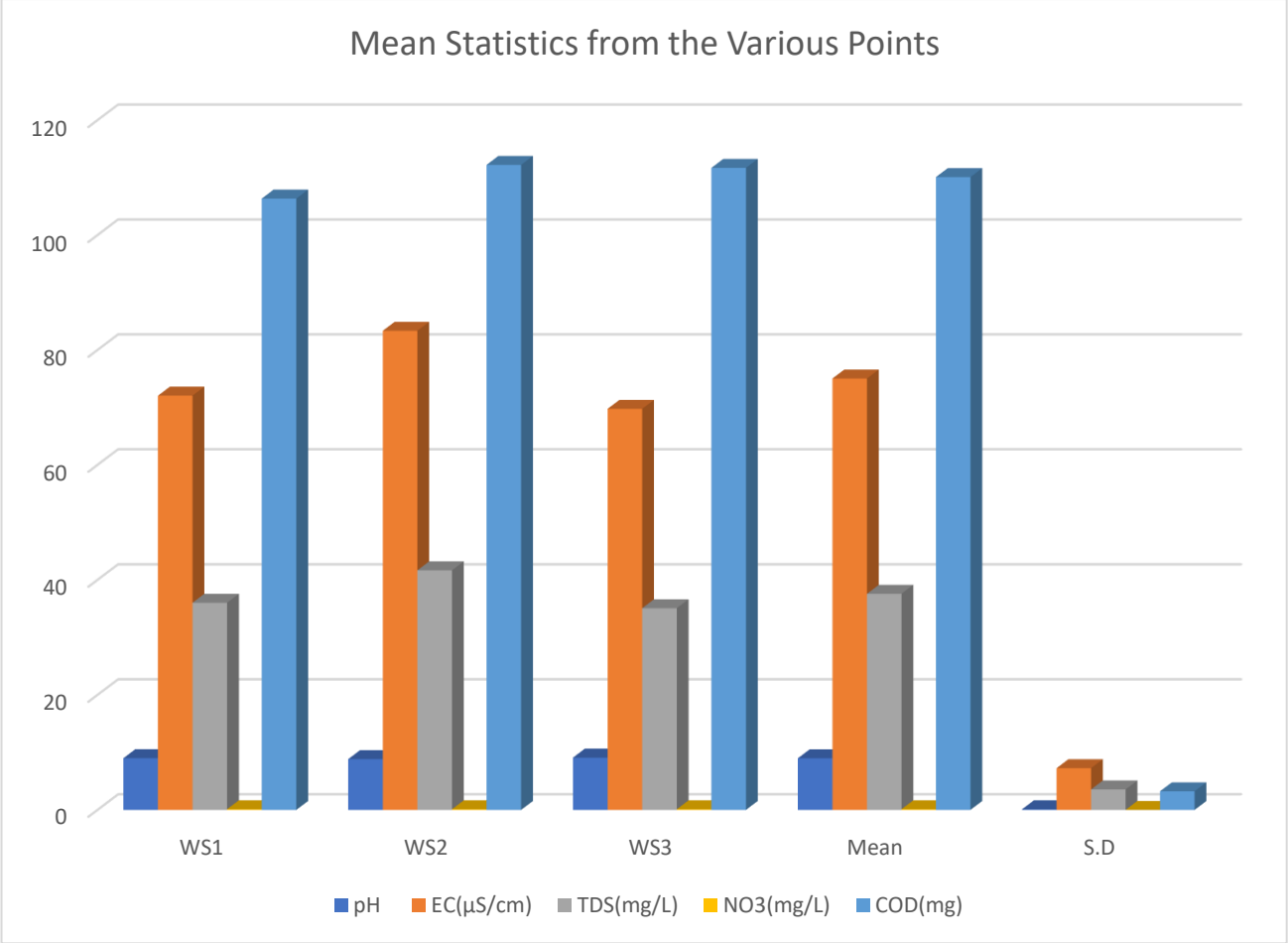


Fig 3.4: Graphical representation of mean statistics of Physicochemical parameters from the various sampling stations.

3.2. Statistical analysis

3.2.1. Correlation analysis

In WS1 EC showed a positive correlation with pH (r = 0.634), TDS showed positive correlation with pH (r = 0.634), and a perfect positive correlation with EC (r = 1.000), NO_3 showed strong negative correlation with pH (r = -0.801), EC (r = -0.895) and TDS (r = -0.8954), COD showed negative correlation with pH (r = -0.091), EC (r = -0.702), TDS (r = -0.702), COD also showed positive correlation with NO_3 (r = 0.327). As pH of the water increases, the EC and TDS value increases slightly, TDS increases with increase in EC, with increase of pH, EC and TDS, nitrate content decreases, with increase of EC and TDS, COD decreases, pH and nitrate has little or no effect on COD as they are weekly correlated.

In WS2, EC showed positive correlation with pH (r = 0.227), TDS showed positive relationship with pH (r = 0.227) and a perfect positive correlation with EC (r = 1.000), NO_3 showed a negative correlation with pH (r = -0.111), TDS (r = -0.172), EC (r = -0.172), COD showed a positive correlation pH (r = 0.231), EC (r = 0.512), TDS (r = 0.512), COD showed a strong negative correlation with NO_3 (r = -0.828). As TDS increases, EC increases, when COD increases nitrate content reduces, as EC and TDS value increases, COD increases slightly, while the value of pH has little or no effect on EC and COD as they are weekly correlated, pH has little or no effect on TDS as they are weekly correlated, pH has little or no effect on nitrate as they are weekly correlated.

In WS3, EC showed a weak positive correlation with pH (r = 0.346), TDS showed strong positive correlation with pH (r = 0.731), EC (r = 0.855), NO_3 showed weak positive correlation with EC (r = 0.218), negative correlation with pH (r = -0.635) and TDS (r = -0.051), COD showed positive correlation with pH (r = 0.585), TDS (r = -0.051), and a negative correlation with EC (r = -0.046), NO_3 (r = -0.509). Increase in pH and EC will cause increase in TDS, increase in pH and nitrate will cause decrease in nitrate and COD respectively. pH will have little or no effect on EC as it is weekly correlated, TDS and EC will have little or no effect on COD as they are weekly correlated.

Table 3.1: Correlation chart of the mean values of the physicochemical parameters

Parameter	*pH*	*EC*	*TDS*	*NITRATE*	*COD*
pH	1				
EC	-0.97315	1			
TDS	-0.96705	0.999684	1		
NITRATE	0.307719	-0.51846	-0.5398	1	
COD	-0.2129	0.432074	0.454622	-0.99518	1

Generally, EC showed a strong negative correlation with pH (r = -0.97), TDS showed strong negative correlation with pH (r = -0.97) and strong positive correlation with EC (r = 0.999), Nitrate showed weak positive correlation with pH (r = 0.31), and negative correlation with EC (r = -0.52) and TDS (r = -0.54), COD showed positive correlation with EC (r = 0.43) and TDS (r = 0.45), COD also showed weak negative correlation with pH (r = -0.21) and strong positive correlation with nitrate (r = 0.995). Increase in pH will cause increased decrease in EC and TDS. Increase in TDS will cause an increase in EC, increase in COD causes increase in nitrate.

3.2.2. Regression analysis

Regression plots were done for all the parameters from the sampling sites and all the strongly correlated parameters from the correlation of the mean values.

Table 3.2: Linear Models formed from the correlation of parameters from the various sampling sites

Independent Variable (X)	Dependent Variable (Y)		R^2	Regression Equation
		WS1		
EC	pH		0.4023	pH = 0.0655 (EC) + 4.2809
TDS	pH		0.4023	pH = 0.131 (TDS) + 4.2809
TDS	EC		1.000	EC = 2 (TDS)
NO_3	pH		0.6422	pH = -32.11 (NO_3) + 13.161
NO_3	EC		0.8007	EC = -347.25 (NO_3) + 117.06
NO_3	TDS		0.8007	TDS = -173.62 (NO_3) + 58.532
COD	pH		0.0083	pH = -0.0016 (COD) + 9.1711
COD	EC		0.4926	EC = -0.1197 (COD) + 84.795
COD	TDS		O.4926	TDS = -0.0599 (COD) + 42.398
COD	NO_3		0.1067	NO_3 = 0.0001 (COD) + 0.1143

		WS2		
pH	EC		O.0514	EC = 8.8488 (pH) + 5.1163
pH	TDS		0.0514	TDS = 4.4244 (pH) + 2.5581
EC	TDS		1.000	TDS = 0.5 (EC)
pH	NO_3		0.012	NO_3 = -0.0041 (pH) + 0.153
EC	NO_3		0.0297	NO_3 = -0.0002 (EC) + 0.1305
TDS	NO_3		0.0297	NO_3 = 0.003 (TDS) + 0.1305
pH	COD		0.0532	COD = 9.6977 (pH) + 26.503
EC	COD		0.2625	COD = 0.552 (EC) + 66.23
TDS	COD		0.2625	COD = 1.1039 (TDS) + 66.23
NO_3	COD		0.686	COD = -952.52 (NO_3) + 223.68
		WS3		
EC	pH		0.1195	pH = 0.0247 (EC) + 7.3756
TDS	pH		0.5341	pH = 0.1308 (TDS) + 4.5113
TDS	EC		0.7303	EC = 2.1388 (TDS) – 5.2696
NO_3	pH		0.4035	pH = -9.3123 (NO_3) + 5.2696
NO_3	EC		0.0475	EC = 44.699 (NO_3) + 64.423
NO_3	TDS		0.0026	TDS = -4.1547 (NO_3) + 33.576
COD	pH		0.3426	pH = 0.0086 (COD) + 8.1358
COD	EC		0.0021	EC = -0.0094 (COD) + 70.812
COD	TDS		0.1309	TDS = 0.0298 (COD) + 31.75
COD	NO_3		0.2595	NO_3 = -0.0005 (COD) + 0.1766

Table 3.3: Linear Models for strongly correlated physicochemical parameters of River Nun

Independent variable (X)	Dependent variable (Y)	R^2	Regression Equation
EC	pH	0.947	pH = -0.0176 (EC) + 10.298
TDS	pH	0.9352	pH = -0.0356 (TDS) + 10.318
TDS	EC	0.9994	EC = 2.0396 (TDS) + -1.6224
COD	NO_3	0.9904	NO_3 = -0.0021 (COD) + 0.348

Table 3.2 shows linear models established from correlation of the physicochemical parameters of the various sampling sites, table 3.3 shows liner models established from the strong correlation of physico-chemical parameters of the general sampling. These models can be used to derive the values for the quality of water.

4.0 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

River Nun serves as the major source of water in Amassoma and some other neighbouring communities, the pH, EC, TDS and Nitrate content of the River Nun water as shown by this study are within standards set by World Health Organization (WHO), however COD was far above the standards set by WHO, this is indication of heavy organic pollution. Therefore the water could pose a health risk to the consumers. Furthermore, various parameters showed strong correlation as EC correlated with pH, TDS with pH and EC, Nitrate with pH, EC and TDS, COD with pH, EC, TDS and Nitrate. Linear equations have been established for the correlated parameters, the equations derived could save time and cost for water quality monitoring as parameters that were not measured directly could be estimated from their linearuty model. However, for the weakly correlated parameters, the linear equations would not be very accurate in estimating the others.

4.2 Recommendation

I. Disposal of waste into the River Nun should be discouraged
II. There should be public vigorous and constant enlightenment campaign against indiscriminate disposal of waste into surface water bodies
III. Ministry of Environment in conjunction with ministry of water resources should undertaker regular monitoring of rivers water quality.

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SCHOOL/ COMMUNITY PARTNERSHIP: A PANACEA FOR REDUCING SECONDARY SCHOOL DROP OUT IN YENAGOA

[1]ANITA Nellie Osoikhia and [2]AMINI Clifford Moses
[1]Department of Educational Administration and Planning, Faculty of Education
National Open University of Nigeria
[2]Department of measurement and evaluation, faculty of education,
National open university of Nigeria
Phone: 09060729323 and 088036700636 Amini.clifford@gmail.com

Abstract
This study investigates school-community partnerships as a sustainable solution to reduce the rising rate of secondary school dropout in Yenagoa, Bayelsa State. A descriptive survey research design was adopted, involving 400 participants selected through stratified random sampling. Data were collected using a structured questionnaire and analyzed using descriptive statistics via SPSS. Findings revealed that financial hardship, parental disengagement, poor school infrastructure, early marriage, and weak community support were major contributors to dropout rates. However, results also showed that active collaboration between schools and communities, including parental involvement, mentorship programs, financial aid, and skill development initiatives significantly boosted student retention. The study highlights the urgent need for a holistic, locally driven approach that integrates educational stakeholders in combating school dropout. Empowering communities to take shared responsibility for education enhances students' academic persistence and emotional well-being. The role of local businesses, NGOs, and religious organizations in supporting education was emphasized. Strengthening these partnerships can bridge the gap between home and school, creating inclusive learning environments. Ultimately, the research offers a framework for community-based educational intervention and retention strategies.
Keywords: School-Community Partnerships, Dropout Rate, Student Retention, Parental Involvement and Educational Development

1.1 Introduction

Education is universally acknowledged as the cornerstone of societal development and individual empowerment. It fosters the acquisition of knowledge, skills, attitudes, and values essential for economic productivity, civic responsibility, and personal fulfillment (Kurangking et al., 2023). In developing countries like Nigeria, however, the education sector faces several challenges, among which is the alarming rate of secondary school dropout (Nwoke et al., 2024) according to Jacob et al. (2022), this growing phenomenon undermines national goals for education, economic growth, and social stability.

School dropout, as defined by UNESCO (2024), refers to the discontinuation of schooling before the completion of the academic program for which a learner is enrolled. This trend has significant implications for the future of youth, where poverty, child labor, early marriage, and limited access to quality education persist. According to national education statistics, a considerable percentage of Nigerian adolescents abandon secondary education before completion, often due to a lack of support systems both within and outside the school environment (Adebayo, 203).

Amid these challenges, school-community partnerships have emerged as a viable intervention model aimed at addressing the multifaceted causes of student disengagement and dropout. These partnerships are structured collaborations between schools and community entities—including parents, local leaders, religious institutions, non-governmental organizations, and businesses—designed to enhance students' academic and psychosocial well-being (Heni et al., 2024). Bukenya (2025) asserts that successful school-community partnerships create a holistic support framework that addresses not only the academic needs of students but also their social, emotional, and economic challenges.

Empirical research supports the argument that students thrive when schools and communities work collaboratively. Epstein (2018) emphasizes that shared responsibilities between school authorities and community stakeholders increase student attendance, academic achievement, and retention rates. Similarly, Jeynes (2022) highlights that students with active family and community engagement demonstrate stronger educational commitment and lower dropout risks. Kraft and Dougherty (2013) further observe that vocational training and community mentorship programs make learning more relevant and appealing, particularly to at-risk youths, thereby reducing dropout tendencies.

In the context of Yenagoa, Bayelsa State, the incidence of school dropout has continued to affect

the educational landscape adversely. While government efforts have focused on infrastructural development and curriculum reforms, these have not sufficiently tackled the socio-cultural and economic underpinnings of the dropout crisis. Hence, the integration of community-based support systems into educational planning and delivery is both timely and necessary. School-community partnerships provide platforms for mobilizing local resources, engaging parents, enhancing school governance, and tailoring education to meet local needs (Eden et al., 2024).

This study, therefore, seeks to explore the potential of school-community partnerships as a panacea to reducing secondary school dropout rates in Yenagoa. By examining the roles, challenges, and prospects of such collaborations, the research aims to propose sustainable strategies for strengthening education through community involvement.

2.0 Methodology

2.1 Research Design

This study employed a descriptive survey research design to assess the impact of school-community partnerships on reducing secondary school dropout rates in Yenagoa. This design was suitable as it enabled the systematic collection, analysis, and interpretation of data from a sample to describe patterns, behaviors, and relationships within the population without altering variables (Creswell, 2014).

2.2 Study Location

Yenagoa (Figure 3.1) is the Local Government Area and capital city of Bayelsa State, situated in Southern Nigeria within the Niger Delta region. The city is geographically located at coordinates 4°55′29″N and 6°15′51″E, covering an area of approximately 706 km². As the administrative and economic center of the state; Yenagoa comprises diverse communities with varying socio-economic backgrounds, making it an ideal location to assess the impact of community involvement on education.

2.3 Population of the Study

According to the National Population Commission of Nigeria (2023), the population of Yenagoa metropolis was approximately 524,400. This study focused on residents of Yenagoa metropolis, specifically targeting secondary school students, teachers, parents, and community stakeholders involved in education. The population of the study included individuals who played a significant role in school-community partnerships and their influence on student retention

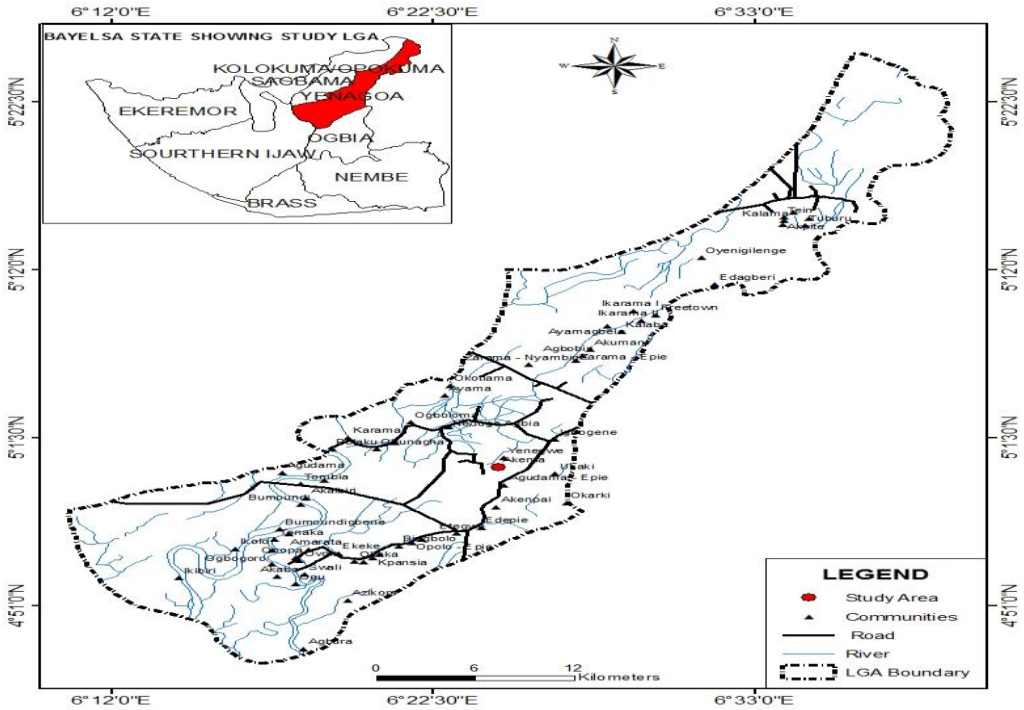


Figure 2.1: Map of Yenagoa Metropolis (Source: Warebi &Tonye, 2018

2.4 Sampling Techniques and Sample Size
The study employed a **stratified random sampling technique** to ensure that different groups within the population were proportionally represented. With a sample size of 400 using Yaro Yamane's formula.

2.5 Instrument for Data Collection
Data was gathered using a questionnaire titled **"Evaluation of School-Community Partnerships in Reducing Secondary School Dropout Rates (ESCPRSSDR)."** The questionnaire was divided into two sections: Section A collected demographic information from the participants, while Section B focused on questions related to the **extent, challenges, and effectiveness of school-community partnerships in addressing secondary school dropout rates in Yenagoa.** The questionnaire featured closed-ended questions using a Likert Four Scaling System, prompting responses categorized as "Strongly Agree (SA)," "Agree (A)," "Disagree (D)," and "Strongly Disagree (SD)."

2.6 Validity and Reliability of the Instrument
The questionnaire for this study underwent a content validation process to ensure its questions were relevant and aligned with the study's objectives. To ensure the reliability of the instrument, the test-retest method was employed. The computed reliability index using the test-retest method was 0.992, indicating a very high level of consistency and stability in the instrument over time.

2.7 Method of Data Collection
Data collection involved distributing a structured questionnaire directly to the respondent. Clear instructions on how to fill out the questionnaire were provided, and the questionnaires were distributed and collected on the spot.

2.8 Data Analysis
Data analysis was conducted using Statistical Package for the Social Sciences (SPSS) software to ensure accuracy and reliability of results. The collected data was analyzed using descriptive statistical methods such as frequencies, percentages, and mean scores, was summarize demographic data and responses from the questionnaire. Each item on the questionnaire will be analyzed by computing the mean (X) of the nominal values assigned to the Likert scaling items. . For this study, a mean response greater than or equal to 2.50 was considered as Agreed, while any mean rating below 2.50 was considered as Disagreed.

2.9 Ethical Considerations
Prior informed consent was obtained from all participants involved in the study, clarifying the purpose, voluntary nature of participation, and confidentiality of their information.

3.0 Results and Discussion of Findings
3.1 Demographic Variables
The demographic variable shows the Age Range, Gender, Educational Qualification, Role in the Community, Household Income Level and Length of Residency in Yenagoa Distribution Table.

Table 3.1: Demographic Distribution of Respondents

Variable	Category	Frequency (n=400)	Percentage (%)
Age (years)	15–24	120	30.0
	25–34	150	37.5
	35–44	80	20.0
	45+	50	12.5
Gender	Male	220	55.0
	Female	180	45.0
Educational Qualification	No Formal Education	40	10.0
	Primary Education	80	20.0
	Secondary Education	150	37.5
	Tertiary Education	130	32.5
Role in the Community	Student	120	30.0
	Teacher	100	25.0
	Parent	110	27.5
	Community Leader/Stakeholder	70	17.5

Variable	Category	Frequency (n=400)	Percentage (%)
Household Income Level	Below ₦50,000	150	37.5
	₦50,000 – ₦100,000	120	30.0
	₦100,000 – ₦200,000	80	20.0
	Above ₦200,000	50	12.5
Length of Residency	Less than 1 year	40	10.0
	1 – 5 years	100	25.0
	6 – 10 years	130	32.5
	More than 10 years	130	32.5

Source: Field Work, January 2025

The demographic data (Table 3.1) reveals that the majority of respondents (37.5%) fall within the 25–34 age group, indicating a youthful population actively involved in the study. Males constituted a slightly higher proportion (55%) than females (45%), showing near gender balance. Educationally, most respondents had attained at least secondary education (70%), which suggests a reasonably literate population capable of providing informed responses. in the community. Students (30%) and parents (27.5%) formed the bulk of the participants, followed by teachers and community leaders. A significant number of respondents (67.5%) reported household incomes below ₦100,000, pointing to widespread economic challenges. Lastly, the length of residency shows that 65% had lived in Yenagoa for over six years, highlighting a stable population with sufficient experience

3.2 Test for Research Objectives

Table 3.2: Mean score on factors contributing to secondary school dropout in Yenagoa

Item	SA 4	A 3	D 2	SD 1	Mean Score	Decision
Financial constraints significantly contribute to the high dropout rate among secondary school students in Yenagoa.	600	600	60	20	3.20	Accepted
Lack of parental involvement in education increases the likelihood of students dropping out of school.	720	540	60	10	3.33	Accepted
Poor school infrastructure and inadequate learning facilities contribute to student dropout rates in Yenagoa.	668	426	142	20	3.15	Accepted
Early marriage and teenage pregnancy are major factors leading to secondary school dropout among female students in Yenagoa.	800	450	60	20	3.33	Accepted
A lack of community support and engagement in schools increases student dropout rates.	640	540	80	20	3.20	Accepted
Total Mean					**3.24**	**Accepted**

Source: Field Work, January 2025

The analysis of Table 4.2.1 reveals that financial constraints, lack of parental involvement, poor school infrastructure, early marriage, and lack of community support are significant factors contributing to secondary school dropout in Yenagoa. The highest mean score (3.33) was recorded for both parental involvement and early marriage/teenage pregnancy, indicating their strong influence on dropout rates. Financial constraints and lack of community support also had high mean scores of 3.20, while poor school infrastructure scored 3.15. With an overall mean of 3.24, all factors were accepted as critical contributors to student dropout, highlighting the need for economic support, parental engagement, improved school facilities, and stronger community involvement to reduce dropout rates.

Table 3.3: Mean score on how do school-community partnerships influence student retention?

Item	SA 4	A 3	D 2	SD 1	Mean Score	Decision
Active collaboration between schools and the community helps improve student retention rates.	720	540	60	10	3.33	Accepted
Parental involvement in school activities significantly reduces the likelihood of students dropping out.	500	600	100	25	3.06	Accepted
Community-based mentoring and counseling programs help students stay in school and complete their education.	600	450	100	50	3.00	Accepted
Providing financial support and scholarships through community partnerships enhances student retention.	840	270	150	25	3.21	Accepted
School-community partnerships that involve local businesses and organizations in skill development programs encourage students to remain in school.	720	540	80	10	3.30	Accepted
Total Mean					**3.18**	Accepted

Source: Field Work, January 2025

The analysis of Table 3.3 shows that school-community partnerships play a significant role in improving student retention in Yenagoa. The highest mean score (3.33) was recorded for active collaboration between schools and the community, indicating its strong influence on keeping students in school. Similarly, partnerships involving local businesses in skill development programs had a mean score of 3.30, emphasizing their importance in motivating students to stay in school. Financial support and scholarships (3.21), parental involvement (3.06), and mentoring/counseling programs (3.00) were also accepted as key retention strategies. With an overall mean of 3.18, the findings highlight the need for strengthening school-community partnerships to improve student retention.

Table 3.4: Mean score on challenges that hinder the effectiveness of school-community collaborations in Yenagoa

Item	SA 4	A 3	D 2	SD 1	Mean Score	Decision
Lack of financial support from the community limits the success of school-community collaborations.	400	360	160	100	2.55	Accepted
Poor communication between schools and community stakeholders affects the effectiveness of collaboration efforts.	560	480	210	30	3.20	Accepted
Limited parental involvement in school activities reduces the impact of school-community partnerships.	400	120	160	180	2.15	Rejected
Inconsistent government policies and lack of support hinder the sustainability of school-community programs.	668	426	142	20	3.15	Accepted
Conflicting interests between schools and community members create barriers to effective collaboration.	600	450	100	50	3.00	Accepted
Total Mean					**2.81**	Accepted

Source: Field Work, January 2025

The analysis of Table 3.4 reveals key challenges affecting the effectiveness of school-community collaborations in Yenagoa. Poor communication between schools and community stakeholders had the highest mean score (3.20), indicating its significant impact on collaboration efforts. Inconsistent govern-

ment policies and lack of support (3.15) were also identified as major barriers to sustaining school-community programs. Additionally, conflicting interests (3.00) and lack of financial support (2.55) were recognized as limiting factors. However, limited parental involvement (2.15) was rejected as a significant challenge, suggesting that parents may already be actively engaged in school activities. With an overall mean score of 2.81, the findings highlight the need for improved communication, policy consistency, and financial support to enhance school-community collaborations.

Table 3.5: Mean score on what ways can school-community partnerships be strengthened to reduce dropout rates

Item	SA 4	A 3	D 2	SD 1	Mean Score	Decision
Increased parental involvement in school activities can enhance student retention and reduce dropout rates.	500	600	100	25	3.06	Accepted
Regular communication and collaboration between schools and community leaders can improve educational support systems.	600	360	130	65	2.89	Accepted
Providing financial and material support from the community can help keep students in school and prevent dropouts.	800	450	60	20	3.33	Accepted
Organizing mentorship and career guidance programs through school-community partnerships can encourage students to stay in school.	480	333	200	69	2.71	Accepted
Strengthening school security and creating a safe learning environment through community collaboration can reduce student dropout rates.	628	441	140	26	3.09	Accepted
Total Mean					**3.58**	Accepted

Source: Field Work, January 2025

The analysis of Table 3.5 reveals how providing financial and material support received the highest mean score (3.33), emphasizing the importance of economic assistance in keeping students in school. Increased parental involvement (3.06) and strengthening school security (3.09) were also identified as effective measures for enhancing student retention. Regular communication and collaboration between schools and community leaders (2.89) and organizing mentorship programs (2.71) were also accepted as valuable strategies. With an overall mean score of 3.58, the findings suggest that financial assistance, parental engagement, and community collaboration play crucial roles in preventing school dropouts.

3.3 Discussion of Findings

The findings in Table 3.2 demonstrate that several socio-economic and cultural factors significantly contribute to student dropout rates in Yenagoa. Financial constraints and lack of parental involvement, both with mean scores of 3.20 and 3.33 respectively, align with the observations of Wangu et al. (2024), who emphasized that poverty and inadequate family support limit students' ability to stay in school. Furthermore, early marriage and teenage pregnancy, which also scored a mean of 3.33, are consistent with studies by Emeri and Olarenwaju (2022) that linked early female dropout to cultural practices and gender-based vulnerabilities. Poor school infrastructure and lack of community engagement further compound these issues, as reported by Ayoko (2023), who noted that dilapidated facilities and poor learning environments discourage student retention.

Table 3.3 reveals that school-community partnerships play a vital role in improving student retention rates, with the highest agreement on active collaboration between schools and the community (mean = 3.33). This supports the work of Echegiri (2025), who noted that community involvement enhances educational outcomes by fostering a sense of shared responsibility. Partnerships that involve local businesses in skill development programs (mean = 3.30) resonate with findings from Siti Mariah et al. (2025) who argued that vocational training and real-world applications of learning keep students motivated. Moreover, parental involvement (mean = 3.06) and the provision of scholarships (mean = 3.21) further emphasize the importance of holistic support systems, as echoed by Utami (2022).

The data from Table 3.4 identify several challenges limiting the effectiveness of school-community partnerships. Poor communication between schools and community stakeholders, with the highest mean

score of 3.20, mirrors findings by Owan (2019), who stated that weak communication channels impede effective collaboration. Inconsistent government policies (mean = 3.15) were also acknowledged as a barrier, aligning with Eze (2023), who highlighted how fluctuating educational frameworks undermine long-term planning. Additionally, financial constraints (mean = 2.55) and conflicting interests (mean = 3.00) were recognized as factors limiting cooperation, which is consistent with findings by Ayeni and Abudu (2024) on community development efforts. Interestingly, limited parental involvement was not perceived as a significant challenge (mean = 2.15), suggesting that parents in Yenagoa may already be actively engaged in their children's education.

The analysis in Table 3.5 underscores practical strategies to strengthen school-community partnerships for reducing dropout rates. The highest mean score (3.33) for financial and material support indicates the critical role of economic backing in sustaining student education, supporting the views of Nwachukwu and Onwuka (2020), who emphasized community-based financial interventions in dropout reduction. Parental involvement (mean = 3.06) and school safety through community collaboration (mean = 3.09) were also highly rated, reinforcing the findings of Okoro and Agada (2021), who stressed that a secure and engaging school environment enhances retention. Regular communication with community leaders (mean = 2.89) and the organization of mentorship programs (mean = 2.71) highlight the importance of continuous interaction and psychosocial support, as recommended by Sumera Batool, et al. (2023).

Conclusion

This study confirms that secondary school dropout in Yenagoa is driven by multiple socio-economic and cultural factors. However, it also highlights that collaborative partnerships between schools and community stakeholders offer a viable means of reducing these dropout rates. Through increased parental involvement, financial assistance, mentorship, and local participation, schools can better support students' academic journeys. The research demonstrates that effective school-community partnerships not only address educational challenges but also strengthen social cohesion. Thus, such collaborations should be viewed as essential tools in enhancing student retention and fostering sustainable educational development.

Recommendations

Stakeholders should prioritize establishing formal partnerships between schools and local communities. Government and NGOs must invest in community-based programs that support students financially and emotionally. Lastly, schools should organize regular engagement forums to encourage parental and community participation in education.

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EVALUATION OF SILVER LACE FERN (*PTERIS ENSIFORMIS*) LEAF EXTRACTS FOR THE MANAGEMENT OF CALLOSOBRUCHUS MACULATUS INFESTATION IN STORED COWPEA (VIGNA UNGUICULATA L. WALP.)

[1]Obana Giedia., [2]Bolajoko A. Akinpelu., [3]Olalekan J. Soyelu, and [4]Olajumoke M. Omoboriowo
[1]Department of Science Laboratory Technology (SLT), Bayelsa State Polytechnic, Bayelsa State, Nigeria
[2] and [4] Department of Biochemistry and Molecular Biology, Faculty of Science, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria
[3]Department of Crop Production and Protection, Faculty of Agriculture, Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria
Phone number: 07085409100, 07030124953, 07063250322 and 08039269076
Obanagabriel23@gmail.com baakinpelu@gmail.com jlekan2001@yahoo.co.uk, Jummyimpact@gmail.com

ABSTRACT
Cowpea (*Vigna Unguiculata* L. Walp.) is a staple legume in tropical and subtropical regions, but its storage is compromised by *Callosobruchus maculatus* infestation. Although synthetic insecticides effectively control pests, their environmental and health risks necessitate botanical alternatives. In this study, *Pteris ensiformis*, a dimorphic fern consisting of both fertile and sterile fronds, was investigated for its insecticidal potential in managing *C. maculatus* infestations in stored cowpea. Four extracts were evaluated: fertile *P. ensiformis* ethanolic leaf extract (FPEELE), fertile *P. ensiformis* hexane leaf extract (FPEHLE), sterile *P. ensiformis* ethanolic leaf extract (SPEELE), and sterile *P. ensiformis* hexane leaf extract (SPEHLE). *The results of the study show that fertile P. ensiformis ethanolic and hexane at zero concentration of the leaf extract exhibit mortality rate 0 and 2 percentage respectively, while sterile P. ensiformis ethanolic and hexane at zero concentration of the leaf extract exhibited 1 and 2 percent respectively.* While at 1.25 mg/mL both fertile ethanolic and n-hexane extract of *P. ensiformis* leaf extract exhibited the mortality rate (12.00%). At 2.50 mg/mL sterile ethanolic extract of *P. ensiformis* showed the highest percentage mortality of 20.00% when compared with the other treatment of sterile ethanolic (11.00%), fertile ethanolic (17.00%) and fertile n- hexane (2.00%), fertile ethanolic (17.00%) leaf extract.The concentration of 5.00 mg/mL indicated that both fertile ethanolic and n-hexane *P. ensiformis* have a mortality percentage value of 14.00% and sterile ethanolic extract (3.00%) and sterile n-hexane (8.00%) of *P. ensiformis*. At concentration 10.00 mg/mL fertile ethanolic leaf extract of *P. ensiformis* had the highest percentage mortality (16.00%), but statistically there was no significance difference when compared with sterile ethanolic (10.00%), sterile n-hexane (14.00%) and fertile n-hexane (15.00%) of *P. ensiformis* leaf extract. This has study has shown that FPEELE is a potential botanical insecticide for minimizing post-harvest losses in cowpea storage. Further evaluation study is therefore recommended.

Keywords: *Pteris ensiformis, Callosobruchus maculatus*, Cowpea storage, botanical insecticide, ethanolic extract.

1.1 INTRODUCTION
Cowpea (*Vigna Unguiculata* L. Walp.) is an important legume crop widely cultivated in tropical and subtropical regions, particularly in Africa, Asia, and South America (Abebe and Alemayehu 2022). It serves as a vital source of dietary protein, carbohydrates, and essential micronutrients for millions of people, especially in developing countries where protein-energy malnutrition is prevalent. Cowpea is highly valued not only for its nutritional benefits but also for its ability to improve soil fertility through nitrogen fixation, making it an essential component of sustainable agricultural systems (Mndzebele *et al*., 2020).

The adaptability of cowpea to diverse climatic conditions, including arid and semi-arid environments, contributes significantly to its widespread cultivation. It exhibits drought tolerance, a short growth cycle, and the ability to thrive in low-fertility soils, making it a critical crop for smallholder farmers (Amare and Balana, 2023). Additionally, cowpea plays a key role in food security due to its multiple uses; the grains are consumed as food, while the leaves, pods, and haulms serve as animal fodder (Omomowo & Babalola, 2021).

Despite its numerous advantages, cowpea production faces several challenges, including biotic and abiotic stresses (Omotoso *et al*., 2020). Pests such as aphids (*Aphis craccivora*), pod borers (*Maruca vitrata*), and weevils (*Callosobruchus maculatus*) significantly reduce yields, while diseases such as bacterial blight and fungal infections pose additional threats (Togola *et al*., 2023).

Among the pest, Weevils (*Callosobruchus maculatus)* has remained a major threat to the storage of cowpea, because it's effects originate from the field,

transportation, and storage, thereby causing a reduction in the quality of cowpea hence making it unfit for market sells (Omotoso *et al*., 2020). Application of synthetic pesticides has been the major method of managing cowpea weevil infestation of the stored grains. Despite the effectiveness of synthetic pesticides in the management of crop pest, the deleterious effects of synthetic pesticides outweigh their advantages.

Botanical pesticides have been reported to be ecofriendly, cost effective and safe for humans (Daraban *et al*., 2023). Therefore, there is need to explore botanical protectants for minimizing post-harvest loses of cowpea. However, there is paucity of information on the insecticidal property of Silver Lace Fern (*P. ensiformis)* leaf. The aim of this study is therefore to evaluate the pesticidal efficacy of Silver Lace Fern (*P. ensiformis*) leaf extracts against cowpea weevil (*Callosobruchus maculate)*.

2.0. MATERIALS AND METHODS

2.1 Plant Description

Pteris ensiformis, commonly known as the Silver Lace Fern, is an ornamental fern from the *Pteridaceae* family, native to tropical and subtropical regions of Asia, Australia, and the Pacific Islands (Zhang and Zhang 2018). It features delicate, bipinnate or tripinnate fronds with silvery-white variegation along the veins, growing up to 50 cm in height (Yañez *et al*., 2023). The fern spreads through a creeping rhizome and reproduces via spores found on the underside of mature fronds (Jones *et al*., 2019). Thriving in moist, well-drained soil under shaded conditions, it is commonly used for landscaping, ground cover, and indoor decoration (Arana *et al*., 2020). Additionally, *Pteris ensiformis* aids in soil stabilization and may have phytoremediation properties, making it valuable in both horticulture and environmental conservation (Fayiga & Saha., 2016). The field image of the plant is presented in Figure 2.1



Figure 2.1: *Pteris ensiformis* (Burm. F.)

2.2. Materials

2.2.1 Reagents and chemicals

The reagents used in this study were all of the analytical grades. The diagnostic kits were procured from Randox Laboratories Ltd. UK, British Drug House (BDH) Chemicals Limited in London, and Sigma Chemicals Limited St. Louis, Missouri, U.S.A. Distilled water was used to prepare all the solutions.

2.2.2 Plant collection

Fresh leaves of both sterile and fertile *Pteris ensiformis* plant were harvested at the A.G. Leventis Museum Fern Garden in Obafemi Awolowo University (O.A.U), Ile Ife. The plants were authenticated at Ife Herbarium, Department of Botany, O.A.U. Ile-Ife Nigeria.

2.2.3 Insect culture

Adult *C. maculatus* (bean weevils) were reared, in the Insect Physiology Laboratory of the Faculty of Agriculture, OAU, Ile Ife on healthy, clean and un-infested bean seeds in a glass jar capped with muslin cloth for ventilation at [(28 ± 2°C); relative humidity (75 ± 5%)]. The newly emerged adults were used for this study.

2.3 Methods

2.3.1 Preparation of *P. ensiformis* leaf extracts

Both sterile and fertile leaves of *P. ensiformis* were separated and air dried at room temperature for two weeks. The ethanolic and n-hexane extracts were prepared by soaking 100 g each of sterile and fertile of *P. ensiformis* dry fine powder leaf separately in 300 mL each of 80% ethanol as well as n-hexane at room temperature for 72 hours and filtered thereafter through Whatman No 1 filter paper. The filtrates were separately concentrated on a rotary evaporator to obtain the ethanolic and n-hexane crude extract of both sterile and fertile leaves.

2.4 Toxicity Bioassay

2.4.1 Toxicity study of *P. ensiformis* leaf extracts on adult *C. maculatus*

"The acute toxicity study of the four *P. ensiformis* extracts (fertile and sterile *n*-hexane extracts, as well as fertile and sterile ethanolic extracts) was carried out according to the method of Ogunsina *et al*. (2011). The exposure chamber was separately pre-treated with each *P. ensiformis* leaf extract. The sides of the Petri-dishes were sealed with sticky paper-tape to prevent vapour escape. Whatman No.1 filter paper (15 cm diameter) were treated separately with different concentrations of *P. ensiformis* extracts (that is 0.6 mg/mL, 1.28 mg/mL, 2.5 mg/mL, 5 mg/mL and 10 mg/mL), of n-hexane and ethanolic fertile and sterile *P. ensiformis* leaf extracts. The experiment was conducted in triplicates and the average number of dead insects during these replications were used as the number of dead insects. The insects were monitored for signs of toxicity and mortality during the first 1, 6, 18 and 24 hours. The LC_{50} value was estimated using Probit analysis with Trimmed Spearman-Karber (TSK) program software.

2.4.2 Repellency activities of *P. ensiformis* leaf extracts against *C. maculatus*

A slight modification of the still-air olfactometer described by Weeks *et al*. (2011) was used to evaluate repellency activities of *P. ensiformis* leaf extracts against *C. maculatus*. Whatman's No. 1 filter paper was divided into two halves; 2 mL of 0.6 mg/mL, 1.28 mg/mL, 2.5 mg/mL, 5 mg/mL, and 10 mg/mL of each *P. ensiformis* extract was applied evenly on one half of the filter paper while 2 mL of 95% ethanol and n-hexane were applied separately on the other half using a micropipette to serve as control. The two halves were allowed to air-dry for 5-10 min before they were attached lengthwise and placed inside the Petri dish. Twenty newly emerged adult *C. maculatus* were released in the middle of each filter paper inside the Petri dish. Weevils that settled on each half of the filter paper disc were counted after 30 minutes and 1 hour. The test was carried out in triplicates and the repellency activity of the extracts was calculated using a statistical package, Statistical Analysis Software (SAS).

2.4.3 Oviposition deterrent and adult emergence activities of *P. ensiformis* leaf extracts on *C. maculatus*

The method described by Parugrug and Roxas, (2008) was adopted with slight modification. Cowpea grains (50 g) were treated with a concentration of 5 mg/mL of fertile hexane, fertile ethanolic, sterile hexane, sterile ethanolic of *Pteris ensiformis* leaf extract separately in triplicate inside 1.5 L glass jars; and with a control.

This was done for each jar from different batches in order to assess the effect of each extract of *P. ensiformis* leaf on the egg-laying ability of the weevils. The test media were left in laboratory conditions at an average temperature of 29.1 ^{o}C and a relative humidity of 75 ± 5% until weevils' emergence. The content of the jar was regularly observed in order to determine the day of weevil emergence.

2.4.4 Sub-acute toxicity study of fertile *P. ensiformis* ethanolic leaf Extract

The sub-acute toxicity study of the fertile ethanolic *P. ensiformis* leaf extract on *C. maculatus* were investigated by method of Omotosho *et al*., (2020). Ten newly emerged adult *C. maculatus* were transferred into Petri-dishes (4.5 cm diameter), which served as the exposure chamber, pre-treated with fertile *P. ensiformis* ethanolic leaf extract. The sides of the Petri-dishes were sealed with sticky paper tape to prevent vapour escape. Whatman No. 1 filter paper (15 cm diameter) were treated separately with 80%, 40% and 20% LC_{50} the extract at 6, 12, 18 and 24 hour exposure period. The experiment was conducted in triplicates.

2.5 GC-MS Analysis of Fertile Ethanolic *P. ensiformis* Leaf Extract

The GC-MS analysis of fertile ethanolic *P. ensiformis* leaf extract was carried out at the Department of Chemical Engineering, Unilorin, Kwara State.

Procedure

The GC-MS analysis was performed using an HP Agilent Chromatograph GC (7890B series) machine, which was equipped with a flame ionization detector, HP injector (MS 5975 series) and MS transfer temperature set at 250 ^{o}C. The analytical method was in accordance with Anyim *et al*. (2015). The machine

was equipped with a Varian column, Agilent J and W HP-5MS, with dimensions of 30 × 0.320 nm and a film thickness of 0.25 µm. To analyze the plant extract, 1 µL of the sample was dissolved in acetone and injected automatically at an injection temperature of 250 ºC into the GC column. The initial GC oven temperature was set at 50 ºC and held for 5 minutes, then increased to 280 ºC at a rate of 5 ºC/min for 9 minutes. The detector temperature was programmed at 280 ºC and the machine was operated in-scan mode, scanning from 45 to 45 amu (atomic mass unit). The MS-spectrum was acquired by electron ionization at 70 eV

2.6 Statistical Analysis

Data were expressed as n = 3. Abbott's (1925) formula was used to correct for natural mortality. The presence of significant differences among means of groups was determined using GraphPad Prism, Statistical Analysis Software (SAS), Trimmed Spearman-Karber (TSK) program (Probit analysis), Turkey Post Test EPA probit analysis was also used.

3.0 RESULTS AND DISCUSSION

3.1 Results

3.1.1 Yield of n-Hexane and Ethanolic Extracts of *P. ensiformis* Leaf Extracts

Pteris ensiformis leaf (43.51g) of fertile and sterile ethanolic yielded 0.1721 g (0.39%) and 0.1575 g (0.36%) of the starting sample respectively while fertile and sterile n-hexane yielded 0.2034 g (0.47%) and 0.1852 mg (0.43%) of the starting sample respectively.

3.1.2 Acute Toxicity Effect of *P. ensiformis* Leaf Extract on *C. maculatus*

Mortality effect of *P. ensiformis* leaf extract on *C. maculatus*

Table 3.1 shows the percentage mortality of acute toxicity effect of *P. ensiformis* exposed to *C. maculatus* when 20 cowpea weevils were used for the treatment. At concentration of 0 mg/mL which represent the control, it was observed that there was no significant difference in percentage mortality of *C. maculatus* exposed to ethanolic sterile and fertile; and n-hexane sterile and fertile. While at 1.25 mg/mL both fertile ethanolic and n-hexane extract of *P. ensiformis* leaf exhibited the highest percentage value (12.00%) this indicated that there was no significant difference between both groups. The percentage mortality of both sterile ethanolic and sterile n-hexane extract where 9.00% and 5.00% which shows a statistical difference when compared with both fertile treatment of *P. ensiformis* leaf extract on *C. maculatus*. At 2.50 mg/mL sterile ethanolic extract of *P. ensiformis* showed the highest percentage mortality of 20.00% when compared with the other treatment of sterile ethanolic (11.00%), fertile ethanolic (17.00%) and fertile n- hexane (2.00%), fertile ethanolic (17.00%) leaf extract.

Table 3.1: Percentage mortality of *P. ensiformis* leaf extract.

Conc (mg/ml)	SPEELE	FPEELE	SPEHLE	FPEHLE
0	1.00^{c}	0.00^{c}	2.00^{c}	2.00^{c}
1.25	9.00^{b}	12.00^{a}	5.00^{c}	12.00^{a}
2.50	11.00^{b}	17.00^{a}	20.00^{a}	2.00^{c}
5.00	3.00^{c}	14.00^{a}	8.00^{b}	14.00^{a}
10.00	10.00^{a}	16.00^{a}	14.00^{a}	15.00^{a}

FPEELE: fertile P. ensiformis ethanolic leaf extract; FPEHLE: fertile P. ensiformis hexane leaf extract; SPEELE: sterile P. ensiformis ethanolic leaf extract; SPEHLE: sterile P. ensiformis hexane leaf extract.

The concentration of 5.00 mg/mL indicated that both fertile ethanolic and n-hexane *P. ensiformis* have a mortality percentage value of 14.00% and sterile ethanolic extract (3.00%) and sterile n-hexane (8.00%) of *P. ensiformis*. At concentration 10.00 mg/mL fertile ethanolic leaf extract of *P. ensiformis* had the highest percentage mortality (16.00%), but statistically there was no significance difference when compared with sterile ethanolic (10.00%), sterile n-hexane (14.00%) and fertile n-hexane (15.00%) of *P. ensiformis* leaf extract.

3.1.3 Repellency efficacy of *P. ensiformis* leaf extracts against cowpea weevil

The result of the repellency activities of *P. ensiformis* leaf extracts on *C. maculatus* is presented in Table 3.2. The fertile ethanolic leaf extract had the highest repellency activity of (86.67%) when compared with

fertile n-hexane (76.67%) while, sterile ethanolic and n-hexane extracts repellency activity was similar (73.33%) though there was no significant difference among treatments. However, there was a significant difference when these treatments were compared with the control.

3.1.4 Anti-oviposition effect of *P. ensiformis* leaf extracts on cowpea weevil

Table 3.2 also shows the effect of *P. ensiformis* leaf extracts on *C. maculatus* egg laying activity. Fertile ethanolic leaf extract of *P. ensiformis* shows the lowest percentage value (9.00%), which was significantly different when compared with the control (29.33%), sterile ethanolic (16.00%), sterile n-hexane (16.67%), and fertile n-hexane (11.33%) leaf extract of *P. ensiformis.*

Table 3.2: The Repellency Efficacy and Antioviposition Effect of *P. ensiformis* Leaf Extracts

Treatment	Repellency (%)	Anti-oviposition (%)
SPEELE	73.33[a]	16.00[b]
SPEHLE	73.33[a]	16.67[b]
FPEELE	86.67[a]	9.00[c]
FPEHLE	76.67[a]	11.33[bc]
Control	10.00[b]	29.33[a]

FPEELE: fertile P. ensiformis ethanolic leaf extract; FPEHLE: fertile P. ensiformis hexane leaf extract; SPEELE: sterile P. ensiformis ethanolic leaf extract; SPEHLE: sterile P. ensiformis hexane leaf extract.

3.1.5 Sub-acute toxicity studies of *P. ensiformis* leaf extract against *C. maculatus*

Fertile *P. ensiformis* ethanolic leaf extract (FPEELE) showed highest repellency, mortality and anti-oviposition activity (Table 3.1 and 3.2). FPEELE was found to have an estimated LC_{50} value of 11.14 mg/mL using Probit analysis by means of Trimmed Spearman-Karber (TSK) program and the sub-acute concentration was estimated to be 8.91, 4.46, and 2.23 mg/mL for 80%, 40% and 20% of LC_{50} value respectively.

3.2 Discussion of the findings

Insecticidal potential of a large number of plant extracts and essential oil has been assessed against several major agricultural pests (Akram *et al*., 2024). The repellency activity of *P. ensiformis*leaf on adults *C. maculatus* in the present study showed that the plant extract repelled bean weevils. Furthermore, the efficacy of repellency activity was relatively enhanced on spores containing *P. ensiformis*leaf (fertile ethanolic leaf extract). This is in line with Uyi and Igbinoba, *et al*. (2016) who reported that the spores constituents (especially terpenoids and phenolic compounds) of Athyrium filix-femina and Polypodium vulgar makes it a better candidate for the larvicidal activities against lepidopteran caterpillars and coleopteran larva.

Furthermore, the study revealed that *P. ensiformis* leaf extracts induced cowpea weevil mortality at all the tested concentrations (1.25, 2.5, 5 and 10 mg/mL) and exposure periods (for 6, 12, 18 and 24 hours). At concentration 10.00 mg/mL fertile ethanolic leaf extract of *P. ensiformis* had the highest percentage mortality (16.00%) compared with sterile ethanolic (10.00%), sterile n-hexane (14.00%) and fertile n-hexane (15.00%). A study by Suresh *et al*. (2021) examined the insecticidal activity of extracts obtained from *Pteris vittata* against *Plutella xylostella*, a common pest of cruciferous crops, reported that the extracts showed significant insecticidal effects on *P. xylostella* larvae, inhibiting their growth and causing mortality. The study concluded that *Pteris vittata* extracts could have potential as a natural insecticide for controlling this specific pest.

Azadirachta indica leaf extract on cowpea weevil on *Eurygaster integriceps* eggs (Neto *et al*., 20219). These findings implies that plant extracts could be employed in management of insect pest. The result of this study indicated that fertile ethanolic leaf extract of *P. ensiformis* possess deterrent effect on *C. maculatus* egg-laying performance. Anti- oviposition effect of *Piper guineense* conducted by Benson *et al*. (2019) suggests the potential extracts of the plant as a natural deterrent against the cowpea weevils.

These findings collectively suggest that fertile *P. ensiformis* leaf has significant potential for pest control, as it repels cowpea weevil as well as inhibits their reproductive capacity and induced the insect. Repellency, anti-oviposition and mortality assay provides a crucial insight into the efficacy and potential implication on insect behaviour and physiology (Omotoso *et al*., 2020) these suggest the potential of *P. ensiformis* as a natural deterrent against cowpea weevils.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The study demonstrates that fertile ethanolic leaf extract of *Pteris ensiformis*, (FPEELE), exhibits significant insecticidal activity against *Callosobruchus maculatus*, reducing infestation in stored cowpea. The extract's bioactive compounds contribute to high mortality rates, strong repellence, and oviposition deterrence, making it a viable botanical alternative to synthetic insecticides. These findings underscore the potential of FPEELE as an eco-friendly pest control solution for post-harvest cowpea storage.

4.2 Recommendation

Based on the result of the study, the research recommends that:

I. Further research should explore its large-scale application, safety profile, and possible synergistic effects with other bio pesticides to enhance efficacy

II. Insecticidal potency of local plant extracts should be explored as safer and ecofriendly alternatives for the management of agricultural crop pest..

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PROXIMATE AND PHYTOCHEMICAL PROFILE OF *IPOMEA AQUATICA* LEAF MEAL

[1]Wozi, Ebikobowei Elvis, and [2]Yeigba, Bolouinbele Japhet
[1]Department of Animal Health and Production, Bayelsa State Polytechnic, Aleibiri, Bayelsa State, Nigeria.
07039004084, elbclajj2017@gmail.com
[2]Department of Animal Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.
08138571388 japhetyeigba@gmail.com

ABSTRACT
This study was carried out to examine the proximate and phytochemical composition of Ipomea aquatica leaf meal. Proximate analysis was performed using standard AOAC method of 2005 while quantitative Analysis was carried out to test for Phytochemicals. The results revealed that the leaves had moisture content of 8.89 %, Crude protein content of 28.20%, Ash content of 13.45%, Crude fiber 3.73%, Ether extract 1.43%, and NFE 48.44%. The predominant phytochemicals detected in the plants were Tannins (55.43 %), Alkaloids (28.68%), Saponin (7.41%), Cardiac glycoside (32.12 %), flavonoids (46.39 %) and Phenols (62.57%). It was concluded that the results obtained indicate that the Ipomea aquatica leaf is a good source of nourishment if properly utilized. Bioactive compounds found in the Ipomea aquatica leaf meal is an indication of its high therapeutic properties.
Keywords: Proximate analysis, Phytochemicals, Ipomea Aquatica, Leaf Meal, Bioactive Compounds

1.0 INTRODUCTION

Ipomea aquatica (IA) is a semi-aquatic tropical vegetable, belonging to the Convolvulaceae family which also known as water spinach, morning glory, kangkung, and green kankoong (Maung et al., 2020). *Ipomea aquatica* is considered as a native plant in Asia, Africa, and Southwestern Pacific islands. *Ipomea aquatica* distributed around the world by European explorers worldwide (Austin, 2008). Ipomoea aquatica contains carbohydrates and other nutrients, such as protein, lipid, fiber, vitamins, and minerals (Ali and Kaviraj, 2018). The levels of crude protein might be influenced by the stage of leaf harvest and the agro-climatic conditions of the area such as water, air, and soil (Gakuya et al., 2014). *Ipomea aquatica* contains adequate quantities of most of the essential amino that are comparable to common foodstuffs such as soybean or whole egg, it is an indication of the beneficial effect of *Ipomoea aquatica* as a food supplement (Meira et al., 2012). In the previous study by Silivong and Preston, (2016), *Ipomea aquatica* has been noted to have greater solubility of crude protein and thereby increasing the Nitrogen utilization by animals with regard to the high crude protein level. *Ipomea aquatica* also contains high levels of minerals such as potassium (K), sodium (Na), calcium (Cl), phosphorus (P), magnesium (Mg), iron (Fe), copper (Cu), manganese (Mn), and zinc (Zn) (Umar et al., 2007). Water spinach is a good source of protein and can be used as feed for all kinds of animal and for humans. The foliage contains protein in the range of 23.6% in the dry season and 27.6% in the wet season (Oshodi et al., 1999). According to Offor and Wariboko, (2013) that the use of locally abundant green leaves as feed supplements without doubt can improve the performance of livestock. Considering the importance of nutritionally balanced and cost-effective alternative diets there is a need for research effort to evaluate the nutritive value of different non-conventional feed resources, for animal feeding trials; like snail feeding trial. The shortage of feed resources for livestock and poultry feeding diverted majority of research in the field of animal nutrition to look into possibilities to overcome this nutritional crisis. In order to achieve this feat, feed materials such as plant leaves that are readily available with the right proportion of nutrients are identified and studied regularly. Thus, this study was carried out to evaluate the proximate and phytochemical composition of *Ipomea aquatica* as a potential dietary supplement in animal nutrition.

2.0 MATERIALS AND METHOD

2.1 Sample Preparation

The *Ipomea aquatica* leaves were collected at Ogboloma community, Gbarain, Yenagoa Local government area, Bayelsa state. The leaves were thoroughly washed to remove debris, air dried and afterwards sundried for 7 days to reduce the moisture content. The leaves were subsequently powdered using a mortar and pestle, and sent for laboratory analysis.

2.2 Proximate Analysis

Samples were analyzed chemically according to the official methods of analysis described by the Association of Official Analytical Chemist (A.O.A.C., 18th edition, 2005). All analysis were carried out in duplicate.

2.2.1 Crude Protein Determination

The crude protein in the sample were determined by the routine semi-micro Kjeldahl, procedure/ technique. This consists of three techniques of analysis namely Digestion, Distillation and Titration.

Apparatus: Analytical Balance, Digestion tubes, Digestion Block Heaters, 50ml Burette, 5ml Pipette, 10ml Pipette, 10ml Measuring Cylinder, 100ml Beakers, Fume Cupboard.

Reagents: ConC.H2SO4, 0.01NHCL, 40% (W/V) NaOH, 2% Boric Acid Solution, Methyl Red Brom-ocresol green mixed indicator, Kjeldahl Catalyst tablet.

2.2.2 Digestion

0.5g of each finely ground dried sample was weighed carefully into the Kjeldahl digestion tubes to ensure that all sample materials got to the bottom of the tubes. To this were added 1 Kjeldahl catalyst tablet and 10ml of ConC. H_2SO_4. These were set in the appropriate hole of the Digestion Block Heaters in a fume cupboard. The digestion was left on for 4 hours, after which a clear colourless solution was left in the tube. The digest was cooled and carefully transferred into 100ml volumetric flask, thoroughly rinsing the digestion tube with distilled water and the flask was made up to mark with distilled water.

2.2.3 Distillation

The distillation was done with Markham Distillation Apparatus which allows volatile substances such as ammonia to be steam distilled with complete collection of the distillate. The apparatus was steamed out for about ten minutes. The steam generator was then removed from the heat source to allow the developing vacuum to remove condensed water. The steam generator was then placed on the heat source (i.e. heating mantle) and each component of the apparatus was fixed up appropriately.

Determination: 5ml portion of the digest above was pipetted into the body of the apparatus via the small funnel aperture. To this was added 5ml of 40% (W/V) NaOH through the same opening with the 5ml pipette.

The mixture was steam-distilled for 2 minutes into a 50ml conical flask containing 10ml of 2% Boric Acid plus mixed indicator solution placed at the receiving tip of the condenser. The Boric Acid plus indicator solution changes colour from red to green showing that all the ammonia liberated have been trapped.

2.2.4 Titration

The green colour solution obtained was then titrated against 0.01N HCL contained in a 50ml Burette. At the end point or equivalent point, the green colour turns to wine colour which indicates that all the Nitrogen trapped as Ammonium Borate [(NH4)2BO 3] have been removed as Ammonium chloride (NH4CL).

The percentage nitrogen in this analysis was calculated using the formula:

% N = Titre value x Atomic mass of Nitrogen x Normality of HCL used x 4 or % N = Titre value x Normality/Molarity of HCL used x Atomic mass of N x Volume of flask containing the digest x 100

1

Weight of sample digested in milligram x Vol. of digest for steam distillation. The crude protein content was determined by multiplying percentage Nitrogen by a constant factor of 6.25 i.e. % CP = % N x 6.25.

2.2.5 Ether Extract Determination

Apparatus: Soxhlet apparatus and accessories, oven, desicator and analytical balance.

Reagents: Petroleum spirit or Ether (40□ – 60□C b.pt).

Determination: 1gm of each dried sample was weighed into fat free extraction thimble and plug lightly with cotton wool. The thimble was placed in the extractor and fitted up with reflux condenser and a 250ml soxhlet flask which has been previously dried in the oven, cooled in the desicator and weighed. The soxhlet flask was then filled to 3/4 of its volume with petroleum ether (b.pt. 40º – 60ºC), and the soxhlet flask. Extractor plus condenser set was placed on the heater. The heater was put on for six hours with constant running water from the tap for condensation of ether vapour. The set was constantly watched for ether leaks and the heat source was adjusted appropriately for the ether to boil gently. The Ether was left to siphon over several times say over at least 10 – 12 times until it was short of siphoning. It was after this was noticed that any ether content of the extractor was carefully drained into the ether stock bottle. The thimble containing sample was then removed and dried on a clock glass on the bench top. The extractor, flask and condenser was replaced and the distillation continues until the flask was practically dry. The flask which now contains the fat or oil was detached, its exterior cleaned and dried to a constant weight in the oven. If the initial weight of dry soxhlet flask was Wo and the final weight of oven dried flask + oil/fat was W1, percentage fat/oil was obtained by the formula:

W1 – Wo x 10

Wt. of Sample taken 1

2.2.6 Dry Matter and Moisture Determination

Apparatus: Oven, crucibles, dessicator and balance.

Reagents: Silical gel, grease.
Determination: 2g of the sample was weighed into a previously weighed crucible. The crucible plus sample taken was then transferred into the oven set at 100C to dry to a constant weight for 24 hours overnight. At the end of the 24 hours, the crucible plus sample was removed from the oven and transferred to dessicator, cooled for ten minutes and weighed.
If the weight of empty crucible was Wo
weight of crucible plus sample is W1
weight of crucible plus oven-dried sample W3

$$\text{(\% DM) \% Dry Matter} = \frac{W3 - Wo}{W1 - Wo} \times \frac{100}{1}$$

$$\text{\% Moisture} = \frac{W1 - W3}{W1 - Wo} \times \frac{100}{1}$$

or % Moisture = 100 – % DM.

2.2.7 Determination of Ash
Apparatus: Porcelain Crucibles, a Dessicator, Analytical Balances and a Furnace.
Determination: 2.0gm of the sample was weighed into a porcelain crucible. This was transferred into the muffle furnace set at 550ºC and left for about 4 hours. About this time it had turned to white ash. The crucible and its content were cooled to about 100ºC in air, then room temperature in a dessicator and weighed. This was done in duplicate. The percentage ash was calculated using the formula below:

$$\text{Ash content} = \frac{\text{wt. of ash}}{\text{original wt of sample}} \times \frac{100}{1}$$

2.2.8 Fibre Determination
Apparatus: Heating mantle, crucibles, furnace, sieve cloth, fibre flask, funnel, analytical weighing balance, a dessicator.
Reagents: 0.255N H_2SO_4, 0.313N NaOH and Acetone.
Determination: 2.0gm of the sample was accurately weighed into the fibre flask and 100ml of 0.255N H_2SO_4 added. The mixture was heated under reflux for 1 hour with the heating mantle. The hot mixture was filtered through a fibre sieve cloth. The filterate obtained was thrown off and the residue was returned to the fibre flask to which 100ml of (0.313N NaOH) was added and heated under reflux for another 1 hour. The mixture was filtered through a fibre sieve cloth and 10ml of acetone added to dissolve any organic constituent. The residue was washed with about 50ml hot water on the sieve cloth before it was finally transferred into the crucible. The crucible and the residue were oven-dried at 105ºC overnight to drive off moisture. The oven-dried crucible containing the residue was cooled in a dessicator and later weighed to obtain the weight W1. The crucible with weight W1 was transferred to the muffle furnace for Ashing at 550□C for 4 hours.
The crucible containing white or grey ash (free of carbonaceous material) was cooled in the dessicator and weight to obtain W2. The difference W1 – W2 gives the weight of fibre. The percentage fibre was obtained by the formula:

$$\text{\% Fibre} = \frac{W1 - W2}{\text{wt. of sample}} \times 100$$

2.2.9 Nitrogen-Free Extract (NFE) Determination
The NFE determined by difference. This was done by subtracting SUM of (Moisture % + % Crude Protein + % Ether Extract + % Crude Fibre + % Ash) from 100 i.e. (100 – (% M + % CP + % EE + % CF + % Ash)

2.3 Quantitative Analysis of the Phytochemicals
2.3.1 Test for Tannins
Analysis used was the method reported by Ejikeme et al., Each wood powder sample (0.30 g) was weighed into a test tube and boiled for 10minutes in a water bath containing 30 cm3 of water. Filtration was carried out after boiling using number 42 (125mm) Whatman filter paper. To 5 cm3 of the filtrate was added 3 drops of 0.1% ferric chloride. A brownish green or a blue black coloration showed positive test.

2.3.2 Test for Saponin
Methodology is as reported by Ejikeme et al., (2014) Distilled water (30 cm3) was added to wood powder samples (0.30 g) and boiled for 10 minutes in water bath and filtered using Whatman filter paper number 42 (125 mm). A mixture of distilled water (5 cm3) and filtrate (10 cm3) was agitated vigorously for a stable persistent froth. The formation of emulsion on addition of three drops of olive oil showed positive result.

2.3.2 Test for Flavonoids
The test for flavonoid adopted is as reported by Sofowara and Harborne. Each sample (0.30 g) weighed into a beaker was extracted with 30 cm3 of distilled water for 2 hours and filtered with Whatman filter paper number 42 (125 mm). To 10 cm3 of the aqueous filtrate of each wood extract was added 5 cm3 of 1.0M dilute ammonia solution followed by the addition of 5 cm3 of concentrated tetraoxosulphate (VI) acid. Appearance of yellow colouration which disappeared on standing shows the presence of flavonoids.

2.3.3 Test for Alkaloids
Test for flavonoid used is as reported by Hikino et al., Extraction of component from 2 grams of each

wood powder sample was carried out using 5% tetraoxosulphate (VI) acid (H2SO4) (20cm3) in 50% ethanol by boiling for 2 minutes and filtered through Whatman filter paper number 42 (125 mm). The filtrate was made alkaline using 5 cm3 of 28% ammonia solution (NH3) in a separating funnel. Equal volume of chloroform (5.0 cm3) was used in further solution extraction in which chloroform solution was extracted with two 5 cm3 portions of 1.0M dilute tetraoxosulphate (VI) acid. This final acid extract was then used to carry out the following test: 0.5 cm3 of Dragendorff's reagent (Bismuth potassium iodide solution) was mixed with 2 cm3 of acid extract and precipitated orange colour infers the presence of alkaloid.

2.3.4 Test for Glycoside

Glycoside test was conducted according to the method reported by Hikino et al., 1984. To 2.00 g of each sample was added 20 cm3 of water, heated for 5 minutes on a water bath and filtered through Gem filter paper (12.5 cm). The following tests were carried out with the filtrate:

(a) 0.2 cm3 of Fehling's solutions A and B was mixed with 5 cm3 of the filtrate until it became alkaline (tested with litmus paper). A brick-red colouration on heating showed a positive result.

(b) Instead of water, 15 cm3 of 1.0M sulphuric acid was used to repeat the above test and the quantity of precipitate obtained compared with that of (a) above. High precipitate content indicates the presence of glycoside while low content shows the absence of glycoside.

2.3.5 Determination of Total Polyphenol Content

The procedure developed by Mônica et al. was adopted for the quantification of total polyphenols. One milliliter (1 mL) of each sample extract was transferred to a different 25mL volumetric flask containing 2.5 mL of 3.54 g/L Iron(III) chloride-hexahydrate (FeCl3.6H2O) solution. The volumetric flask containing the sample solution was then placed in a water bath and maintained at 80˚C for 20 min. After this, 2.5 mL of acetate buffer (CH3COOH/CH 3COOK) solution (pH 4.6), 5.0 mL of 3.28 g/L,10-phenanthrolinehydrate (1,10-phen) and 2.5 mL of 3.72 g/ L Ethylene diaminetetraaceticaciddihydrate (EDTA) solutions were added, respectively. Finally, each flask was filled to the mark with distilled water, cooled and then the absorbance measurements were made at 511 nm.

3.0 RESULTS AND DISCUSSIONS

The result for the proximate composition of *Ipomea aquatica* leaf meal is shown in Table 3.1. From the results obtained in this study, the proximate composition of *Ipomea aquatica* on dry matter basis was Moisture content (8.89%), Crude Protein (28. 02%), Ash content (13.45%), Crude Fibre (30.70%), Ether extract (1.43%), Nitrogen free extract (48.44 %).

The result obtained in this study revealed that the proximate composition of the *Ipomea aquatica* leaves did not agree with the result reported by Ogundiran et al., 2019, as the result in the present study was higher in all the components recorded. These variations in nutrient composition of the *Ipomea aquatica* leaves can be attributed to several factors such as processing methods, stage of leaf harvest and agro-climatic conditions of the area such as water, air, and soil. Furthermore, Wafer and Tarimbuka, 2016 also reported that nutrient contents of vegetable and fruits vary as a result of environmental factors such as season, altitude, geographical condition, maturity stages and processing methods. Nevertheless, the result of the proximate composition from the present study, and reports by other authors shows that *Ipomea aquatica* leave can serve as a good source of dietary protein and energy that can be adequately utilized by livestock.

Table 3.1: Proximate composition of *Ipomea aqautica* leaf meal

Parameters	Percentage (%)
Moisture content	8.89
Crude protein	28.20
Ash content	13.45
Crude Fibre	3.73
Ether extract	1.43
Nitrogen Free extract (NFE)	48.44

The result of the phytochemical composition of *Ipomea aquatica* leaf meal is presented in Table 3.2. From the results obtained in this study, the phyto-chemical composition of *Ipomea aquatica* leaf meal

showed that the Alkaloid concentration was 7.41mg/100g, Saponin 28.68 mg/100g, Tannin 55.43 mg/100g, Cardiac Glucose 32.12 mg/100g, Flavonoid 46.39 mg/100g, and Phenol 62.57 mg/100g. The result from the present study revealed that Phenol was the most abundant bioactive compound in *Ipomea aquatica* while Alkaloids had the lowest concentration. This is in agreement with the report of Goa et al., (2011) that *Ipomea aquatica* leaves were rich in two phenol compounds; Stigmasterol and caffeic. This implies that the abundance of phenol in water spinach has detoxifying properties as caffeic is known to enhance the activity of certain detoxifying enzymes in the liver, contributing to the detoxification of harmful substances from the body. According to Okamoto et al., 2011, *Ipomoea aquatica* contains moderate levels of tannins, which contribute to its protective effects on the liver and kidneys. This is not in agreement with the findings from the present study which showed that tannins were the second most abundant phytochemical in *Ipomoea aquatica* leaves. This implies that excess of tannins can lead to liver dysfunction, but on the other hand, Tannins have been found to bind with proteins and other macromolecules, leading to the stabilization of cell membranes and reducing oxidative damage (Okamoto et al., 2011).

Liu et al., 2012 posited that Flavonoids are one of the most prominent phytochemicals found in *Ipomoea aquatica*, contributing significantly to its medicinal properties. This is in agreement with the findings of the present study as flavonoid concentration was one of the most abundant phytochemicals found in *Ipomoea aquatica* leaves. Flavonoids are known for their strong antioxidant properties, which help in neutralizing harmful free radicals in the body.

Table 3.2: Phytochemical composition of *Ipomea aquatica* leaf meal.

Parameters	Concentration mg/100g
Alkaloids	7.41
Saponin	28.68
Tannin	55.43
Cardiac Glucose	32.12
Flavonoid	46.39
Phenol	62.57

4.0 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

A biochemical analysis of a plant aims to unravel the rich dietary composition of indigenous plants and their capacity to be utilized as alternative sources of nutrients and nutritional supplements. The nutritional composition information of plant also help promote the use of more biodiverse feed for livestock feeding. The proximate analysis of *Ipomea aquatica* leaf meal showed that the leaf can be utilized as an alternative source of feed, because of its high protein, and energy content. The phytochemical analysis of *Ipomea aquatica* leaf meal in this study showed an appreciable amount of Tannins, Saponin, Alkaloids, Cardiac glycoside, phenol and flavonoids. These bioactive compounds found in the *Ipomea aquatica* leaf meal are majorly used for therapeutic purposes.

The findings, suggest that high protein and energy content of *Ipomea aquatica* leaf meal can be utilized as feed supplement for livestock. It was shown that appreciable amount of phytochemicals in *Ipomea aquatica* leaf meal make it suitable for therapeutic purposes.

4.2 recommendation

Based on the findings of this study, it is recommended that ipomea aquatica is rich in protein and essential vitamins and therefore can be used as a veritable animal feeds supplement.

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MULTIPLE EXCHANGE RATE AND ECONOMIC PERFORMANCE IN NIGERIA: A PRACTICAL APPROACH

Ofoniofoni Sueneme Bobkime
Department of Banking and Finance Niger Delta University, Bayelsa State

Prof. Gbalam Peter Eze
Department of Banking and Finance Niger Delta University, Bayelsa State

ABSTRACT
The study intends to explore effect of multiple exchange rates on economic performance in Nigeria. The study encompasses multiple exchange rate and economic performance variables includes official exchange rate, interbank exchange rate, bureau de change exchange rate and real gross domestic product for the period covering 1995 to 2023. The study expands on the empirical investigation through descriptive analysis. The descriptive result established that the data set are normally distributed from the Jarque-bera test at 5% significant level. Considering the long run impact among the variables, the Johansen co-integartion test was conducted and result showt that the series has a long run impact reporting from the max-eigen and trace test. Wherefore, the error correction model was employed to identify the impact of multiple exchange rate on economic performance. The result shows that official exchange rate has a positive and significant impact on real gross domestic product in Nigeria, inter-bank exchange rate has a positive though insignificant impact on real gross domestic product in Nigeria. The study further reveals that there is a negative and insignificant impact of bureau de change on real gross domestic product in Nigeria. The study concludes that the there is an impact between multiple exchange rate and economic performance. The study thus, recommends that regardless of the specific exchange rate system adopted, there should be an improved transparency in the foreign exchange market and strengthened governance for successful implementation.

Keywords: Multiple Exchange Rates, Economic Performance, Official Exchange Rate, Jarque-Bera Test

1.0 INTRODUCTION
Various extant of empirical studies in recent time have shown how important exchange rate could assist in determining how productive resources are distributed across nations in the global market (Takaendesa, 2023; Sunday et al., 2018). Accordingly, a country's economic performance and development may suffer from a badly managed exchange rate system (Rodrick, 2015). Hence, the appropriate selection and administration of exchange rate are essential components of economic management to attain macroeconomic stability, particularly in developing nations.

According to Sunday et al. (2018), economic actors, particularly those in developing nations, are concerned about the exchange rate and how it is managed. This worry arises, among other things, from the reality that exchange rate regulations impact nations' capacity to fully benefit from global commerce. In this sense, the goal of policymakers is to guarantee that changes in the exchange rate are in line with the demands of the macroeconomic fundamentals that are now in place.

The spread of different exchange rates, especially among the world's less developed economies has been one of the most notable and important phenomena in the pattern of development of exchange restrictions since the conclusion of the war (Eugene, 2020). The economic structures and issues of low-income nations, whose foreign trade primarily consists of swapping exports of primary items for imports of capital equipment and other manufactured goods, are best suited to modern multiple exchange rate regimes.

However, the literature has not fully addressed how different exchange rates affect macroeconomic performance and economic growth. Majority of current research examines capital regulations and macroeconomic performance without considering how they are determined simultaneously (Arellano, 2003). Furthermore, not all capital control is made equally. While some policies limit capital outflows, others focus on capital inflows. Developing nations' experiences with different exchange rates, however, have typically been unsatisfactory. The insulating effects of these agreements were diminished in the majority of countries due to a wide range of currency rates (Emma, 2014). In addition to creating entrenched interest groups, multiple exchange rates also lead to inefficiencies and welfare losses by warping the relative costs of products and services. Adoption of numerous systems has often resulted in short-term balance of payments alleviation. Foreign exchange demand pressures affected nations who did

not rein in their excessively expansionary fiscal and monetary policies. These pressures manifested as significant depreciations of the floating portion of their exchange rates and balance of payments deficits in the commercial market.

Although, different exchange rates can offer local economies some protection against outside shocks, they are not a good substitute for prudent monetary and fiscal policy for those who want macroeconomic stability. In order to boost the economy and bring back macroeconomic stability, the World Bank has recommended that the Federal Government should unify the country's currency rate windows and implement a number of other reforms (Damilola, 2023). Therefore, the aim of the study is to analyze the different elements of the multiple exchange rate system and their effects on the economy.

Nigeria also maintains a multiple exchange rate regime, with an official exchange rate coexisting with unofficial parallel market exchange rates that are marked by huge spread, high transaction costs, and lack of transparency. Furthermore, there is conflicting evidence in recent research on multiple exchange rates and economic growth in both developed and developing economies (Bahmani-Oskooee & Kandil, 2017). Furthermore, earlier research on the relationship between multiple exchange rate and economic performance in Nigeria was conducted using the Ordinary Least Square Method by (Bakare, 2021; Fapetu & Oloyede, 2014) and vector error correction (see Adelowokan, et al., 2015; Fapetu & Oloyede, 2014). These studies demonstrated that there are currently little literatures on the relationship between multiple exchange and economic performance in Nigeria within the error correction framework. This aimed at assessing the effects of multiple exchange rate on economic performance in Nigeria) It is anticipated the study will contribute to the body of empirical knowledge already available on the relationship between multiple exchange rates and economic growth.

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

The monetary approach is one of the most basic theories underlying the various exchange rates and economic performance. The idea placed a strong emphasis on how financial transactions or the balance of payments' (BOPs') capital account influence exchange rates. According to the idea, aggregate demand results from a dual exchange rate framework. Overall BOP disequilibrium is thought to be caused by excess demand for or supply of money, but capital transactions are what cause adjustments through potential changes in the exchange rate and economic output.

Therefore, the stance implies that changes in exchange rates lead to changes in economic production. Therefore, the price of foreign currency in terms of domestic currency is considered the exchange rate (Bahmani-Oskooee & Kandil, 2007). Given the domestic interest rate, output, and price level, the supply of foreign currency and the demand for it in the foreign nation are calculated. Given the nominal money stock, a rise in domestic nominal interest rates will decrease demand for real money balances, which will cause the exchange rate to depreciate and the level of domestic prices to rise. Therefore, the break in the relationship between the exchange rate and the transaction flows depicted in the monetary model or approach is satisfactorily explained by the what?

As a result, the break in the relationship between the exchange rate and the transaction flows shown in the balance of payments' current account can be satisfactorily explained by the monetary model or approach (Yougbare, 2008).

2.2 Empirical Review

Bakare, (2021) used the ordinary least square multiple regression analytical method to conduct an empirical investigation of the effects of the foreign exchange rate reforms on the performance of private domestic investment in Nigeria. The results of the multiple regression analysis indicated a strong but unfavorable correlation between Nigerian private domestic investment and the floating foreign exchange rate. The study's results and conclusion back up the government's decision to abandon the floating exchange regime and switch to purchasing power parity, which scholars believe is a better way to determine a realistic naira exchange rate and improve Nigeria's macroeconomic performance.

Bahmani-Oskooee and Kandil, (2017) investigated the exchange rate variations on output in oil-producing nations: the instance of Iran across time applying a new test for co-integration. They did this by using annual data on real and nominal measures of the effective exchange rate for Iran. The study concluded that currency appreciation is contractionary in the long run and expansionary in the near run, and it did not find any indication of co-integration between output growth and the parallel real-dollar exchange rate, either nominal or real.

An empirical re-examination of the connections among growth, volatility, and the exchange rate system was conducted by Yougbare, (2008). The findings show that fixed exchange regimes increase growth in a variety of ways, with the effects being

most noticeable at slower growth rates. Regarding the second objective, it has been demonstrated that pegged exchange regimes increase the detrimental direct and indirect growth consequences of volatility. Overall, the results imply that fixed exchange rates limit the economy's capacity to adapt to shocks and volatility.

Fapetu and Oloyede, (2014) used the error correction model (ECM) framework and ordinary least square estimate techniques to study Nigeria's economic growth and foreign exchange management from 1970 to 2012. According to the study, controlling the foreign exchange rate has an impact on a wide range of economic factors, which in turn has an impact on economic growth.

In order to ascertain the structural stability of the relationship between the exchange rate and output of goods and services Eze and Okpala, (2014) conducted a quantitative analysis of the effects of exchange rate policies on Nigeria's economic growth. They did this by testing the stability of parameter estimates using the Chow test procedure. According to their research, Nigeria's economic growth performance is mostly determined by the money supply (M2) and exchange rate (EXR), in addition to government expenditure (GEX). Additionally, the results of the Chow test indicated that there have not been any notable structural changes in the relationship between Nigeria's economic growth performance and the exchange rate. The upshot is that management effectiveness is what counts, regardless of the exchange rate regime whether it is fixed or variable. By managing its currency rate policy better overall, Nigeria may significantly boost its economic growth performance.

3.0 METHODOLOGY

Model Specification

Burns and Grove, (2005) state that depending on the study, data can be gathered using a range of techniques as long as the goals of the investigation is fulfilled. This study assesses the impact of multiple exchange rates on economic growth evidence from the Nigerian economy based on yearly data sources from the 1995-2023 Central Bank of Nigeria (CBN) Statistical Bulletin**.** The official exchange rate, interbank exchange rate, and bureau de change exchange rate were used as independent variables in the study, whereas real gross domestic product was used as dependent variable.

To test the relationship between multiple exchange and economic performance in Nigeria, the study specified the functional form as follows:

RGDP = F (OER, IBEXR, BDCER) (2.1)

The study explicitly transformed the functional form into econometric form which is shown below as equation 2.2

$=\beta_0++ \ + +$ (2.2)

Where RGDP denote real gross domestic product, OER represent official exchange rate, IBEXR denote inter-bank exchange rate, whereas, BDCER represent bureau de change exchange rate.

What are respective coefficients for each of the independent variables signify their relationship (elas-ticity). While, denote the intercept. The in the equation represent disturbance terms, t represent time period (1, 2, 3, ……..t).

4.0 RESULTS AND DISCUSSION

4.1 Results

Table 4.1: Descriptive Statistics

Part A: Descriptive Analysis

	RGDP	OER	IBEXR	BDCER
Mean	66953.28	188.4359	187.4793	214.1303
Median	44285.56	147.2700	150.5700	153.0600
Maximum	234425.9	644.6500	645.1900	770.8800
Minimum	2895.200	21.02000	21.88000	33.01000
Std. Dev.	65264.88	144.9024	142.2193	167.0642
Skewness	0.946775	1.402816	1.456657	1.503243
Kurtosis	2.940843	4.778575	5.135043	5.281199
Jarque-Bera	4.336746	13.33384	15.76368	17.21008
Probability	0.114364	0.001272	0.000378	0.000183
Sum	1941645.	5464.640	5436.900	6209.780
Observations	1.19E+11	587908.0	566337.0	781492.6
Part B; Correlation Statistics				
RGDP	1			
OER	0.9583	1		
IBEXR	0.8553	0.9955	1	
BDCER	0.9405	0.9852	0.9855	1

Source: Author Compilation Extracted from E-View Output 2025

The study was able to establish the outcome of the descriptive statistics from Table 4.1 part A. The average GDP stood at N' 66953.28 billion, while the official exchange rate mean stood at $/N'188.4359, also the inter-bank exchange rate mean shows 187.4793, and the bureau de change rate mean is 194.2464. The outcome of the study also reports a non-zero standard deviation which translates the series to a more efficient regression. According to Table 4.1 outcomes, given the Jarque-Bera Prob at five percent level of significant, the summary of the descriptive statistics reports that all the series are normally distributed.

Further, Table 4.1 Part B shows the correlation matrix of the variables under consideration. From the empirical results RGDP and OER; GDP and BDCER has a high relationship with each other with the minimum value of 0.9405. While interbank exchange rate and real gross domestic product has a moderate correlation with each other.

Table 4.2: ADF Unit Root Test

Variables	At Levels			At 1st Difference			Order of Integration
	Trend & Intercept			Trend & Intercept			
	t-stat	Critical Value	Prob.	t-stat	Critical Value	Prob.	
lnRGDP	0.3623	-5.2834	0.7723	-3.1823	-3.1382	0.0000**	I(1)
lnOER	0.1823	-3.4529	0.6593	-4.1332	-1.3034	0.0071**	I(1)
lnIBEXR	-3.016	-3.9232	0.3045	-5.1293	-3.2933	0.0124**	I(1)
lnBDCER	-3.1352	-4.3842	0.3203	-6.0884	-5.9304	0.0320**	1(1)

Source: Author Compilation extracted from E-View Output 2025

Table 4.3: *Summary of Philip Perron (* PP) Unit Root Test

Variables	Level Form			1 st Difference			Order of Integration
	Trend and Intercept			Trend and Intercept			
	t-stat	Critical Value	Prob. Value	t-stat	Critical Value	Prob. Value	
lnRGDP	0.3152	-4.7238	0.8823	-2.1544	-4.7239	0.0005**	I(1)
lnOER	-1.0224	-2.6354	0.5670	-3.6225	-2.6353	0.0007**	I(1)
lnIBEXR	-2.0165	-3.8342	0.5402	-3.8007	-3.8542	0.0004**	I(1)
lnBDCER	-3.1121	-4.7233	0.4838	-5.4622	-4.3741	0.0008**	I(1)

Source: Author Compilation extracted from E-View Output 2025
** indicates a significance level of at 5%.

From table 4.2, The Augmented Dickey Fuller (ADF) and Phillip-Perron unit root test conducted Table 4.3, both trend and intercept show that all the variables were integrated of order I(1). The above results imply that all the variables are stationary at first difference.

Illustrated from the trend and intercept of the Phillip-Perron unit root test and the Augmented Dickey Fuller (ADF) test indicate that all of the variables were integrated of order I(1). According to the aforementioned findings, every variable is stationary at first difference.

Table 4.4 Lag Order Selection Model

Lag Selection	Lag Selection Criterion						Remarks
	LogL	LR	FPE	AIC	SC	HQ	
0	32.357	NA	0.034	-2.466	-2.268	5.183	No
1	151.659	186.733*	0.000*	-11.448	-10.461*	-0.388*	Yes
2	167.801	19.65128	0.000	-11.460*	0.841	-9.6837	No

Source: Author Compilation extracted from E-View Output 2025

Table 3 shows Lag Order Selection Model. The best lag for the model is lag one (1)

Table 4.5 Johannsen Co-integration Test

Hypothesized No. of CE(s)	Trace Test			Maximum Eigenvalue Test		
	Trace Statistic	Critical Value @ 5%	Prob	Max-Eigen Statistic	Critical Value @ 5%	Prob
None *	76.63580	47.85613	0.0000	47.15582	27.58434	0.0001
At most 1 *	29.47998	29.79707	0.0544	19.23705	21.13162	0.0902
At most 2	10.24293	15.49471	0.2625	10.00497	14.26460	0.2116
At most 3 *	0.237956	3.841466	0.6257	0.237956	3.841466	0.6257

Source: Author Compilation extracted from E-View Output 2025

***Note**: Trace statistic and max-eigenvalue test indicates 4 cointegration at 0.05 level*

Consequently, it is necessary to perform the Johannsen Test of Cointegration as suggested by Johansen, (1988). From Table 4.5 4 co-integration test was conducted using the Johansen co-integration test based on Trace Statistics and Maximum Eigenvalue Test at a 5% significant threshold to determine whether a link existed between these variables in long run. There is evidence of co-integration, or a long-term link, between the variables, according to the findings.

Table 4.6 Error Correction Model

Dependent Variable: D (LnRGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.1649	0.0137	12.9919	0.0000
D(LnOER)	0.3084	0.1801	1.7414	0.0453
D(LnIBEXR)	0.1653	0.1089	1.5244	0.1127
D(LnBDCER)	-0.0115	0.1165	-0.0979	0.3233
ECM(1)	-0.2332	0.2861	-0.8172	0.0000
R-squared	0.54410	Akaike info criterion	-0.7050	
Adj. R-squared	0.4486	Schwarz criterion	-0.5182	
Prob(F-statistic)	0.0000**	Hannan-Quinn criter	-0.6457	

***Source**: Author Computation from E-view output version 9*

Note: *** denote 5% significance level*

The study starts the error correction model based on the cointegration test result Table 4.5 to evaluate how quickly the past period's deviation from a long-run equilibrium, or the error, affects its short-run dynamics. The short-term disequilibrium can converge to the long-term equilibrium at a rate of 23.0%, according to the Error Correction Model which displays a value of -0.2332 and a probability value of 0.0000 at the 5% level of significance.

Table 4.7 Residual Diagnosis Test

	Prob.
Normality (Jarque-Bera Test)	
Breusch-Godfrey Serial Correlation LM Test	0.194
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.109

***Source**: Author Computation from E-view output version 9*

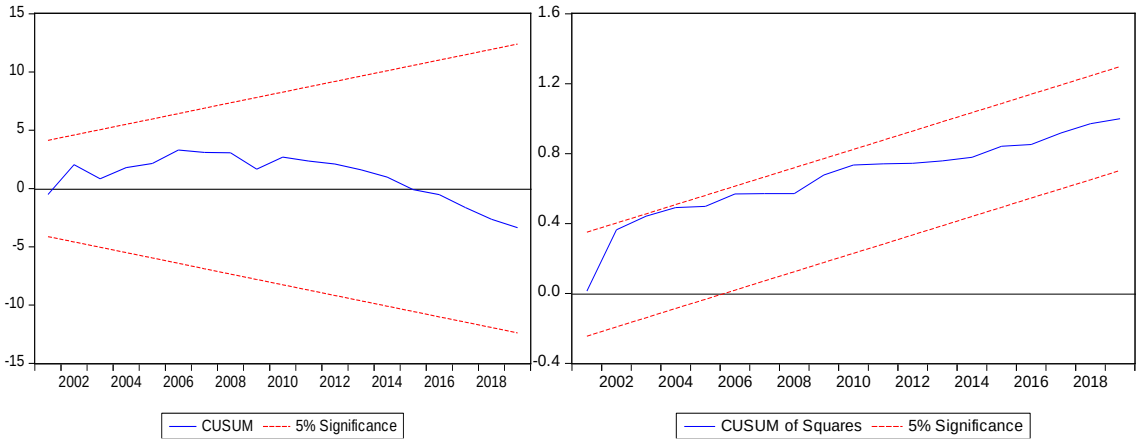


Figure 4.1 Test result for model stability (CUSUM and CUSUM of Square)
***Source**: E-view output version 9*

Results

4.2 Discussion

From Table 4.6 the outcome demonstrates that real gross domestic product exert a positive and significant impact by the official exchange rate. The Table showed that the official exchange rate contributed 0.3084 to the real gross domestic product. The implication is that gross domestic product increases in tandem with each unit change in the official exchange rate. The study is in line with that of Eze and Okpala (2014), who conducted a quantitative examination of how exchange rate policies affect Nigeria's economic growth and found that the exchange rate has a major role in determining the country's economic performance.

Furthermore, there is a positive but insignificant link between gross domestic product and interbank exchange rate, according to the empirical analyses from the error correction model results. Gross domestic product was shown to be influenced by the interbank exchange rate by 0.1653. The implication is that Nigeria's actual gross domestic product increases by 0.1653 for every unit change in the interbank exchange rate. Bahmani-Oskooee and Kandil's (2017) study, which used annual data on real and nominal measures of the effective exchange rate for Iran, is not supported by this study. The study concluded that currency appreciation is contraction-ary in the long run and expansionary in the short run, and it did not find any indication of co-integration between output growth and the parallel real-dollar exchange rate, either nominal or real.

Additionally, Table 4.6 demonstrates that bureau de change has an insignificant and adverse effect on Nigeria's real gross domestic output. It was found out that bureau-de-change contributed -0.011 to real gross domestic product. It suggests that there is a positive 0.011 change in Nigeria's gross domestic product for every unit change in the bureau de change. The study is similar with the study of Oloyede, (2014) that looked at foreign exchange management and Nigeria's economic growth. According to the study, controlling the foreign exchange rate has an impact on a wide range of economic factors, which in turn has an impact on economic growth.

Table 4.6 shows that the explanatory variables collectively explained 54.4% of the variance in the dependent variable gross domestic product, as indicated by the co-efficient of determination R^2 of 0.544. The remaining 45.6%, however, can be explained by additional factors that are not part of the model. The Adjusted R^2 of 0.448, which is near 54.4%, confirms the model's goodness of fit.

Furthermore, from Table 4.7 the diagnosis test shows the F-statistic of 1.344 and a probability of 0.194, which are not statistically significant at the 5% level, shows that there is no serial correlation in the model. Therefore, the null hypothesis that there is no serial association is. Also, the Heteroskedasticity Breusch-Pagan-Godfrey test which shows no statistical significance at the 5% level with an F-statistic value of 2.178 and a Prob. Value of 0.110.

Also, as Figure 4.1 illustrates, the CUSUM and CUSUM Squares tests demonstrate that the model is stable because the chart plots fall inside the bound at the 5% significant level. According to Bahmani-Oskooee and Nasir (2004), if the plots of these statistics fall inside the crucial bounds at the 5% significant level, the null hypothesis which the regression equation is accurately specified cannot be rejected.

5.0 Conclusion and Recommendations

5.1 Conclusion

The study extends to explore multiple exchange rates on economic performance in Nigeria. The study encompasses multiple exchange rate and economic performance variables (includes official exchange

rate, interbank exchange rate, bureau de change exchange rate and real gross domestic product for the period covering 1995 to 2023.

The study was able to stress out the importance of multiple exchange rate on economic performance by empirically showing an established extant of literatures in both developed and developing country. The study indicates that multiple exchange rate components such as inter-bank exchange rate and bureau de change are insignificant except for official exchange rate.

When faced with economic challenge and sudden shock in an economy, the country can opt for the implementation of a multiple rate system which is a way of subduing local inflation pressure and the importers demand for foreign currency thereby boosting economic performance.

The study concludes that there is an impact between multiple exchange rate and economic performance.

5.2 Recommendations

Based on the findings, the study thus, recommends that regardless of the specific exchange rate system adopted, improved transparency in the foreign exchange market and strengthened governance are crucial for successful implementation.

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BOARD DIVERSITY AND FINANCIAL REPORTING QUALITY OF LISTED MANUFACTURING COMPANIES IN NIGERIA

Goroke Ebikibina (FCNA)
Director, Finance and Accounts, Ministry of Marine and Blue Economy, Bayelsa State.
ebikibinagoroke@gmail.com; 08135260487
and
Bolouikie, Paul Igali (CNA)
Bayelsa State Ministry of Culture

Abstract
This study interrogated the effect of board diversity on financial reporting quality of listed manufacturing companies in Nigeria. Specifically, this study interrogated how board diversity (measured by age diversity and education diversity) affects the quality of financial reporting (proxied by relevance and faithful representation), using a cross-sectional data of 21 consumer goods manufacturing companies listed on the Nigerian Exchange Group from 2019-2023. Ex-post facto research design was adopted for the study. Data was obtained from the annual reports and other relevant materials of the companies under study. The data obtained was analyzed using multiple regression techniques. findings revealed that education diversity and age diversity have a significantly positive effect on the quality of financial reporting of these companies. It was therefore suggested by way of recommendation that in order to continue to have a high-quality financial reporting, listed manufacturing companies in Nigeria should endeavour to have a rich blend of age and education in the composition of their board of directors. In fact, this study went a step further to suggest that individuals between the age of 45-60, as well as, individuals with a minimum qualification of PhD should be the only ones appointed into the board.

Keywords: Board diversity, Age diversity, Education diversity, Financial Reporting.

1.0 INTRODUCTION

In recent years, owing to the financial scandals that engulfed the corporate world, there have been so much focus on the quality of financial reporting, and this will continue to be the primary focus even in the foreseeable future (Temprano & Gaite, 2020). Every organisation, especially the publicly listed ones, is expected by law to prepare financial statements that reflect its financial condition (Kaawaase et al., 2021). Alzoubi (2014) therefore argues that financial statements should always provide reliable information to assist users in making informed decisions. Thus, the quality of financial reporting, which is an important part of reliability, plays a significant role in potentially influencing stakeholders in their decision making and also in evaluating corporate performance (Davis & Cestona, 2021). This basically means that inferior quality financial information is detrimental to its users, and can cause stakeholders to lose confidence and trust in the relevance, faithful representation, neutrality, comparability, timeliness and understandability of the financial information (Pathak et al., 2021). Consequently, companies are encouraged to provide higher quality financial information. Moreover, due to the growing nature of financial reporting quality in the world today, several standards and guidelines such as Account Ability, Global Reporting Initiative, United Nations Global Compact and so on have been promulgated in order to improve financial reporting quality among companies. These guidelines, as well as pressure from stakeholder groups (such as government, consumers and investors), have given rise to the need for publish financial reports that meet the demands of the day. (Aribaba et al., 2020). Therefore, financial report, being a report published by a company or organisation about the economic, environmental and social impacts caused by its everyday activities, should be seen at all times to be a true reflection of the state of affairs of these reporting entities. Any issue that affects business stakeholders including employees, community, government, shareholders, finance providers, amongst others is what financial reporting disclosure is concerned with (Nwobu, 2017). It is for this reason that the individuals saddled with the responsibility of running the day-to-day activities of companies must ensure that they do not compromise on the quality of financial reporting.

From the foregoing, it can be deduced that the financial reporting of companies can only be as good as the individuals responsible for the preparation of such reports. Thus, there is no denying the fact that the body charged with the responsibility of preparing a high-quality financial reporting within any organisation (that is the board of directors) has to be structured in such a way that it should be able to have a proper understanding of, and capability to contend with the matters of the company, as well as have the

ability to exercise incisive and unbiased judgment. In this sense, the board of directors should comprise people who are independent in mind and status, and also be independent of management and free of all business and other relationships which could materially interfere with or be perceived to materially interfere with the exercise of independent judgment (Tan & Taofik, 2022). Without doubt, the board of directors forms one of the cornerstones of corporate frameworks, as it is one of the most influential decision making body in any organisation. It is in view of the apparent importance of the board of directors that it widely accepted that the composition of the corporate board could play a vital role in determining the quality of financial reporting of companies. It therefore goes without saying that the composition and diversity of board (in terms of age, gender, education, experience, religion, ethic etc) can go a long way in shaping the quality of the reports presented by the board (Peters & Zukbee, 2023).

As important as board diversity is to the presentation of high-quality financial reporting among companies, it is disheartening to note that (to the best of the knowledge of this researcher) very little or nothing has been done, in terms of academic research, on the effect of board diversity on financial reporting quality of listed Nigerian manufacturing companies. It is on this note that this study intends to consider how board diversity can affect financial reporting quality of manufacturing companies in Nigeria. Interestingly, where there has been work done on this subject matter, the focus of researchers has mostly been on gender diversity and experience diversity. Therefore, in an attempt to fill the identified knowledge gap, the study intends to interrogate the effect of board diversity (using education and age as proxies) on the quality of financial reporting of companies in the manufacturing sector of Nigeria so as to assist the manufacturing companies in providing important information to board of directors and the shareholders.

2.0 Literature Review

2.1 Conceptual Review

Board Diversity

According to Ullah et al. (2023), the board of directors of any company is one of the major elements of corporate governance. It is saddled with the responsibility of leading and taking charge of the management of such an organization, as well as provide oversight functions such as checkmating the excesses of the managers because they tend to act in their own self-interest as against the interests of the shareholders. Governance of organisations should therefore aim at protecting the interests of all stakeholders (Ullah et al., 2023). The role of the board of directors in any organisation cannot be over-emphasized, hence its composition, which can be likened to mean board diversity, (in terms of gender, age, experience, nationality, education and so on) should be appropriate. Board diversity can therefore be defined as a concept used to connote the various personal attributes that make the workforce heterogeneous (Xu et al., 2018), so it can be said to be those varied personal attributes and physical differences in people who are members of the board that make the board heterogeneous. Ahmadu (2017) posits that board diversity is a composition of board members with diverse educational qualification, gender, orientation, expertise, experience, age and culture.

For any board to be effective, its members ought to have varying perspectives and approach to management. This, according to Tan and Taofik (2022), can help to produce a broader range of solutions and decision criteria for strategic decisions. This is because board diversity is viewed as an apparatus for a solid inward control framework as it expands proficient and powerful dynamic exercises of the board of directors in the corporate organization, which advances the utilitarian capacity of the board, especially its capacity to take part in complex critical thinking (Augustine et al., 2021). Ullah et al. (2023) additionally believe that through board diversity, the board of directors is empowered with constituencies of society and equality of representations such that the board can deliver services with fairness and bring forth a fair outcome to all the stakeholders of the organisation.

The code of corporate governance in Nigeria also lends credence to the need for diversity of board members. Therefore, in the composition of the board of directors of any listed company in Nigeria, there is no religious, cultural background, educational qualification or nationality restriction. As a result, listed companies in Nigeria employ directors that are not limited to any culture, religion, gender, educational qualification or nationality as long as such director has the personnel resources needed by the firm. This is the bedrock of board diversity in Nigeria (Augustine et al., 2021).

Financial Reporting Quality

According to International Accounting Standard Board (IASB, 2015), financial reporting quality determines fundamental qualitative characteristics and enhances qualitative characteristics (which include relevance, faithful representation, comparability, verifiability, timeliness, and understandability of financial statements). Financial reporting quality is therefore defined as the faithfulness of the

information conveyed by the financial reporting process (Davis & Cestona, 2021). It is a report presented based on the condition of an organisation, which tends to decrease/ increase in relation to the ability of the funder to understand financial information. It is imperative to point out that excellent financial reporting quality reduces information asymmetry between the principal and agent in accordance with the company's legal obligations. Therefore, quality financial statements prevent the company from encountering a condition in which the investment is lower and serves as a tool for determining future fiscal policies. Financial reporting should also be capable of providing information to help stakeholders to make decisions especially relating to projecting the amounts and timing of future cash flows to the enterprise (Tan & Taofik, 2022). This is because the quality of financial reporting in any organisation is a reflection of the quality of the board of directors, occasioned by board diversity amongst others.

Board of Directors (BOD) Education Level and Financial Reporting Quality

Educational diversity is an indication that while some board members have obtained doctoral degrees (PhDs), other do not have. It has equally been found that directors with higher education levels are more likely to develop their potential and make better decisions (Pathak et al., 2021). According to Call et al. (2017), board members who have a high level of education tend to possess a deeper understanding of the business risk, which facilitates their ability to work effectively. The result is that they make fewer errors in the accounting system, thereby reducing information asymmetry. In contrast, Temprano and Gaite (2020) assert that educational diversity is not indicative of high-quality financial information. As a matter of fact, they are of the opinion that a board with different educational backgrounds are more likely to process and respond differently to issues they confront, which leads to cognitive conflict. Thus, the differing views of researchers on the effect of board of directors (BOD) education level on quality of financial reporting has given rise to the consideration of BOD education level as one of the measures of board diversity of this study, hence the formulation of the following null hypothesis:

Ho1: The diversity in the education level of a board does not affect the quality of the financial reporting of listed manufacturing companies in Nigeria.

BOD Age and Financial Reporting Quality

Diversity in age, as one of the indicators of board diversity, shows the average age of directors, which is obtained by combining the ages of the older and younger members of the BOD. Age can be a proxy for determining an individual's cognition, experience, and motivation (Xu et al., 2018). In addition, board members are expected to gain extensive knowledge, experience and skills as they age (Pathak et al., 2021). As a result, they are viewed as more reliable for handling unexpected problems and wiser in making decisions (Xu et al., 2018). However, as directors age, they tend to experience a decline in their cognitive abilities and a loss of productivity (Temprano & Gaite, 2020), leading to lower quality financial reporting. Further, younger directors tend to have broader networks, enabling them to bring more innovations to the Table, which is capable of enhancing the quality of the financial reporting. Consequently, the combination of older and younger board members complement each other and improve the board's control of the business (Temprano & Gaite, 2020). Thus, this study proposes the following hypothesis:

Ho2: Age diversity of board members does not affect the quality of the financial reporting of listed manufacturing companies in Nigeria

2.2 Theoretical Review

Agency Theory

This study is anchored on the agency theory, initially propounded by Berle and Means (1932) and later expounded by Jensen and Meckling (1976). This theory emphasizes that a relationship exists between the principal (shareholders) and the agent (managers/ directors) through a contract in which the principal delegates accountability to the agent to act on the principal's behalf (Pucheta-Martínez et al., 2018). However, because the principal does not have full decision-making rights, there is a misalignment of interests and information between the principal and the agent (Madison et al., 2016). This issue however is addressed through the demand for financial information as a monitoring tool that helps to reduce the information gap caused by information asymmetry and principal-agent problems (Chrisman, 2019). Furthermore, the agency theory is extended by the possibility that board diversity provides better management monitoring, which leads to a balanced board that is likely to prevent information asymmetry. When combined with the stewardship theory, the overall proxies of BOD diversity, which includes nationality and education, can be considered to be pro-organisational, thus they tend to reduce agency conflict (Chrisman, 2019).

2.3 Empirical Review

Ullah et al. (2023) investigated the relationship between board diversity and financial reporting

quality (FRQ) in China, an emerging market, by using panel data techniques. Specifically, the study investigated firms registered from 2005 to 2018. Board diversity was categorised into relation (i.e., gender and age), task (i.e., education, tenure and experience), and overall board diversity (sum of relation and task diversities). Findings indicated that board diversity has a significant positive impact on FRQ. The relationship between board diversity and FRQ is also strong in non-state owned firms and during non-crisis periods. Their findings remained consistent after numerous robustness checks comprising instrumental approach, propensity score matching, generalised method of moment, lag of independent variables, Heckman two-step model, change analysis, and alternative FRQ measures. Overall, board diversity is found to be associated with corporate outcomes. The study therefore recommended that the board of directors should comprise a rich blend of gender, age, education and tenure in order to enhance the quality of financial reporting.

Peters and Zukbee (2023) conducted a study to evaluate the effect of board heterogeneity on financial reporting quality drawing samples from listed deposit money banks on the floor of the Nigerian Exchange Group during a 5-year period: 2017-2021. The study employed the independent variables of board independence (BIND), board size (BCOM), and board gender diversity (BGD) as the board characteristics of the listed deposit money banks. The dependent variable of financial reporting quality was measured in terms of Jones Discretionary Accrual (FRQ). Furthermore, the study controlled the model's goodness of fit by employing the variable of cash flow to asset ratio (CFOA). The pool OLS regression was used to test the hypotheses of the study. Findings revealed that the effect of board independence on financial reporting quality is negative and statistically insignificant; the effect of board composition on financial reporting quality is negative and statistically significant; and the effect of board gender diversity on financial reporting quality is negative and statistically insignificant during the period under review. From the findings of this study, the researchers concluded that only board composition has significant effects on the financial reporting quality of listed deposit money banks in Nigeria, hence the researchers carefully recommended that the number of directors on the board should be of a reasonable size. Also, to guarantee quality financial reports, large boards should be discouraged in Nigerian listed deposit money banks. This will foster faster communication, coordination, and ultimately timely publishing of financial reports.

The study conducted by Tan and Taufik (2022) scrutinised how the diversity of board of directors (BOD) can determine the financial reporting quality (FRQ) and how firm size may act in a moderating role. They used faithful representation and relevance as FRQ measurements. Faithful representation has one proxy, which is financial restatement. Relevance has two proxies, which are the predictive value and confirmatory value. Moreover, board diversity included its members' gender, age, expertise and educational level. The research sample consisted of 377 companies listed on the Indonesia Stock Exchange from 2016 to 2020. Using a panel data, it was discovered that male directors can reduce the potential for financial restatements, but when moderated by firm size, they cannot guarantee the predictive value. Moreover, old directors can also reduce financial misconduct, but unqualified opinions are difficult to obtain when moderated by firm size. Further, a BOD without a member holding a doctoral degree can have a significant adverse effect on financial restatements and agency conflict. Meanwhile, board expertise boosts the fairness of financial reporting, resulting in obtaining an unqualified opinion and providing a predictive value. Based on the findings, it was concluded that the FRQ can be improved if there are female directors, younger directors, and directors who hold PhDs serving on the boards.

3.0 METHODOLOGY

The research design adopted for this is the ex-post facto research design. This design was adopted because all the relevant data for this study are historical in nature, since the primary source of data is the secondary (that is, annual reports of the companies under study and other relevant materials). The population of this study consisted of all listed manufacturing companies that are in the consumer goods category. As of today, there are 21 consumer goods manufacturing companies quoted on the Nigerian Exchange Group (www.nxggroup.com). The 21 consumer goods manufacturing companies represented the sample size since they all had the relevant information for this study for a five-year period from 2019 to 2023. In addition, using multiple regression techniques, Stata 17 was used to examine the panel data.

This research model can be expressed in the form of the following equation.

$Q = {}_0 + {}_1AGE_{1\ it} + {}_{22\ it} + \varepsilon_{it}$

Where;

FRQ = Financial Reporting Quality

AGE = BOD Age Diversity
EDU = BOD Education Diversity
ε = Error term

4.0 RESULTS AND DISCUSSIONS

Descriptive Analysis

Descriptive statistics of the data for study is shown in Table 4.1. It indicates that, the mean financial reporting quality (FRQ) was 97.92, which was considered to be low. According to Xu et al. (2018), a young member of a BOD would be anyone under 50 years old. However, the average age for a BOD was 52, indicating that most directors would be considered to be old. In the same manner, the mean distribution of 0.78 represented that the average percentage of directors who hold a PhD is 78%.

Table 4.1: Descriptive statistic of financial reporting quality and BOD diversity proxies

Variable	N	Minimal	Maximal	Mean	Std. Dev
FRQ	105	-324.28	11,454.43	97.92	400.71
AGE	105	34.25	71.33	52.15	5.21
EDU	105	0.00	1.00	0.78	0.28

Source: Author's Computation, 2024.

4.1 Regression Results

The author examined the relevance and faithful representation of financial reporting as determinants of the quality of financial reporting, while diversity in education and age represented the BOD diversity. Therefore, analysis was carried out on how the diversity of the BOD (that is, education and age) affects the quality of financial reporting.

Table 4. 2: Financial reporting quality regression result

Variable	Expected			Result		
	FRQ	RPV	RCV	FQR (RSS)	FRQ (RPV)	FQR (RCV)
AGE	(-)	(+)	(+)	-0.00272*	25.67	0.00953***
				(0.00161)	(20.46)	(0.00261)
EDU	(-)	(+)	(+)	0.000585**	289.06	0.000712
				(0.000291)	-353.71	(0.000495)
Constant				0.243**	-60.12	3.856***
				(0.0972)	(49.76)	(0.159)
Observations				105	105	105
R-squared				0.012	0.018	0.043

Notes: *, **, *** indicate significance at the 10%, 5%, and 1% levels.
Source: Author's Computation, 2024.

Table 4.2 shows that board age negatively and significantly impacted the restatement, accounting for -0.00272 with a 10% error rate. However, board age significantly and positively affected the confirmatory value, accounting for 0.00953 with a 1% error rate. There was impact from board education on the predictive and confirmatory values, as well as on restatement at 289.06, 0.000712 and 0.000585, with a 5% error rate respectively.

4.2 Discussion of Findings

Board age and financial reporting quality

According to Table 4.1, most members of the boards were 52 years of age, older than age (50 years) proposed by (Xu et al., 2018). Surprisingly, board age had a negative and significant effect on restatement, accounting for 0.00272 with a 10% error rate in Table4.2. This meant that the older directors were more accurate and were more likely to reduce the number of financial restatements. Moreover, board age also had a positive and significant effect on the confirmatory value, evidenced by 0.00953 at a 1% error rate in Table, 4. 2. It meant that older directors were not only more accurate but also provided unqualified audit opinions. Thus, users could anticipate the company's financial condition in the future. This study supports the findings of Pathak et al. (2021), in that older directors have more work experience and broader knowledge. As a result, they were more reliable in handling problems and wiser when making decisions. Hence, this paper only

emphasized the directors' ages, with an average of 52 years, as an indicator of older directors.

Board educational level and financial reporting quality

According to Table 4.1, 78% of directors hold a PhD. Board education had significant effect on the predictive and confirmatory values, accounting for 289.06 and 0.000712, respectively. The results of this research were empirically the same as Tan and Taofik (2022), in that the higher education levels of directors guarantees a higher quality of financial information. Thus, it could be assumed that the board members' level of education is critical in the improvement of financial reporting quality. This study also supports the findings of Akpan (2014), in that directors who hold a PhD tend to possess a more profound understanding, hence facilitating their ability to work effectively. In addition, they are more likely to develop their potential to make better decisions (Pathak et al., 2021).

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This paper investigates the effect of board diversity on quality of financial reporting of manufacturing companies in Nigeria. It was observed that the boards of the sampled companies are dominated by older directors (average age of 52 years) but they can reduce financial misconduct and provide an unqualified opinion. In larger firms however, the older directors are the ones responsible for financial misconduct, and find it hard to provide an unqualified opinion. Moreover, board education is dominated by individual with their doctorate degrees, whose input is enhancing the quality of financial reporting.

5.2 Recommendations

Based on these findings, in order to improve the quality of financial reporting of manufacturing companies in Nigeria, it is recommended that companies should have a rich blend of aged and highly educated personnel in the make-up of their board of directors. This study also recommends age bracket of 45 years to 60 years for members of board of Directors of companies because it is believed that along with age, comes experience. Similarly, the minimum academic qualification for any individual in the board of directors should be a PhD in any related field. This, the researchers believe, will bring about a rich and robust contribution to the quality of financial reporting by the board.

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CORPORATE FINANCIAL REPORTING QUALITY AND MARKET VALUE OF LISTED FIRMS IN NIGERIA

Boro Grace Lyon
Ignatius Ajuru University of Education Faculty of Management Sciences
Department of Accounting
graceboro16@gmail.com 09075654770

Abstract
This study examined the relationship between corporate financial reporting quality and Market value of the listed firms in Nigeria. The specific objectives of the study were to determine whether corporate financial reporting quality mechanisms have any relationship with market value of quoted firms. The study employed descriptive research design. The Nigerian exchange group's listed companies made up the study's population. The researcher used convenient and purposeful sampling techniques to select fifteen (15) companies listed on Nigerian exchange group, which strategically reflected the characteristics of the population. Data were extracted from these companies' annual reports from 2019 to 2023 and analyzed using a panel data regression. Corporate financial reporting was proxies by accrual quality and earnings quality while market value was measured by market to book value of the firm. Firm size was used as control variable. According to the research findings, earning quality and firm size have a stronger association with market value than accrual quality. The study recommends that corporate organizations in Nigeria should focus on enhancing their earnings quality reporting. By providing transparent and reliable earnings information, companies can build trust and credibility with investors and other stakeholders. It further recommends that awareness and education among market participants should be increased to foster a better understanding of the significance of reliable financial reporting practices and encourage market participants to consider financial reporting quality as an essential factor in their decision-making processes.
Keywords: Accrual quality, Earnings quality, Firm size and Market to book value

1.0 INTRODUCTION

Considering that the only way that shareholders and investors may stay updated about the performance of a company is through the publication of financial reports, the quality of these reports is extremely important to every management (Olumide et al., 2020). The necessity for reliable corporate financial reporting is more critical than ever in the current economic climate as emerging markets and mono economies like Nigeria struggle with the effects of an unprecedented drop in oil prices. Because many complex economic decisions are based on the information obtained from accounting information systems, it is crucial to evaluate, maintain, and enhance the quality of corporate financial reporting. Accounting information systems are essential to a firm's active flow as well as for complex economic decisions (Owolabi et al., 2020). The need for producing quality business financial reports is now widely recognized on a global scale. Publishing good quality information is important because it could have a favorable impact on key capital providers, other players, and decisions affecting the overall efficiency of the market (Nwaobia et al., 2020). As a result, one of the major discussions around financial reporting quality focuses on how it will affect an entity's future performance, or more specifically, how the stock market will react to this improved perceived quality.

Due to their poor reporting and non-adherence to accounting standards, audit and accountancy firms around the world have come under heavy scrutiny and criticisms following the dramatic collapse of the American company Enron Corporation in 2001 and the subsequent dissolution of Arthur Andersen, which was then one of the "Big five." In fact, the Enron catastrophe was regarded as the greatest audit failure of all time, according to Bratton (2018).

Aim and objectives of the study

The main aim of the study is to determine the relationship between corporate financial reporting quality and market value of listed firms in Nigeria.
The specific objectives of the study were to:

1. Determine the relationship between accrual quality and market value of listed consumers firms in Nigeria.
2. Ascertain the relationship between earnings quality and market value of listed consumers firms in Nigeria.
3. Determine the relationship between firm size and market value of listed consumers firms in Nigeria.

2.0 LITERATURE REVIEW

2.1 Conceptual Review

The several variables that are relevant to this study are examined in detail by the conceptual framework of this study. The conceptual framework will explain

the concepts of corporate financial reporting quality, corporate performance, and market value in order to give deep insight into the challenges at hand.

Corporate financial reporting quality

Financial reporting quality (FRQ) refers to the accuracy, reliability, and relevance of financial statements in portraying a company's true financial position and performance, facilitating informed decision-making by stakeholders. It ensures that financial reports are free from material misstatements and biases, enhancing their credibility. According to Dechow and Schrand (2019), high-quality financial reporting reduces information asymmetry between managers and investors, promoting trust and transparency. Ball and Shivakumar (2022) argue that FRQ curbs managerial discretion by emphasizing the timely recognition of economic losses, thereby fostering accountability. Barth et al. (2019) suggest that FRQ contributes to capital market efficiency by improving the comparability of financial data across firms. Furthermore, Chen et al. (2023) highlights the role of FRQ in corporate governance, linking it to reduced earnings management and stronger investor protection. Overall, FRQ is a cornerstone of effective financial communication, underpinning sustainable economic decision-making. A better level of corporate financial reporting quality specifically helps to minimize asymmetric information errors that result from competing interests. Businesses that provide accurate financial information to the various market agents give their customers a competitive advantage and better information.

Accrual Quality

Accruals are adjustments made to financial statements to recognize revenue or expenses when they are incurred, regardless of when the actual cash flow occurs. They are non-cash adjustments to earnings that are made to account for things like unearned revenue, accrued expenses, and deferred taxes. Accrual quality refers to the reliability and accuracy of these accruals (Dechow et al, 2002). High accrual quality suggests that a company's reported earnings and financial position are more likely to reflect the underlying economic reality. Factors that affect accrual quality include accurate estimation of future revenue and expenses, proper recognition of revenue and expenses according to accounting principles, adequate documentation and support for accruals and consistency in applying accounting policies. If a company has high accrual quality, it implies that its reported earnings and financial position are less likely to be distorted or manipulated, leading to a more reliable financial reporting quality.

Earnings Quality

Earnings quality refers to the ability of a company's reported earnings to reflect its true economic performance. It focuses on the relevance, persistence, and sustainability of earnings as an indicator of the company's financial health (Dechow et al, 2002) . High earnings quality indicates that reported earnings are a faithful representation of the company's underlying profitability. Factors that contribute to earnings quality include transparency in accounting policies and disclosures, absence of earnings management or manipulation, consistency in revenue recognition practices, reliability of financial statement components, such as provisions and reserves. Companies with high earnings quality are more likely to provide accurate and reliable financial information, which helps stakeholders make informed decisions.

Firm Size

The size of a firm is determined by taking the logarithm of all of its assets. The size of the corporation is frequently used as a factor of market value. The desire to demonstrate a positive influence on market value is increased for larger organizations (Prior et al., 2019; Surroca et al., 2020). The company's size has also been heavily considered in various financial quality reporting research studies, but it is unclear whether this effect of size exists.

Market Value

This is a gauge of how effectively a company makes use of resources from its main line of business and brings in money. Market value is a monetary indicator of the outcomes of a firm's activities and policies. The idea of "market value" refers to the degree to which a company has accomplished its planned objectives. It shows how consistently effective the organization has been in its operations (Saeidi, Sofian, & Siti Zaleha, 2019). The efficacy of an organization during operations and the degree of satisfaction it provides to its stakeholders are evaluated and assessed using the performance of a business firm as a signal (Antony & Bhattacharyya, 2020).

Market to Book Value

Market-to-Book Value (MTBV) is a financial metric used to evaluate the market value of a firm in relation to its book value. It provides insights into how the market values of a company compared to its accounting value. The MTBV ratio is calculated by

dividing the market price per share by the book value per share. The book value represents the net worth of a company and is derived from its accounting records. It is calculated by subtracting a company's total liabilities from its total assets. The book value per share is obtained by dividing the book value by the number of outstanding shares.

2.2 Theoretical Review

Agency Theory

Jensen and Meckling (1976) are the scholars who introduced the concept of agency. The major agent association is described in the agency philosophy. The shareholders are the "principal," while the "agents" are the management. Due to the divergent objectives of these two parties, agency costs are produced (Jensen & Meckling 1976). Corporate disclosures made through financial reporting and regulation help to resolve agency problems since they require administration of entities to provide mandated and optional disclosures for the benefit of investors and other interested parties. According to the agency theory, managers are generally required to communicate information to the entity's owners as appropriate as they learn first-hand corporate information about an entity's operations. As a result, the agency theory is used as the theoretical foundation for this study. Accordingly, agency theory postulates that directors may decide to overshoot financial information by using the knowledge they have under their control to guide their accounting and reporting decisions. They typically behave in their own perceived best interests to do this (Jensen & Meckling 1976). Therefore, reducing agency costs by enforcing internal control measures ought to encourage managers to act in the shareholders' best interests rather than their own. Opportunism should, nevertheless, continue to some extent because restrictions are insufficient (Jensen & Meckling 1976).

2.3 Empirical Review

Owolabi et al. (2020) investigated the relationship between corporate financial reporting quality and market performance (TOBINQ). This study found a significant relationship between market performance (TOBINQ) in listed deposit money banks in Nigeria and corporate financial reporting quality (earnings predictability, timeliness) using panel methodology in addition to other econometric tests (descriptive statistics test, correlation analysis, and Hausman test). The study revealed a significant but negative relationship between corporate financial reporting quality (timeliness and earnings predictability) and market performance (TOBINQ) in listed deposit money banks in Nigeria. The study concluded that deposit money bank managers should prioritize implementing best practices in financial reporting to enhance market performance despite observed challenges with timeliness and predictability.

The impact of corporate financial reporting quality on deposit money banks' investment decisions was studied by Bamidele et al. (2018) with reference to Nigeria's Zenith Bank Plc. Information taken from Zenith Bank Plc's audited annual reports, which covered the years 2010 through 2017.The study used E-view 9 to analyze the data using both the descriptive and ordinary least square regression methods. The results revealed that variables related to Corporate Financial Reporting Quality (FRQ) measures such as profit after tax, cash used in/from investing, and cash and cash equivalents, had a substantial impact on investment. The outcome also demonstrates that corporate financial reporting quality has a considerable impact on deposit money bank investments (R2 = 0.98; P 0.05). The study came to the conclusion that Deposit Money Banks in Nigeria make more investment decisions when corporate financial reporting is of greater quality. Therefore, it was suggested that DMBs voluntarily produce quality reports, as this has been proved to stimulate the market and increase investments. The study found that corporate financial reporting quality significantly influences deposit money banks' investment decisions, with measures like profit after tax, cash flows, and cash equivalents showing substantial impact ($R^2 = 0.98$; $p < 0.05$). It was concluded that high-quality corporate financial reporting enhances investment decisions in Deposit Money Banks, and voluntarily producing quality reports can stimulate market growth and attract investments.

Saliu (2018) investigated how financial reporting affected quoted firms' market values in Nigeria. The main goal of this study is to establish a connection between profit after taxes, return on assets, and return on equity and the caliber of financial reporting. Primary and secondary sources were both used in the data collection. The majority of the primary data came from the distribution of a questionnaire, and the secondary data came from the annual reports of a selection of chosen or quoted corporations. Cross-sectional and survey research designs were used in the study. The stratified sampling technique was used to determine the sampled businesses, and the proportional sampling technique was used to determine the sample size. 450 copies of a well-structured questionnaire were also issued, but only 350 of them were returned and studied. Financial reporting and market value were the variables taken

into account in the study, and they were represented by the accuracy of the financial reporting, return on equity, return on asset, and profit after tax. For the statistical study of the variables, two analytical techniques were used. These statistics are both descriptive and inferential. Variables were treated to frequency and percentages under descriptive statistics. The level of significance utilized to test the hypothesis was 5%, and data analysis was done using SPSS version 20 and E-Views 7 statistical software. The study found a significant relationship between financial reporting quality and the market values of quoted firms in Nigeria. Specifically, the accuracy of financial reporting, return on equity (ROE), return on assets (ROA), and profit after tax (PAT) were identified as critical factors influencing firms' market value. The study concluded that financial reporting quality plays a pivotal role in determining the market value of quoted firms in Nigeria.

Knowledge Gap

The knowledge gap lies in understanding the specific mechanisms through which Accrual Quality (AQ) and Earnings Quality (EQ) impact the market value of listed firms in Nigeria. While AQ and EQ are widely recognized as important proxies for financial reporting quality, their direct influence on Market to Book Value (MTBV) in the Nigerian context remains underexplored. There is a lack of empirical studies focusing on how variations in AQ and EQ affect investors confidence and decision-making in Nigerian markets. Firms that consistently demonstrate high AQ and EQ are more likely to attract positive market sentiment, translating into better stock performance and higher valuation. Ultimately, the quality of financial reporting serves not only as a tool for transparency but also as a strategic asset that can impact a firm's competitive advantage in the market. Hence the need for the study.

3.0 METHODOLOGY

3.1 Method

The study covered the Nigeria Exchange Group's listed companies for a five-year period between 2019 and 2023. Five additional factors were used in the study, which were further divided into independent, control, and dependent variables for analysis. The Nigeria Exchange Group's listed companies made up the study's population. As it is frequently impractical and widely acknowledged that no study can be conducted on the complete population. Thus, the researcher chose fifteen (15) enterprises listed in the market that span three important sectors using convenient and purposeful sample approaches that strategically reflect the characteristics of the population. The secondary data used in this study were taken from the annual financial statements of the chosen companies as well as publicly available share price information from the stock market. All variables for the time period were observed using the panel data regression analytical technique. The Panel Least Squares (PLS) regression estimation was used in the investigation. The PLS regression method is more appropriate and was therefore adopted for this study. It corrects for the bias caused by the missing variable and enables the evaluation of variations in cross-sectional units as well as differences in individual units over time (Baum, 2019).

Table 3.2 Description of Variables

Variable Name	Variable Type	Measurement
Accrual Quality (AQ)	Independent	Total accruals to assets = (Net Income – Operating cash flow) / Beginning total assets
Earning Quality (EQ)	Independent	Quality of earnings ratio = Net cash from operating activities / Net income
Size of the Firm (FSize)	Independent	Natural logarithm of Sales
Market value (PF)(Market to Book Value	Dependent	Market Value divided by Book Value of Firm

Source: *Author Compilation (2024)*

Model Specification

$$FP = \beta o \sum_{t=1}^{n} \beta i \, Xit + \varepsilon$$

Source: Panigrahi, Anita Sharma (2020)

Where:
FP_{it}= Market to Book Value (MTBV) of a Firm i at time t; i = 1, 2, 3…, 15 firms respectively.
β0 = the intercept of equation
βi = Coefficient of X it variables
X_{it}=the different independent variables for Corporate Governance of firm i at time t
t = Time from 1, 2…, 5 years
ϵ = error term which account for other possible factors that could influence FP_{it} that are not captured in themodel.

The econometric models employed in this study were linear Multivariate Models which were develop as thus:

PFit = β0 + β1 (AQit) + β2 (EQit) + β3 (FSizeit) + β4 (LRit) + εit

4.0 RESULTS AND DISCUSSION

4.1 Presentation of Results

Table 4.1: Descriptive Statistics

. summarize MTBV AQ EQ Fsize LR

Variable	Obs	Mean	Std. Dev.	Min	Max
MTBV	75	1.087995	1.690904	-2.979792	11.63466
AQ	75	-.034698	.0958861	-.4348785	.1131745
EQ	75	1.711719	5.06042	-24.5778	18.06054
Fsize	75	5.486681	1.122352	3.252853	7.328283

Source: Stata 13 Output

Always use descriptive statistics to show sample size features. According to Table 4.1, MTBV has a mean value of.1.087995, a minimum value of -2.979792, and a maximum value of 11.63466. The distribution's spread was measured by the standard deviation, which was 1.690904. The median accrual quality rating is -0.34698, which indicates a 3% accrual quality. The aforementioned results also demonstrated that the typical EQ-earning quality for the enterprises in our sample is around 2% (1.711719). Fsize's mean value was 5.486681. The shared characteristics of each variable showed that, with the exception of AQ-accrual quality, all the variables are positive and exhibit a rising tendency throughout the course of the sampling period.

Table 4.2: Correlation Matrix

	MTBV	AQ	EQ	Fsize	LR
MTBV	1.0000				
AQ	-0.1305	1.0000			
EQ	0.1096	-0.4840*	1.0000		
Fsize	0.4024*	0.0839	0.0198	1.0000	

. spearman MTBV AQ EQ Fsize LR, stats(rho) star(0.05)(obs=75)

Source: Stata 13 Output

The Pearson correlation analysis matrix displays the correlation between each pair of independent variables as well as the correlation between the explanatory and the explained variables. It is helpful in determining the strength or depth of the association between all independent variables because high correlation might result in multicollinearity, which can produce false results and inferences. The correlation matrix is useful in determining the direction and strength of the link

between the variables, but it does not lend itself to statistical inference.

According to Table4.2, the relationship between Market to Book Value (MTBV) and Accrual Quality (AQ) is unfavorable. The performance of certain companies listed on the Nigeria Exchange Group will therefore be negatively impacted by an increase in any of these factors. Accrual Quality (AQ) in particular exhibit negative correlation coefficient of -0.1305 and as a result, performance will decline marginally if market to book value increases. However, Earning quality (EQ) and business size (Size) are positively correlated with Market to Book Value (MTBV). Thus, for the chosen listed companies in Nigeria, a rise in earning quality and firm size will result in a slight increase in Market to Book Value (MTBV). Because of likely benefits from economies of scale, the association between company size and profit could also suggest that larger companies in this industry will report higher profits than smaller ones. It is also important to note that, with the exception of Market to Book Value (MTBV), the correlations between the variables in table4.2 are weak; as a result, the change or influence will be minimal. When the correlation coefficient between the variables is more than 0.80, there is a strong degree of correlation, according to Kennedy (2003).

Table 4.3: Multi-Collinearity Test

. estat vif

Variable	VIF	1/VIF
AQ	1.14	0.875494
Fsize	1.10	0.911569
EQ	1.06	0.940672
Mean VIF		1.12

Source: Stata 13 Output

According to Table 4.3, all of the independent variables' VIF values constantly fell below the threshold of 10, which is bad for regression analysis. A mean VIF score of 1.06, which is higher than the threshold of 1 deemed appropriate for regression analysis, supports this. Additionally, all of the variables' TVs were above 0 and very close to 1, which is ideal for regression analysis. The Table provides convincing evidence that multicolinearity among independent variables is not a concern. Because the dependent variable is binary and is better suited for this kind of study, panel regression analysis was employed to evaluate the study's main hypothesis.

Table 4.4: Hausman Specification Test

. hausman fe re

	Coefficients			
	(b) V_B))fe	(B) re	(b-B) Difference	sqrt(diag(V_b- S.E.
AQ	-.5789364	-4.132643	3.553706	1.770476
EQ	.0018749	-.010746	.0126209	.0181957
Fsize	.3140005	.11546	.1985405	2.223528
LR	-1.150524	-1.698278	.5477543	2.103422

b = consistent under Ho and Ha; obtained from xtreg B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)

= 13.67
Prob>chi2 = 0.0084
Source: Stata 13 Output

Decision Rule:
Ho: The null hypothesis is that the preferred model is random (greater than 0.05)
Ha: The alternative hypothesis is that the preferred model is fixed (less than 0.05)
Given that the probability value of the test is less than the threshold value of 0.05, the Hausman test result in Table4. 4 above does not offer enough support for this null hypothesis at the 5% level of significance. The investigation confirms that the systematic nature of the difference in coefficients makes the fixed effect model the most suitable one. As a result, the study used the outcome from its fixed effect control.

Table 4.5: Regression estimates for corporate financial reporting quality on market value

. xtreg MTBV AQ EQ Fsize LR, fe

Fixed-effects (within) regression — Number of obs = 75
Group variable: COY — Number of groups = 15
R-sq: within = 0.0047 — Obs per group: min = 5
between = 0.0911 — avg = 5.0
overall = 0.0355 — max = 5
F(4,56) = 0.07
corr(u_i, Xb) = -0.1523 — Prob > F = 0.9917

MTBV	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
AQ	-.5789364	2.793197	-0.21	0.837	-6.174381	5.016509
EQ	.0018749	.0428978	0.04	0.965	-.0840597	.0878095
Fsize	.3140005	2.232106	0.14	0.889	-4.157444	4.785445
_cons	.1436072	12.124	0.01	0.991	-24.14369	24.43091
sigma_u	1.0075225					
sigma_e	1.5506367					
rho	.29685016	(fraction of variance due to u_i)				

F test that all u_i=0: F(14, 56) = 1.69 Prob > F = 0.0836
Source: Stata 13 Output

4.2 Discussion of Findings
Because the data utilized in this study are panel data, the fixed effect regression model displays R2 within, between, and overall values of 0%, 9%, and 3%, respectively. Within R2 denotes that independent variables don't account for any of the year-to-year changes in the market value (market to book value) in this panel. R2 shows that independent factors account for 9% of differences in market value between firms (cross-sectional units) in the sample studies. Overall R2 indicates that independent variables only account for 3% of the panel's variance. The Table also demonstrates that the model is not fit, as shown by the F test of 0.07, which is more than 0.05% and is supported by the overall P-value of 0.991, which indicates that the model is not fitted. According to the Table above, the coefficient of the intercept is positive for the fixed effect result. This shows that the market value of the chosen companies increases by 0.1436072 (14%) at each given moment in time when these explanatory variables are held constant. According to the results shown in the above Table,

all of the study's explanatory and control variables were determined to be statistically insignificant with a P-value of at least 5%. Corr. (u_i, Xb) of the model's -0.1523 and rho of 0.29685016 reveal that the model is not appropriate for formulating policy. As a result, the current analysis accepts the three previously stated null hypotheses and comes to the conclusion that business size, accrual quality, and earning quality have no significant impact on market value. The research conducted by Owolabi, Okere, and Adeleke (2020) is compatible with the current finding. Who discovered that the market performance (TOBINQ) of quoted deposit money banks in Nigeria had a weak and unimportant negative link with corporate financial reporting quality proxy by timeliness (TML). The results, however, go against those of Bamidele, Ibrahim, and Omole (2018) as well as Saliu (2018), whose research found that the quality of financial reports has a significant impact on return on assets and that higher reporting quality influences deposit money banks' investment decisions in Nigeria, respectively.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study looked at the relationship between corporate financial reporting quality and market value of listed firms in Nigeria. The study established a negative association between corporate financial reporting quality (accrual quality) and a positive but insignificant relationship between corporate financial reporting quality (earning quality and firm size) and market value.

5.2 RECOMMENDATIONS

According to the findings of the study, it is recommended as follows:

1. Although the relationship between earnings quality and market value was found to be insignificant, it is still important for companies to focus on enhancing their earnings quality reporting. By providing transparent and reliable earnings information, companies can build trust and credibility with investors and other stakeholders. This can potentially improve market perceptions in the long term, even if the direct impact on market value may be limited.
2. Companies should strive to improve their accrual quality. This can be done by using conservative accounting policies, disclosing more information about their accruals, and having strong internal controls.
3. Increase awareness and education among market participants, including investors, analysts, and regulators, about the importance of financial reporting quality. This can help foster a better understanding of the significance of reliable financial reporting practices and encourage market participants to consider financial reporting quality as an essential factor in their decision-making processes. They should look for signs of aggressive accounting practices, such as large accruals or large changes in revenue from one period to the next.

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INFLUENCE OF SLOPE ASPECT ON FLOOD DYNAMICS ON FLOODPLAINS OF EPIE AND KOLO CREEKS IN BAYELSA STATE, SOUTH-SOUTH NIGERIA

Wolisi, I.H.N[1] and G.O Okeah[2]
[1]Department of Flood and Erosion Control, Ministry of Environment, Bayelsa State.
[2]Department of Geography and Environmental Management, Faculty of Social Sciences, University of Port Harcourt.
Corresponding author: E-mail- ibebiwaruwolisi068@gmail.com. Phone No: 08068835076

ABSTRACT
The study examined how the orientation of slope of floodplains controls the direction of flow of water. The aim of this study is to assess the influence of slope aspect on flood dynamics on floodplains of Epie and Kolo Creeks in Bayelsa State, South- South region of Nigeria. Secondary data on Relative relief was obtained from Wolisi and Chukwu-okeah, (2023). Longitudinal profiles were used to show the topographic landscape of the area by plotting the elevation versus horizontal distance of the area for every 100meters interval from the banks of the rivers to a distance of 0.5km moving inland from the banks of the rivers (left/right). Results of the analyses showed in totality that, only about 16.67%) of the floodplain of the Epie Creek contributes to river or fluvial floods whereas the remaining 83.33% of the floodplain would contribute to pluvial floods. Along the Kolo Creek floodplain, results indicate that the slopes of the middle-left and upper-right flanks tilt towards the direction of the Creek while, those of the upper-left and lower-left flanks tilt towards inland direction. The results further indicate that on the Kolo Creek, 33.33% of the floodplain would contribute to river or fluvial floods; 33.33% to pluvial or flash floods; and 33.33% to flash or compound floods (due to flat land surface). Therefore, the study area is more at risk of pluvial flood type due to the direction of the slope inclination which tilts more on the direction of the countryside than towards the river channels. Therefore, amongst others, the study recommends the control of human activities within these floodplains and the proper planning of the area to mitigate the effects of flooding in the area.
Key Words: Aspect, Positive Slope, Negative Slope, Floodplain, Orientation.

1.0 INTRODUCTION
1.1 Background of the study.

The earth constitutes undulating surfaces thereby given rise to numerous slopes of varying degrees (Masood et al., 2020). This is why geomorphologists have been interested in understanding the formation of slopes by adopting various theories and models. Hence, in order to understand the topography of any terrain in terms of its landforms, it is important to have a wider knowledge of the characteristics of slope of the area. Bolstad (2012) described a slope as the change in the elevation (rise) over a corresponding change in the horizontal distance (the run). In terms of the shape of a terrain, slopes can also be described as positive, negative or neutral.

According literature, a positive slope occurs where the land area increases in elevation from left to right while, a negative slope is where the land area decreases in elevation from left to right; but where elevation of land area remains at the same level over a distance, it can be termed neutral or zero slope (Kimerling & Moellering, 2000; www.mathcentre. ac.uk. 2009).

By the above definitions, it implies that for a positive slope, the direction of the inclination surface faces the left moving uphill while for a negative slope, the direction of the inclination surface faces the right moving downhill. These descriptions give rise to the concept of slope aspect which has been defined as the compass direction of the maximum slope at a particular location on an inclined surface (Kimerling & Moellering, 2000). Malaperdas and Panagiotidis (2018), described the aspect of a slope as; (1) the compass direction that a topographic slope faces and that can be generated from continuous elevation surfaces; (2) the direction that a slope inclination faces which can be determined from the direction that one faces looking downhill or uphill; (3) the position facing a particular direction such as any cardinal point.

Slope and aspect are two important topographic variables that are useful in many studies including hydrology, conservation, landscape engineering and so on. Hence, understanding of the slope aspect of any terrain can help in ensuring safety and minimization of cost and losses in case of any natural disaster. Data on slope aspect can be useful in determining watershed boundaries, surface flow paths of water in the events of rainfall, erosion modeling, irrigation works, recreation site planning and so on (Boltsad, 2012; Kimerling & Moellering, 2000). (Masood *et al*., 2020), opined that, in a process-form relationship, the form and orientation of slopes is an outcome of causal relation between weathering, erosion, transportation and deposition;

hence, the type of slope is directly linked to the type of environmental and climatic conditions in an area.

Water Channel such as rivers, streams, seas and adjoining interland are usually separated by floodplains. Floodplains have been described as relatively flat, largely horizontally bedded alluvial landforms occupying large parts of valley bottom, adjacent to river channels, separated from the channels by banks which may form a levee and normally underlain by unconsolidated sediment (Ritter *et al.,* 2002). Dunne and Aalto, (2013), also defined a floodplain as a sedimentary plain of low relief bordering a river channel, typically with topographic amplitude between ridges and the beds of the stream channel of 0.1 and 0.5 times the bank-full depth of the river, connected by various sedimentation processes and inundated to some extent by most annual floods.

In terms of the morphology, the floodplain has been described as an area of land on a watershed that is generally flat; prone to flooding and; next to a river stretching from banks to the outer edges of the valley (Okolie, 2016). Similarly, Bridge (2003), described the dimension of a floodplain to be a relatively flat land area which progressively decreases in elevation towards a river channel but however, at areas very close to the river; there exists a strip of land referred to as a levee which is slightly higher in elevation. Considering the morphology of the floodplain, it is expected that; when the river channel is overtaxed; the floodplains being the land area in direct contact with the river is expected to be flooded before water can spill into the terraces.

Flooding can occur where the carrying capacity of the river is exceeded and this can be as a result of inflow of water from either the tributary channels into any section of the river or the lateral inflow of water from the floodplains (Teo, 2010). Umeuduji (2017) described a floodplain as a geomorphic feature with a fairly level land usually aligned on either sides of a river. Therefore, the elevation of the floodplain along a river is an important factor to be considered when talking about the flow of water into stream channels because, the floodplain is said to be a function of the river (Umeuduji, 2017).

According to Garg (2012), the elevation difference of a watershed is a variable topographic factor from point to point thereby having control over the rainwater falling on the catchment. Also, the slope of a terrain has been said to control many geological and hydrological processes including the runoff and accumulation of water (Nelson, 2015). Therefore, slope can be said to be an important topographic element that influences the hydrology and geological characteristics of a watershed. The aim of this study is to assess the influence of slope aspect on flood dynamics on floodplains of Epie and Kolo Creeks in Bayelsa State, South- South region of Nigeria.

2.0 LITERATURE REVIEW

2.1 Overview of flooding and flood types

Flood is an overflow of water that submerges land that is usually dry. Water flooding of dry lands is determined by various factors. Land topography ie longitudinal profile (Slope aspect) and volume of water precipitation or rainfall. Flood can occur as a surface water runoff as a result of heavy precipitation or rainfall.

Flood resulting from surface runoff in general is a temporary condition of partial or complete inundation of normally dry land areas from overflow of inland or tidal waters or from any natural and/or human induced hazard and can also occur as a result of the rapid accumulation of surface runoff from any source within the surface earth.

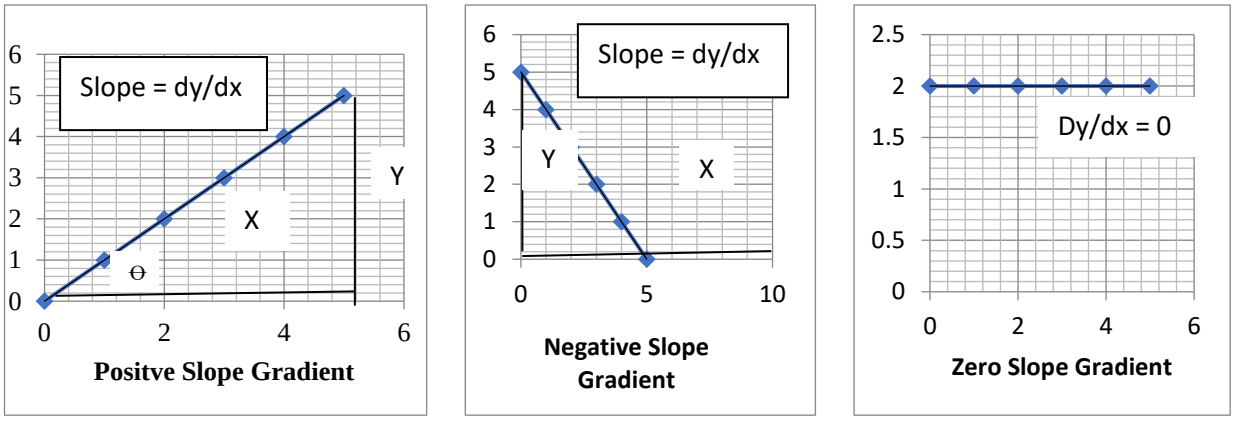
Teo (2010) has stated that floods can be caused through natural (i.e precipitation, landslides, storm surges, high groundwater levels, glacier melts etc.) and human or anthropogenic means (e.g dam and embankment failures, floodplain encroachment, changes in land use, inadequate drainage capacity and management, etc.). Based on the above, floods have been categorized into:

i) River or Fluvial floods: which occur mostly on floodplains when stream flow exceeds the channel's capacity thereby spilling over the bank.
ii) Overland or Surface water or Pluvial Floods: which occur when the volume of water that falls on the catchment (precipitation) is unable to drain away through the drainage systems or infiltrates into the soil to form groundwater,
iii) Coastal Floods: which involves the inundation of land adjacent to seas, estuaries and large lakes due to high tides,
iv) Flash floods: which occurs as a result of extreme rainfall event or mostly the sudden release of water over a short period of time and
v) Compound Floods: which occur when two or more extreme events happens simultaneously or successfully with underlying conditions that amplify the impact of the events.

2.3 Conceptual Framework on: Slope aspect-Surface Runoff-Flood type Relationship.

In line with the theory on motion of a body on an inclined plane, the authors conceptual framework is on *Slope-Type-surface-Runoff and Flood type relationship* as shown in figure 2.1 where; the slope types represents the orientation of the inclined

surface where; areas with positive slope is expected to direct surface runoff into the river (to increase in stream discharge) to cause river floods while, areas with negative slope is expected to direct surface runoff inland and would contribute to influx of more water inland to cause pluvial floods. But areas with no remarkable changes in the inclination of the surface of the land; the surface runoff is expected to be near zero and may result in the accumulation of water thereby resulting to flash or compound floods. This may be feasible if other hydraulic factors are kept constant as earlier described. The graphical illustration of the various slope type are presented in Figs 2.1 a, b and c).



a b c

Fig2.1:. Slope Direction on an Inclined Plane. Source *(* www.mathcentre.ac.uk., 2009)

The conceptual model of the slope types, direction of flow of surface runoff in each of type of slope and the associated risk is presented in Figure 2.2

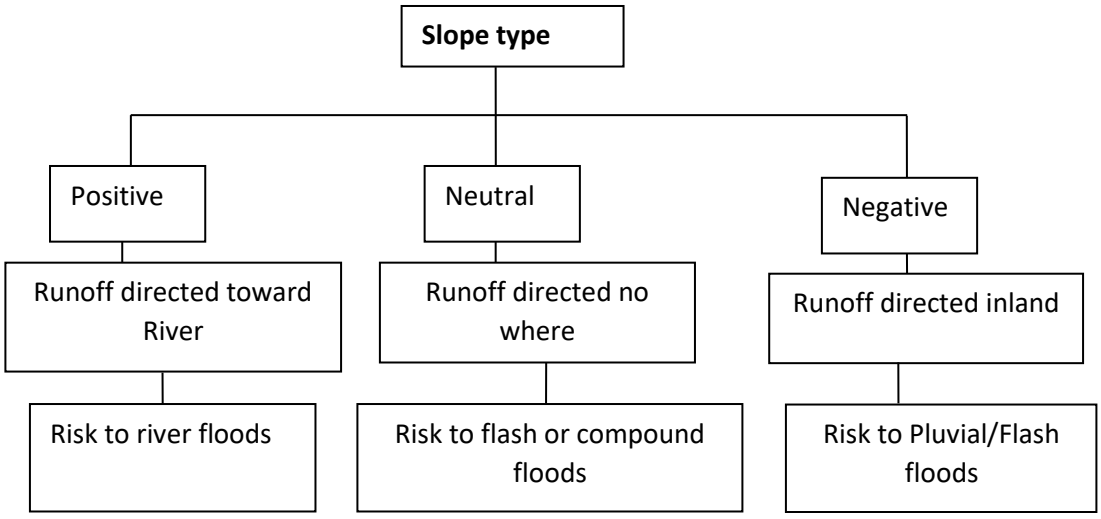


Fig.2. 2: Slope-aspect-surface Runoff-Flood Type Relationship

2.2 Theoretical Framework

Theories on Motion of Bodies on an Inclined Surface

Right from the day of the early philosophers like Aristotle in the 4th Century BC, theories on Motion of bodies on an inclined surface were used to explain the force behind the movement of object on the earth surface and space. Hence, Oliveira (2022) captured the fundamental principle of the Aristotle's theory on Motion of a body on an inclined surface which states that: "*The times it takes for a body to travel a distance is inversely proportional to the motive power of the mover."* This implies that, for an object to be in motion, another object (he called the mover) must induce it". Aristotle has further argued that, for a body to be set in motion, that body or object must be in direct contact with the mover which exerts the force (Oliveira, 2022).

In the light of the above, this present study adopts the above theory in order to give explanations to the movement of water on the earth's surface arising from any rainfall event. Thus, water falling on any surface may be forced to move in the direction of the slope inclination. Therefore, in line with the theory adopted here; the slope inclination would serve as the '*mover'* and the water falling on it would serve as the '*moved*.' Hence, the direction of the surface water in terms of surface runoff; in the event of rainfall or any source of water entering the area would be determined on the orientation of the slope or slope-aspect (negative, positive or neutral). Here, the type of slope acts as the mover while the surface runoff serves as the moved as explained in the Aristotle's theory above.

2.4 Review of related studies

Various studies on the factors that cause flooding of floodplains have been carried out by different scholars. Studies showed that morphometric characteristic such as the elevation differences that produces slopes of varying magnitude influences surface runoff within a watershed. For instance, Bhatt and Ahmed (2013) carried out a study on the influence of runoff on the Upper Krishna basins with the aim of assessing the morphometric variables influencing the flooding of the main Krishna River (India). using Remote Sensing and GIS as instrument of the study. The study concluded that the major reason for the high flood in the area by the Krishna River is due to the high relief ratio (Rh), ruggedness number (Rn), and less time of concentration (Tc) which causes greater runoff from the hilly parts into the mainstream channel.

Hossein et' al.,(2014) investigated the role of slope aspect (direction) on the occurrence of landslides in some watersheds within in the Chahar Mahal and Bakhtiari Province in Iran using geospatial technique to obtain data. Results obtained from the analysis of the data revealed that the occurrence of landslides in the area is influenced to a reasonable extent by the orientation of slopes with regards to the sun, wind and other climatic factors. Similarly, Marco *et al.,* (2014) in their work on the influence of slope aspect on the distribution of landslides in the Milia and Roglio basins in Italy using historical data, statistical analyses of the data showed that, slope aspect (direction) influences the occurrence of superficial landslides.

Again, Yang, et al., (2020) in their work on the distribution of vegetation within the mountainous dry valley of Southwest China by physical observations and analysis of nutrient content, revealed that, the vegetation distribution increases more within the northward direction where the soil is exposed to air, sun and other climatic elements. Similarly, Abolghasen, et al., (2014) in their work on impact of slope aspect on soil properties using the randomized factorial design in four geographic directions. The results of the analyses indicated that, less soil nutrients (nitrogen, phosphorus, etc.) were found more at the surface within slope aspect between 0 and 30 degrees while at slope aspect of between 30 and 60 degrees, soil nutrients were found at relatively lower depths.

Moghaddam, (2014) in a study on the effects of different slope aspects on the surface runoff generation in a Kakhk treated and representative watersheds, reported that soil loss was higher on slopes facing northwards, while higher nutrient loss was recorded on slopes facing eastward direction than those oriented towards other directions.

3.0 METHOD

3.1 Study Area

The study area comprises two surface water channels, which include Epie Creek which is situated in Yenagoa town. While the Kolo Creek is in Emeyal Clan of Ogbia Local Government in Bayelsa state. Yenagoa and its environs are located between latitudes 004.3500 ^{0}N and 005.00 ^{0}N and between Longitudes 006.250 ^{0}E and 006.500 ^{0}E. The area covers communities located along the Epie, and Kolo Creeks floodplains which comprise communities within the Yenagoa metropolis, Bayelsa state. the Epie Creek is placed centrally in Yenagoa metropolis while the Kolo Creek is located in Ogbia east of Yenagoa.

These two water channels were selected for the study based on the fact that most of the communities in the study area, are located on the floodplains of these water bodies. Most areas on these floodplains were once agricultural lands for the production of mainly cassava, water-yam, cocoyam, and variety of vegetables. Presently, the area is fast undergoing some form of transformation mainly, urbanization since1996 when Yenagoa town was made a state capital. The Map of the study area is presented in Fig. 2.1

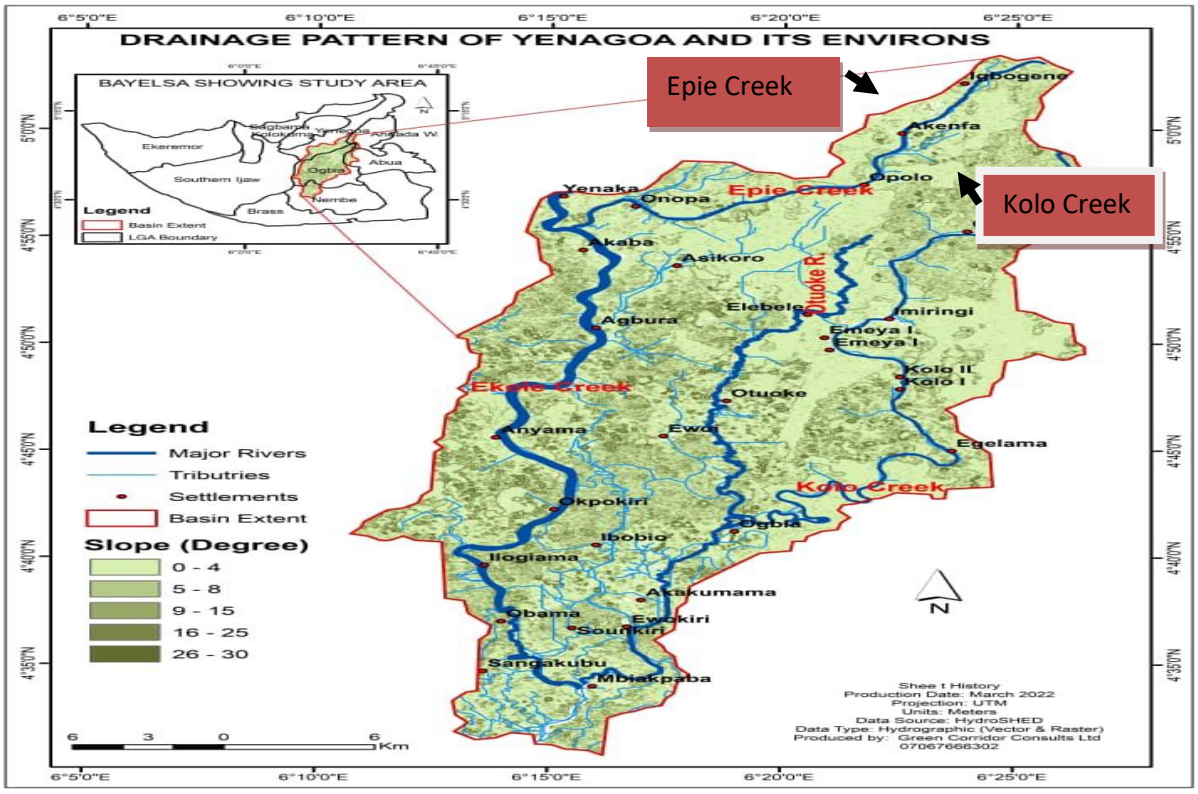


Fig. 3.1: Map of the Yenagoa metropolis Showing the position of Epie Creek, Ekole River and Kolo Creek in Yenagoa Metropolis

3.2 Data Collection

The study area covered 30.6km^2 comprising the left and right flanks of Epie sub-watershed and 29.16 km^2 comprising the Kolo left and right flanks making a total of 56.76km^2 Thus, for ease of data collection; each of the Creek floodplain was subdivided into three sections (10.20 km^2 for Epie & 9.72km^2 for Kolo), which corresponds to the upper, middle and lower segments of the rivers and their floodplains.

Secondly, the study also covered an area between 0.00meters to 500meters (0.5km) inland from the left and right banks of each river floodplain. Each of the segments of the floodplains was subdivided into five (5) sampling points of 100meters moving inland from the left and right flanks or banks of the rivers. Secondary data on relative relief (RR) was obtained from report of Wolisi and Chukwu-okeah, (2023).

Longitudinal profiles were used to show the topographic landscape of the area by plotting the elevation versus horizontal distance of the area for every 100meters interval from the banks of the rivers to a distance of 0.5km moving inland from the banks of the rivers (left/right).

From the longitudinal profiles obtained, the direction of the hypotenuse with regards to the orientation of the slope inclination was used to depict the probable direction of flow of water and the probable type of flood in the different segments of the two water channels floodplains.

4.0 RESULTS AND DISCUSSION

4.1 Result

The summary of the slope-aspect and probable flood types inherent in the various segments of the floodplains of the Epie Creek and Kolo Creek are presented in Table 4.1 and Table 4.2.

Table 4.1: Summary of Slope Aspect, Surface Runoff direction and Type of Flooding within the Floodplains (Left) of Epie, Kolo and Ekol Rivers

River/ Segment	Slope Type	Runoff Direction	Potential Source of Flooding
Epie (Left)			
Upper	**+ve**	**to River**	**Fluvial**
Middle	**-ve**	**to Inland**	**Pluvial**
Lower	**-ve**	**to Inland**	**Pluvial**

Kolo (Left)			
Upper	**-ve**	**to Inland**	**Pluvial**
Middle	**+ve**	**to River**	**Fluvial**
Lower	**-ve**	**to Inland**	**Pluvial**

Source: Authors' Fieldwork (2024).

Table 4.2: Summary of Slope Aspect, Surface Runoff direction and Source of Flooding within The Floodplains (Right) of Epie and Kolo

River/ Segment	Slope Type	Probable Runoff Direction	Potential Source of Flooding
Epie(Right)			
Upper	**-ve**	**to Inland**	**Pluvial**
Middle	**-ve**	**to Inland**	**Pluvial**
Lower	**-ve**	**to Inland**	**Pluvial**
Kolo(Right)			
Upper	**+ve**	**to River**	**Fluvial**
Middle	**Neutral**	**Flat**	**Flash/Compound**
Lower	**Neutral**	**Flat**	**Flash/Compound**

Source: Authors' Fieldwork (2023).

The results of the plot to determine the slope aspects (orientation) with regards to the probable flood type for the three segments of Epie Creek is presented in Fig 4.1. This shows that along Epie Creek floodplain; it is only the left flank of the upper segment that slants towards the river while the slope of the rest of the segments (left/right) were found to slant in the direction of the countryside.

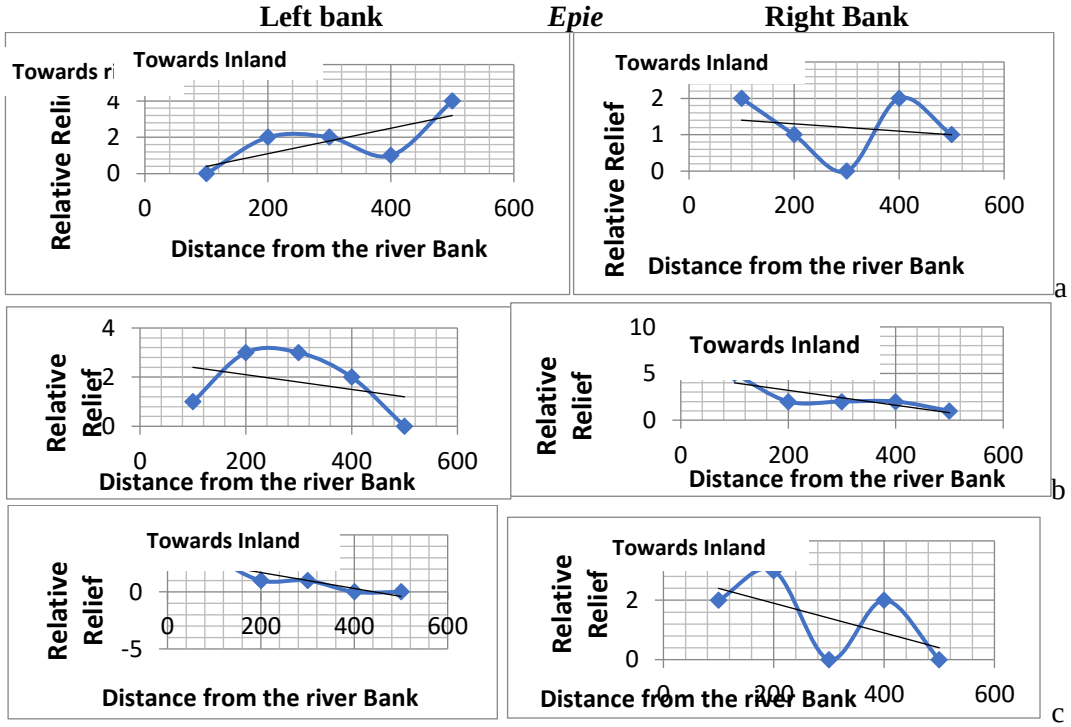


Fig. 4.1: ***The slope Aspects of the three Segments of Epie Creek floodplain (Left & Right).***

The results of the plot to determine the slope aspect (orientation) with regards to the probable flood type for the three segments of Kolo Creek is presented in Fig 4.2. It indicates that along the Kolo Creek floodplain, the slopes of the middle-left and upper-right flanks tilt towards the direction of the river while, those of the upper-left and lower-left flanks tilt towards inland direction inland direction.

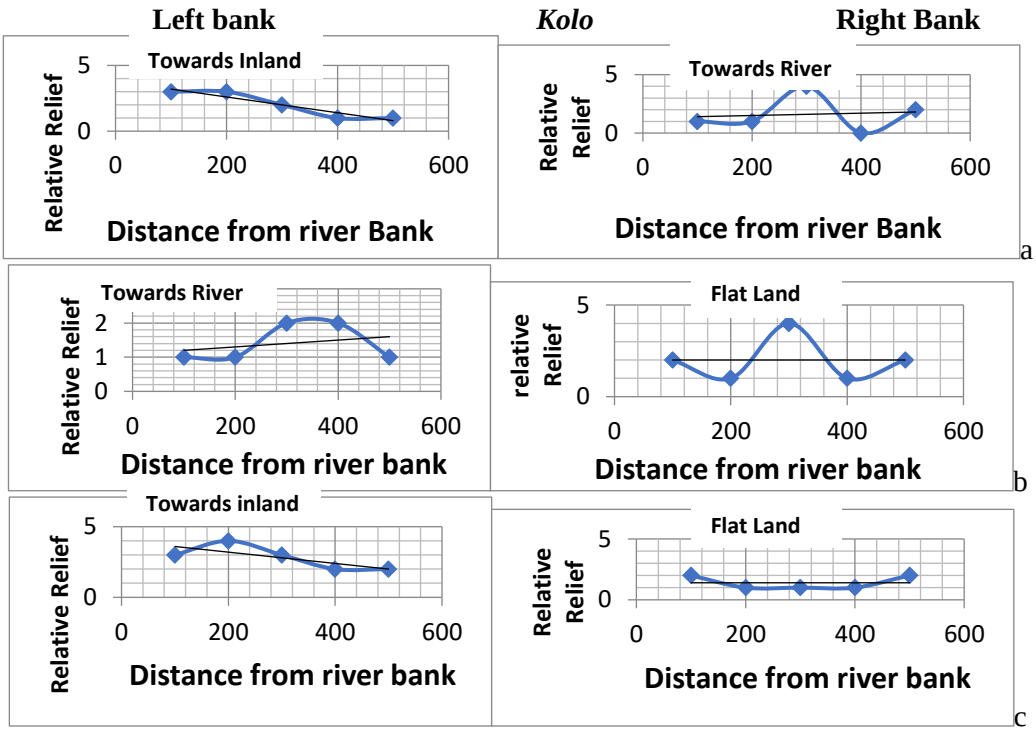


Fig. 4.2. ***The slope Aspects of the three Segments of Kolo Creek floodplain (Left & Right).***

4.2 Discussions

The longitudinal profiles obtained by the plots of the change in the elevation moving offshore from the banks of each of the Epie Creek and Kolo Creek segments are presented in Fig 4.1 and Fig 4.2 respectively. This clearly shows the slope aspect (orientation) and the probable direction of surface water and flood type in the different segments of the floodplains of the two Creeks. The Result presented in Fig 4.1 shows that along Epie Creek floodplain; it is only the left flank of the upper segment that slants towards the river while the slope of the rest of the segments (left/right) slant in the direction of the countryside. This implies that, only the upper- left segment that can contribute water and sediments into the Creek whereas the other segments are naturally designed to drain water into the countryside. This is in line with Teo, (2010). Only about 16.67% of the floodplain of the Epie Creek can contribute to river floods whereas the remaining 83.33% of the floodplain would contribute to pluvial floods.

Along the Kolo Creek floodplain, result presented in Fig 4.2 indicates that the slopes of the middle-left and upper-right flanks tilt towards the direction of the Creek while, those of the upper-left and lower-left flanks tilt towards inland direction. But the results further showed that the slopes of the middle-right and lower-right flanks slant to neither direction which indicates relatively flat lands Thus, in line with Teo, (2010). The results further showed that 33.33% of the floodplain would contribute to river or fluvial floods; 33.33% will contribute to pluvial or flash floods; and 33.33% will contribute to flash or compound floods (due to flat land surface).

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

With reference to the direction of the river and the countryside; the study has shown the concept of slope-aspect can be used to depict the direction of flow of water in terms of surface runoff direction within the various segments of the floodplains of the two water channels (Epie and Kolo Creeks). Therefore, areas with positive slopes will be at risk of river floods; areas with negative slopes are at risk of pluvial of flash floods and areas with negative slopes will be at risk of a combination of flood types.

5.2 Recommendations

Based on the findings, the study therefore recommends the control of human activities within the floodplains especially those who inhabit the left flanks of the middle and lower segments of Kolo Creek floodplain that is at risk of compound floods. Also, town planners and other authorities saddled with flood management should carry out further study on the morphology of the floodplains of these water channels in order to proffer solution to the problems of flooding in Yenagoa metropolis and its environ.

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INTERACTIONAL JUSTICE AND CONTINUANCE COMMITMENT

[1]Okilo Aduba PhD and [2]Abidde Kilegha Victoria PhD
[1]Department of Business Administration, School of Management Sciences
Bayelsa State Polytechnic Aleibiri, Bayelsa State, Nigeria
Fredojonesaduba@gmail.com
[2]Department of Public Administration, School of Management Sciences
Bayelsa State Polytechnic Aleibiri, Bayelsa State, Nigeria

Abstract
Employee commitment which is very crucial to the productivity and survival of any organization has received much attention from management scholars. This is because the effective and efficient achievement of organizational goals depend on the commitment of workers in the organization. When employees are treated in a fairly manner, owners and managers of organizations will be able to extract commitment from them and achieve organizational goals. This indicates that both interactional justice and continuance commitment are variables directly connected to organizational efficiency and effectiveness. Therefore, the objective of this study is to identify the relationship between interactional justice and continuance commitment. The study is a conceptual review of related literature to identify the relationship between the variables. The results of the review revealed that interactional justice is strongly related to continuance commitment. Higher and sustained continuance commitment of employees in the organization depends very much on interactional justice. A good and acceptable interactional justice produces good employee behavior that result in continuance commitment. Based on the results, the study thus recommends that organizations should increase the level of interactional justice so as to increase the continuance commitment of employees in the workplace.
Key Words: Employee commitment, Continuance commitment, Interactional justice, Employee behavior

1.0 INTRODUCTION

Given the increased competition in the global market place, it becomes imperative for the employee to be encouraged to perform efficiently and increase their level of job commitment and productivity. Rathore and Sen (2017) posited that high productivity level of an organization depend largely on increased level of worker's commitment. Rahman et al (2016) argued that if all the employees in an organization are treated in a fairly manner by addressing their needs and interests without any favoritism, owners and managers of organizations can be able to extract commitment from them and achieve organizational goals.

Employee commitment is very crucial to the growth and survival of any organization. According to Rathore and Sen (2017), committed workers demonstrate high level of motivation, reduce absenteeism, and increase their work productivity. Williams and Anderson in Azizi et al (2014) added that employee who demonstrates high level of commitment stays in the organization, accepts its goals, put adequate efforts and even make sacrifices to ensure that the organization achieves its goals.

As such, owners and managers of organizations need to give adequate attention to the very important issue of justice in the workplace. This is because the level of justice in the organization is a major determinant to the level of employee commitment in the organization. According to Fuchs and Edwards (2012), justice is a crucial issue in modern management and any manager who fails to ensure that there is justice in their organization is likely to face the risk of losing its workforce, their commitment and citizenship behavior.

Therefore, the main objective of this study is to identify the relationship between interactional justice and continuance commitment

REVIEW OF RELATED LITERATURE

Theoretical Review

Social Exchange Theory

The social exchange theory originated in the late 1950s and evolved through the early 1960s (Priyankara et al, 2018). The major contributors to the development of the social exchange theory are George Homans, John Thibaut, Harold Kelley and Peter Blau. The theory was developed from the socio-psychological and economic perspectives (Emerson, 1976; Cropanzano & Mitchell, 2005). Social exchange theory provided strong guidelines for explaining the association between organizational justice and employee commitment; it indicates that the social connection at workplace impact the employees' behavior and attitudes. The social exchange theory has been one of the major theoretical perspectives in the field of social psychology since the early writings of Blau (1964) and Emerson (1976). This theoretical orientation is based on earlier philosophical and

psychological orientations deriving from utilitarianism on the one hand and behaviorism on the other.

Social exchange is described as voluntary actions of individuals that are motivated by the returns they are expected to bring and typically do in fact bring from others (Chinomona & Dhurup, 2015). The fundamental premise of the social exchange theory is that it involves an exchange between two parties whereby one party does something and the other party reciprocates. The reciprocated benefits can be in form of economic rewards or social benefits (Chinomona & Dhurup, 2015).

The social exchange theory is based on the underlying principle that reciprocated benefits bring about social bonds among the exchange parties (Kacmar et al, 2012). This is due to the fact that social exchange creates the feelings of personal obligation, gratitude and trust among the exchange parties, which in turn build a foundation of social solidarity (Yoon & Suh, 2003). The underlying assumption of the social exchange theory is that people create and maintain social relationship on the basis of their expectations that such relationships will benefit the parties. The exchange of benefits (whether intrinsic or extrinsic benefits) independently of normative obligation provide the impetus for social interaction. When one party to the exchange relationship does something for the other party (like providing benefits for the other party), there is bound to be an expectation of some form of valued, future return that is both non-specific and not tied to an explicit market value (Chinomona & Dhurup, 2015).

The social exchange theory explains human exchange relations both at the micro and macro levels (Emerson, in Priyankara et al, 2018). The theory states that economic and social exchanges are the two forms of exchange relations that take place in an organizational setting. According to Priyankara et al (2018), economic exchange is explicit and contractually bound with defined terms and associated with monetary rewards in an employment relationship; while social exchange is usually unspecified obligations which are connected with non-monetary rewards in an employment relationship, and it often involves indirect chains of exchange.

Social exchange theory argues that all forms of social exchange are based on the norm of reciprocity guiding both parties in an employment relationship (Blau, 1964). According to Priyankara et al (2018), reciprocity refers to an inner obligation that arises within a pay to repay another party since he or she is taken care of by that particular party. The demands of norm of reciprocity are that people should help those who have helped them, and should not cause injury to those who have helped them. The norm of reciprocity serves as a mechanism for maintaining stability in a social systems like organization.

Social exchange theory is one of the most prominent theories use in explaining workers' behaviour in an organization (Cropanzano et al, 2017). The theory has been applied in different areas in organizational research including organizational justice workers' behaviour (organizational citizenship behaviour, commitment, etc.), organizational support and supervisory support (Cropanzano et al, 2017). In organizational setting, social exchange theory is applied when an actor (e.g. organization, manager or employee) treats another person in a positive or negative manner.

Treating a person in a positive manner involves providing support to him or her or ensures that justice is done to the person; while a negative treatment includes rude, abusive supervision and bullying). In response to the positive manner of treatment, the person involved reciprocates positively by being demonstrating loyalty, care, commitment and organizational citizenship behaviour; while for negative manner of treatment, the person involved react negatively by putting up adverse behaviours such as avoidance, neglect and violence towards the first actor (e.g. organization, manager or employee). The reciprocal responses can either be relational responses or behavioural responses (Priyankara et al, 2018).

Applying the social exchange theory to organizational settings, managers or even the organization as a whole may offer a range of benefits to employees in order to induce a feeling of indebtedness on them. Relating the theory to organizational justice and workers; behaviour, we can observe that when managers treat the workers fairly and equitably, the reciprocity norms of social exchanges demand that the workers reciprocate with good work behaviours in their efforts to informally compensate this treatment. At the end, workers will opt to remain loyal to the organization, exhibit organizational citizenship behaviours, increased their level of job commitment, reduced absenteeism and lateness to work.

Chinomona and Dhurup (2015) stated that the social exchanges are supported by macro motives such as loyalty and commitment. He further explained that if workers' macro motives are positive, they are more likely to display good work behaviour to compensate the organization and its managers for their contribution to these motives. However, when workers' macro motives become negative, the desire to payback their social exchange debts to the organization or managers reduces, shutting off the desire to exhibit good work behavior.

The relationship between organizational justice and workers' behaviour is well explained with the social

exchange theory which brought about the reciprocity norms. In a simple term, justice in the organization causes employees to reciprocate with positive work behaviour. Workers' behaviours involve unspecified obligations that reflect social exchange. Hence, the social exchange theory provides an organization with the theoretical background for explaining workers' behaviour in response to the justice system. Once a group leader (manager) establishes a justice system in the organization and treat all his subordinates with dignity and respect, there is bound to be a social exchange between the leader (manager) and the subordinates (group members). Here, the subordinates who receive support or fair treatment from the group leader are likely to reciprocate with good work behaviour such as regular work attendance, job commitment and organizational citizenship behaviour. For supporting the subordinates or treating them fairly, the group leader (manager) sends a strong signal to the subordinates to display good work behaviours in reciprocation. Cropanzano & Mitchell (2005) supports the idea of social exchange theory that treating all workers equitably and fairly will bring about a positive reciprocity norm in form of good work behaviour from the workers.

The Concept of Interactional Justice

Interactional justice can take various forms. Colquitt et al in Ajala (2015) posited that interactional justice comprises of two components namely interpersonal and information justice. According to Ajala (2015), interpersonal justice has to do with the respect and dignity with which one treats another while informational justice shows whether one is truthful and provides adequate justifications when things go wrong. Mendryk (2017) posited that employee's perception of unfair interpersonal treatment and information injustice results to bitterness and anger which impact negatively on their level of job satisfaction, commitment and productivity.

It is important for managers to ensure that there is interactional justice in their organization. This is because employees' perception of interactional justice or injustice has significant implications on the work behaviour (Balassiano & Salles, 2012). When there is perceived interactional justice, employees will be satisfied and exhibit good work behaviours such as organizational citizenship behaviour and job commitment. On the other hand, employees will put up a negative behaviour in the workplace such as lateness to work, increased absenteeism, lack of job commitment, low productivity and increased tendency to leave the organization (Balassiano & Salles, 2012). However, Jawad et al (2012) stated that fairness of interpersonal treatment depends on the extent to which decision-making authorities are trustworthy and communicate decisions accordingly. Jawad et al (2012) stated that interactional justice is evaluated on the basis of interpersonal treatment and how well decision makers communicate information to the employees.

Meanwhile, Ajala (2015) outlined some key attributes of interactional justice that can make an employee develop a perception of fair treatments. These attributes include truthfulness (i.e. the information given to the employee must be accurate and realistic, and presented to him or her in an open and forth right manner), respect (that is, the employee must be treated with dignity), propriety (i.e. the statements and questions must never be inappropriate or involves prejudicial factors such as sexism or racism), and justification (i.e. when an employee perceives injustice, given him or her adequate explanations or apology so that it eliminates or reduce the sense of anger he or she has developed. Rathore and Sen (2017) noted that when an employee perceives a fair interpersonal treatment in the organization, he or she becomes more committed to the organization, arrive at work early and increased his or her productivity. Rathore and Sen (2017) further stated that interactional justice is the key that holds employees together while interactional injustice drives the employees apart and make them to become less committed, motivated and productive.

According to Masterson, Lewis, Goldman and Taylor (2000) Interactional justice is what subordinates perceive and how these subordinates respond to their perceptions; relating to how they are treated. Folger and Cropanzan (1998) posits that "interactional justice relates to the quality of relationships between individuals within organizations".

Aside to the justice of outcome and procedures, researchers have also found that the quality of interpersonal treatment or relations that an individual receives has a tremendous effect on his/her perception of justice.

According to Bies and Moag (1986) in Tsai (2012), there are four fundamental elements of interactional justice:

- Respect: Individuals should be treated with respect;
- Truthfulness: The treatment should be free of deception;
- Propriety: Supervisor's comments and questions should be appropriate;
- Justification: The treatment should be justifiable.

The Concept of Continuance Commitment

Continuance commitment refers to an employee's awareness of his costs associated with leaving the organization and the gains of staying with the organization (Meyer & Allen, in Paramanandam, 2017). This type of commitment is calculative in nature in the sense that the worker weighs the two scenarios i.e. the costs to leave and the gains to stay with the current organization. It means that the worker cannot take the risk to quit his or her job as he or she realizes the cost of giving up opportunities such as salary/wage, allowances, bonuses and other fringe benefits. Here, the worker decides to continue to work with the organization because he or she is not certain of an alternative job that can provides all the benefits he enjoys in the current organization. It means that the worker desires to continue to being a member of the organization because of the high cost or risk associated with leaving the organization (Balay, in Ozdem, 2012).

Therefore, continuance commitment is defined as a type of commitment which an employee demonstrates as a result of the in-depth analysis of the costs and benefits of leaving or staying with his or her organization (Madi et al, 2012). It is a decision of an employee to remain committed or stay with an organization because of the fear of being unemployed or difficulty in getting a better job elsewhere (Madi et al, 2012). The main reasons why workers demonstrate continuance commitment are highlighted by Meyer and Allen in Balassiano and Salles (2012). According to them, a worker continues or remains in the organization because he or she feels like there is no alternative, and that the personal costs associated with quitting the job are too high. Azizi et al (2014) agreed that a worker who demonstrates continuance commitment tends to stay with the current organization because of the risks or costs associated with leaving the organization.

An employee displays continuance commitment after carrying out an assessment of the risks of leaving the organization and the benefits of staying with the organization (Beck & Wilson, 2000). Ulndag et al (2011) stated that limited employment alternatives and uncertainty are the crucial factors that force an employee to remain with his or her organization. Here, the employee decides to stay with the organization not because he or she has affection for the organization but because of the fear of not getting a better job. Mohammed and Anisa (2012) noted that employees who display high level of continuance commitment stay with the organization because they are aware of the risks, costs and limited alternatives out there. Many Nigerian workers demonstrate continuance commitment because of the fear of not getting a better job out there. As Khaleh and Naji (2016) rightly stated, increasing rate of unemployment in Nigeria has prompted workers to remain with the current organization because of the fear of not getting a better job on time.

Continuance commitment and how it works in an organization was described in details by Meyer and Allen in Folorunso et al, 2014). According to Meyer & Allen, working in the same organization for a long time increases the worker's investment level in that organization and because of the period spent in the organization, the worker enjoys some benefits which come in form of pay rise, promotion, allowances, annual leaves, recognition, honor, medical benefits, accommodation benefits, and others. If one day, the worker feels unsatisfied with management policies and decisions, and is considering leaving the organization, he or she is likely to analyze the costs of leaving the organization and the gains of staying with the organization. The costs here refer to the risk of being unemployed, losing all the benefits he enjoys in his former organization, or the time wasted in finding a better job.

The gains on the other hand, refer to the benefits he or she will continue to enjoy which include salary, promotion, allowances, annual leaves, recognition, honor, medical benefits, accommodation benefits, and others. If after analyzing the costs and gains, the worker decides to continue with the organization, such worker can be said to have demonstrated continuance commitment. It is important to note here that the worker did not decide to stay with the organization because he or she develops affection for the organization (as seen in the case of affective commitment) but because of the fear of losing all the benefits he or she is currently enjoying with the organization and the risk of being unemployed.

Meyer and Allen (1991) define continuance commitment as "awareness of the costs associated with leaving the organization". It is calculative in nature because of the individual's perception of weighing of costs and risks associated with leaving the current organization. Meyer and Allen (1991) further state that "employees whose primary link to the organization is based on continuance commitment remain because they need to do so".

Relationship between Interactional Justice and Employment Commitment

The findings of this research show that interactional justice is essential for improved outcomes of employee commitment in organizations. The findings point to the significance of interactional justice in enhancing the particular outcomes of continuance commitment. The findings in this vein enrich

knowledge on the need for organizational managers to be more cautious and considerate of their treatment of the workers, and the extent to which work environment are conducive and responsive to the workers sense of being, dignity and respect. This corroborates Akanbi and Ofoegbu (2013) view that the conditioning of favourable and healthy work environment goes beyond the structuring of roles and motivational packages. It involves the recognition of workers right to fair and respectful treatment in the organization as well.

The observed link between interactional justice and the measures of employee commitment offers a position which also validates the social exchange theory; reinforcing the view that treatments and attitude toward others, such as expressed between management and subordinates in the organization is significant. Mahmut (2011) affirmed that when workers are recognized and valued in the workplace, they tend to identify more with the organization and their sense of belongingness increases. According to Mahmut (2011) when workers identify with the organization, they become defensive of the organization and are therefore willing to work and increase the quality and quantity of their input to the benefit of the organization; thus demonstrating the commitment of the workers to the organization. When there is perceived interactional justice, employees will be satisfied and exhibit good work behaviours such as organizational citizenship behaviour and job commitment. On the other hand, employees will put up a negative behaviour in the workplace such as lateness to work, increased absenteeism, lack commitment, low productivity and increased tendency to leave the organization.

Gichira (2016) empirically examined the influence of justice perceptions on employees' commitment in the health sector in Kenya. The researcher adopted descriptive survey research design where data were collected from 195 employees using a structured questionnaire. The data collected were analyzed statistically using inferential statistics such as correlation, multiple linear regression models and ANOVA. The finding showed that distributive, procedural and interactional justice perceptions have a significant relationship with affective, continuance and normative commitment in the health sector in Kenya.

Conclusion

The concept of interactional justice and its impact on continuance commitment is a very vital and contemporary area of discussion and interest amongst management scholars. The various literature reviewed indicates the existence of a strong relationship between interactional justice and continuance commitment of employees in the organization. A good interactional justice system serves to encourage greater and better continuance commitment and work behavior. Rathore and Sen (2017) stated that interactional justice is the key that holds employees together while interactional injustice drives the employees apart and make them to become less committed, motivated and productive.

Recommendation

The results obtained from reviewed literature revealed a strong relationship between interactional justice and continuance commitment of employees in the workplace. Therefore, the study recommends that owners and management of organizations should give critical attention to interactional justice in the workplace as a way of improving the continuance commitment of employees so as to instigate a positive work behavior and increase productivity.

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THE EFFECT OF FAIR VALUE ACCOUNTING AND HISTORICAL COST ACCOUNTING ON FINANCIAL PERFORMANCE OF SELECTED LISTED MANUFACTURING COMPANIES IN NIGERIA

Obalakumo, Anderson Pereowei
Bayelsa State Polytechnic, Aleibiri, Ekeremor LGA
08066649767, perez2andy@gmail.com

Goroke Ebikibina (FCNA)
Director, Finance and Accounts, Ministry of Marine and Blue Economy, Bayelsa State.
and
Bolouikie, Paul Igali (CNA)
Bayelsa State Ministry of Culture

ABSTRACT
The purpose of this research was to interrogate the effect of fair value accounting and historical cost accounting on financial performance of selected listed manufacturing companies in Nigeria. This study used panel data regression to evaluate two hypotheses on how fair value accounting and historical cost accounting affect both return on equity and profit after tax of ten (10) companies listed on the Nigerian Exchange Group, using their annual reports from 2019 to 2023. It was discovered that fair value accounting and historical cost accounting do not have any statistical significant effect on return on equity, as well as on profit after tax of manufacturing companies in Nigeria. Thus, it was concluded that there is statistical significant difference between financial performance measured at fair value and that measured at historical cost. The report therefore recommended that since findings have revealed that there is no statistical difference between the two methods of accounting measurements, manufacturing companies should be allowed to adopt the accounting measurement approach of their choice. However, adequate disclosure concerning their preference should be made in line with generally accepted accounting standards. However, they should be mandated to follow consistently the approach of their choice for at least five years.

Keywords: Fair value accounting, Historical cost accounting, Financial Performance, Return on equity, Profit after tax.

1.0 INTRODUCDION

Over the years, the role of accounting policies, valuation techniques and approaches in sustaining corporate entities, partnerships, joint ventures, small and medium scale businesses have been underscored by the attention it has enjoyed even in recent literature. The quest for qualitative, reliable accounting and financial reporting remains a fundamental issue of concern for firms and users of financial statements whose economic decision is informed by the available financial information at their disposal (Amaefule et al., 2021).

Due to the importance of financial reporting to organisations and their stakeholders, firms employ different accounting techniques and approaches in preparing and presenting financial statements and valuing their assets and liabilities. These approaches have considerable impact on financial and non-financial data, which ordinarily such impact may not be considered or known by the users of such information except where proper disclosure is made (Jadi et al., 2022). Needless to say that since profit maximization is the bottom line of every private enterprise, the custodians of the resources of an organisation, as well as the preparers of the financial statements of such an organisation are always evolving with new approaches to report profit figures that would seem attractive to the owners of the business and potential investors.

As such, in the recent past, there have been considerable debates amongst policymakers and experts as to the method of accounting measurement that would report the most appreciable profit figures in line with generally accepted accounting principles. It is for this reason that in the world of accounting, several approaches to accounting measurement have been brought up.

Such methods include fair value, current value, present value, deprival value, as well as historical cost accounting, which is the oldest and most commonly used method in financial reporting among companies (Amaefule et al., 2018). Despite the relative usefulness of the historical cost accounting, there have been several criticisms levelled against it, which has brought about the need to consider other methods of accounting measurement, especially the fair value accounting method. It is in view of this that there has been an increasing number of international accounting standards which are encouraging and or requiring

the use of fair value accounting for financial reporting purposes, according to Biswas (2020).

It is worthy of note to point out that the fair value and the historical cost are not mutually exclusive, rather they are complementary, as each has both strengths and weaknesses (Biswas, 2020). Jadi et al. (2022) opine that amongst all the values that are submitted to accounting valuation, the most utilized one is historical cost. This component can be verified, as it is recorded in the document that proves the property right over a certain asset, such as a promissory note or a debt. While the accounting system based on historical cost is widely accepted by accountants due to its objective nature, as it is supported by transactions that have already been completed, and it is generally easily understandable to its users, scholars have debated over the relative merits of fair value accounting and the quality of the information that it provides to investors and other key users of financial statements as against the traditional historical cost method, in terms of adequacy of information disclosure (Jadi et al., 2022).

Amaefule et al. (2021) are of the opinion that it is the level of criticisms that has been levelled against historical cost accounting that has given rise to the introduction of fair value measurement. However, as in IFRS 13, which addresses how to measure fair value, it does not stipulate when fair value can or should be used. This position of IFRS 13 could – if not checked – encourage fraudulent practices leading to doubt in the integrity of system operatives and the correctness of financial statements published by firms. AlJeburi and Al-Yasiri (2019) recommend that there is a need for a serious work towards shifting from historical cost in recording non-current assets to the fair market value of these assets. These accounting methods differ in opinion on how management should present the firm's records to shareholders and other users of accounting information. The ambiguity and controversies surrounding the appropriate method of accounting query the relevance of these methods of accounting formulated. The weakness observed in the preparation of firms' financial statements using the historical cost accounting and the ambiguity surrounding the proper understanding, interpretation and application of the fair value accounting creates confusion in the discussion of fair value versus historical cost methods of accounting (Amaefule et al., 2018).

Since organisations are at cross roads concerning which method of accounting measurement to adopt in the preparation of financial statements, especially when international harmonization of accounting is taken into consideration, it has become pertinent to take a cursory look at the two prevalent methods (that is, historical cost and fair value) and interrogate the effect each of them has on the profitability of firms. This study therefore investigates fair value accounting and historical cost accounting and their effect on financial performance of manufacturing firms. Moreover, notwithstanding the fact that there have been quite a good number of studies conducted in relation to examining the effect of these two measurement approaches on financial performance of manufacturing companies in Nigeria, among whom are Amaefule et al. (2018), Amaefule et al. (2021) and Jadi et al. (2022), the conclusions reached and recommendations made by all of them have not been encouraging, as none of them was able to recommend, on the basis of their findings, which approach of accounting measurement would be appropriate in reporting the profit figures of companies. It is in an attempt to fill this knowledge gap that this study intends to specifically interrogate the effect of fair value accounting and historical cost accounting on profitability of manufacturing companies in Nigeria.

2.0 LITERATURE REVREVIEW

2.1 conceptual review

concept of Fair Value Accounting

The primary qualities of accounting information are relevance and reliability, the two criteria to enhance the usefulness of the financial report. Fair Value Accounting (FVA), as an approach to accounting measurement, places the greater function in financial statements because this information is perceived as more relevant to investors and creditors than historical cost information. In recent years, international standard setters and regulators such as the International Accounting Standards Board (IASB) and the Financial Accounting Standards Board (FASB) have begun to favour the use of Fair Value Accounting over Historical Cost Accounting in financial reporting (Jadi et al., 2022). A key reason for this shift in methodology is to improve the relevancy of the information contained in financial reports. The general principle underlying the shift is that up-to-date information improves investors' and regulators' abilities to make informed decisions (Amanamah & Owusu, 2016).

The International Accounting Standard Board (IASB) defines fair value as ‘’an amount at which an asset could be exchanged between knowledgeable and willing parties in arms-length transaction’’ (IASB 2008). IFRS 13, Fair Value Measurement, sets out a single framework for measuring fair value and provides comprehensive guidance on how to measure it. IFRS 13 defines Fair Value “as the price that would be received to sell an asset in an orderly transaction between market participants at the measurement

date". This definition of fair value reflects an exit price option, which is the market price from the perspective of a market participant who holds the asset (Amaefule et al., 2021).

Concept of Historical Cost Accounting

According to Amanamah and Owusu (2016), Historical Cost Accounting (HCA) measures an asset at the cost of obtaining it. Going further, they characterize HCA as a technique whereby the estimation of asset or liability expressed on statement of financial position is ascertained by its acquisition cost. He further emphasizes that financial accounting measurement shapes the standard of exchange value, that is, the financial statement against an asset and liability frames the current market value of the asset. Historical cost can likewise be portrayed as 'bargains value' or also referred to as purchase cost of an asset which is either in bill payment, worth of other kinds of payment or cash equivalent used in acquiring or purchasing the asset. Historical cost of an asset is ascertained with the basis of a stable measuring unit forecast (Horsfall & Omah, 2020). Historical cost shows assets and liabilities as though there had been no adjustment in the sum or incentive from the date of procurement (from commencement). Authors such as Alkababji (2016), who have scrutinized HCA have put together their analysis with respect to its incorrectness (absolute deviation from genuine estimation of value). Irrespective of their criticism, most accounting systems still accept it.

Concept of Financial Performance

Financial performance, as a concept, has been a topical issue among scholars and researchers alike in various areas of business and strategic management. In the same manner, it has been a major issue for business practitioners (such as managers and entrepreneurs) because it is an important part of the overall success of any organization (Ihimekpen, 2021). Its importance notwithstanding, performance is difficult to define and measure, especially in the business world. Agu and Amedu (2018) assert that financial performance (FP) refers to a financial benefit that a business derives from its investment in an undertaking. It can also be regarded as the reward an entrepreneur enjoys for investing his resources in a given venture. It is the bottom line that indicates the efficiency of an entrepreneur or company's management in managing shareholder's wealth. It is an important aspect in determining the efficiency and effectiveness of management particularly in the utilization of investment made by shareholders to create more wealth as a return to the amount invested (Agu & Amedu, 2018). Ihimekpen (2021) views the concept of financial performance as the act of quantifying monetarily the policy and operations of a business firm, the results of which is determined in the firm's Return on Assets (ROA), Return on Equity (ROE), Earning per Share (EPS), net profit margin and other indices. For the purpose of this study, two financial performance measures are employed. They are: return on equity and profit after tax.

Return on Equity (ROE)

Return on equity is used to measure corporate financial performance in this study. It details how well a company has used the capital from its shareholders to generate profits. Investors use ROE as a measure of how well a company is using its money. Many researchers have used it in their studies, according to Ihimekpen (2021). In this study, it is calculated as profit after tax divided by shareholder's equity. Ihimekpen (2021) views that return on equity (ROE) has not been a major player in the determinant of capital structure performance of firms in Nigeria. The interest of shareholders in any corporate body is how their capital employed will yield profit to which will in turn determine the amount to be paid as dividend. Asuquo et al. (2018) opines that this type performance ratio measures the financial performance and the managerial efficiency of firm and the higher the ratio, the more efficient is the performance of profitability of a firm.

Profit After Tax (PAT)

Profitability refers to the capacity to make profit from business ventures. It reflects the efficiency of management in the utilization of resources at their disposal. As per Biswas (2020), profitability is the ability of an investment to earn a return from its use. Firm's profitability is an index of efficiency. The net profit after tax simply reveals a satisfactory balance between the monies received and monies given. It reflects the balance monies available to the business for distribution after taking into consideration all direct and indirect costs, nominal charges and taxation (Chukwu & Akpeekon, 2019).

2.2 Theoretical Review

This study is anchored on the Schumpeter theory of profitability. Schumpeter developed the circular flow model in 1934, which differs from the static state model of Clark. As posited by Schumpeter, the entrepreneur is an innovator, who is able to break from the competition, acquire a transitory monopoly in which he can accrue profits until his competitors catch up; but before they do so, he is able to move on to further innovation in new fields. However, Siddiqi (1971) cited in Jadi et al. (2022) observed that Schumpeter

saw the entrepreneur's reward as a functional reward linked to his innovation ability rather than a surplus. He identified five ways in which Schumpeter acknowledged that innovation would lead to profit generation as:

1. Introduction of new products or improvement of existing ones.
2. Introduction of production methods.
3. Penetration into new markets.
4. Discovery of new sources of raw materials.
5. Changes in organizational structure, such as creation of monopoly.

In line with the above theory, the introduction of new accounting standards represents an innovation, which reflects changes in production method with implications on probability. Thus, the shift in accounting treatment from historical cost to fair value will affect the profit of firms, such as manufacturing companies in Nigeria. Thus, the need to examine the nature of such an impact on their financial performance (Jadi et al., 2022).

2.3 Empirical Review

Amaefule et al. (2018) did a comparative study on the effect of fair value measurement and historical cost measurement on the performance of quoted firms in Nigeria. The study employed the ex-post facto research design and analyzed data obtained from Nigerian Stock Exchange between 2007 – 2011 HCA and 2012 – 2016 for FVM using paired sample T Test as statistical tool. They found out that there exists positive but insignificant difference in the Profit after Tax (PAT) of the firms. They also found that there exists negative but insignificant effect on earnings per share. The study recommended that Accounting Standards should be reviewed on the fair value practices in IFRS to encourage improved operations of firms across national borders.

In the study conducted by Amaefule et al. (2021), they examined the effect of Historic Cost Accounting (HCA) and Fair Value Accounting (FVA) practices on profitability of quoted manufacturing firms in Nigeria. Secondary data was obtained from 10 quoted manufacturing firms from 2015-2019 from the Nigerian Stock Exchange Fact book and annual reports of the quoted manufacturing firms. Using panel data methodology and the fixed effects model as estimation technique at 5% level of significance to analyse the effect of both accounting measurement approaches on profit after tax, the study observed that there is ambiguity in the interpretation of the instrument conveying the principles, recommendations and application of fair value accounting method and this has given rise to several arbitrary and conflicting interpretations – especially as it suits the reporting body corporate. Premised upon the foregoing, the study recommended among others that accounting professionals and research fellows, relevant accounting institutions and government agencies, and system operators should continue to address the issue of measurement with a view to providing sustainable solution.

The objective of the study conducted by Jadi et al. (2022) was to examine the differential effect of fair value accounting and historical cost measurements on firm value and financial performance of manufacturing companies in Nigeria. Data was collected from ten companies' financial statements from 2005-2014, to measure ROE, ROA and TOTAL ASSETS which are proxies for firm value and financial performance. Data were analyzed using t-test statistic. Results show that fair value measurement increases asset value and equity of a company, thereby guarding against unnecessary erosion caused by overstating profit under the HCA, while ROE and ROA do not significantly differ under the two measurement approaches. The study recommends that more policy (practical approach than paper principles) may be easier, while the need for fair value measurement to be extended to other aspect of income statement than limiting it to statement of financial position items may equally be sufficient in measuring performance.

3.0 METHODOLOGY

This study used quasi experimental research design to compare the effect of historic cost accounting and fair value accounting on the profitability of selected manufacturing firms in Nigeria. The population of this study was the number of listed industrial goods manufacturing companies with the relevant data during the period under study (that is, 2019-2023). As such, the population size, which incidentally is the sample size of this study, was 10 industrial goods manufacturing companies, according to the Nigerian Exchange Group. The financial statements of five of the sample companies were prepared using historical cost accounting approach while the financial statements of the remaining five companies were prepared using fair value accounting approach, for the 5-year period under study. Therefore, relevant data relating to fair value data, historical cost data, return on equity and profit after tax, was obtained from the annual reports (and other secondary sources) of the companies under study. Descriptive t-statistic was used to determine both the mean and standard deviation of the parameters (the result was test run using SPSS).

Measurement of Variables

Two hypotheses were formulated and tested for the purpose of establishing the effect of fair value and historical cost measurements on financial performance of selected listed manufacturing companies in Nigeria. Financial performance was represented by return on equity and profit after tax, both of which was based on the two measurement approaches (fair value and historical cost measurements). Return on equity (ROE) was computed as profit after tax scaled by total equity., while Profit after Tax (PAT) is the value of reported profit figure obtained directly from the annual reports.

Model Specification

The functional relationship between the dependent and independent variables, the disturbance, coefficient and intercepts is as stated below:

FP = *f*(FVA, HCA)

FP = ROE and PAT

ROE = *f*(FVA, HCA) (i)

PAT = *f*(FVA, HCA) (ii)

From the above functional relationship, the econometric models are specified thus

$ROE = \square_0 + \square_1 FVA_1 + HCA_1 + U_1t \ldots$ (iii)

$PAT = w_0 + w_1 FVA_2 + HCA_2 + U_2t \ldots.$ (iv)

Where:

ROE = Return on equity

PAT =Profit after tax

FVA = Fair value accounting

HCA = Historical cost accounting

Uit = Error term

$\square_0$, $\square_0$, w_o, = intercepts

$\square_1$, $\square_1$, w_1 = slope coefficients

4.0 RESULTS AND DISCUSSIONS

4.1 *Descriptive Statistics*

This section presents the descriptive analysis of the minimum, maximum, mean and standard project. The descriptive statistics of variables cover deviation.

Table 4.1 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Stat	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
FPAT	10	.95	51.00	21.8750	17.33117	.466	-	-	1.334
FROE	10	.90	53.70	28.7070	19.56529	.089	.687	.687	-1.261
FVA	10	73547.00	299066.00	208746.2000	93673.28360	-.556	.687	-1.623	1.334
HBV	10	11032.00	112354.00	54805.1000	34477.38693	.200	.687	-1.053	1.334
HPAT	10	659.00	43087.00	15384.4000	15624.04390	1.178	.687	.247	1.334
HROE	10	3.20	100.90	27.7100	27.94445	2.304	.687	6.174	1.334

Source: Researcher's Computation, 2024.

The descriptive statistics of the parameters are shown in Table 1. The mean value, standard deviation, minimum values, maximum value, skewness and kurtosis were recorded. The mean value of FPAT, FROE, FVA, HBV, HPAT and HROE were recorded as 21.875, 28.7070, 208746.2, 54805.1, 15384.4 and 27.71 respectively. The deviation from the mean values were recorded as the Standard deviations. The skewness indicates the degree of asymmetry or departure from symmetry of the distribution. The positively skewed values mean that majority of the values are less than the mean value while the negatively skewed value means that majority of the values are greater than the mean. The Kurtosis indicates the degree of the peakness of the distribution.

Interpretation of Inferential Statistics Result

Hypothesis 1

H_0: There is no statistical difference between the return on equity measured at fair value and historical cost.

The tables below summarize the results of paired test analyses among the variables. This exercise serves two important purposes. First is to determine whether there is any difference between ROE and PAT measured at fair value and historical cost accounting. Secondly, to determine the level of significance in the differential effect between these variables measured at both fair value and historical cost accounting.

Table 4.2: Paired Sample Statistics

Variables		Mean	N	Std. Deviation	Std. Error Mean
	Fair Value ROE	28.7070	10	19.56529	6.18709
	Historical cost ROE	27.7100	10	27.94445	8.83681

Source: Researcher's Computation, 2024.

The mean value and the standard deviation of the fair value and the historical cost on return on equity are shown in Table 2 above. The mean value and standard deviation of the fair value on return on equity were recorded as 28.7070 and 19.56529 respectively. Also the mean value and the standard deviation of the historical cost on return on equity are given as 27.71 and 27.94445 respectively.

Hypothesis 2

H_0: There is no statistical difference between fair value PAT and PAT measured at historical cost

Table 4.3: Paired Samples Statistics

Variables		Mean	N	Std. Deviation	Std. Error Mean
	Fair Value PAT	21.8750	10	17.33117	5.48060
	Historical cost PAT	8.8700	10	4.97796	1.57417

Source: Researcher's Computation, 2024.

Table 4.4: Paired Samples Test

Variables	Paired Differences					T	Df	Sig.(2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Fair Value PAT HC PAT	13.00500	20.08430	6.35121	-1.36244	27.37244	2.048	9	.071

Source: Researcher's Computation, 2024.

The mean value and the standard deviation of the fair value and the historical cost on profit after tax are shown in Table 4 above. The mean value and standard deviation of the fair value on profit after tax were recorded as 21.8750 and 17.33117 respectively. Also the mean value and the standard deviation of the historical cost on profit after tax are given as 8.87 and 4.97796 respectively. Table 5 shows the mean difference between the two conditions, the standard deviation and standard error associated with that difference. The mean difference is recorded as 13.005 and standard deviation as 20.0843 with standard error as 6.35121. The Table also displayed the 95% confidence interval for the difference between the mean. The confidence interval indicates that on 95% of occasions, the difference between the two conditions would be somewhere between -1.36244 and 27.37244**.**

The pair samples test for equality of the mean has the t- value recorded as t = 2.048 and Sig (2 tailed) that is the p- value as p =0.071. At 5% level of significant, the p- value is greater than 0.05; the result shows that there is no evidence of statistical significant difference in the fair value on profit after tax and historical cost on profit after tax. The null hypothesis (H_0) is therefore accepted and concluded that fair value profit after tax does not significantly differ from profit after tax measured at historical cost.

4.2 Discussion of Findings

The result of the analysis in Table 3 showed that at 5% level of significance, the p- value is greater than 0.05, thereby indicating that there is no evidence of statistical significant difference in the fair value on return on equity and historical cost on return on equity. Therefore, the null hypothesis (H_0) is accepted and concluded that there is no significant statistical difference between return on equity measured at fair value from historical cost in manufacturing companies in Nigeria. This is in line with Jadi et al. (2022) who in their study, concluded that there is no statistical difference between return on equity measured at fair value ad historical cost.

Table 5 shows the relationship between fair value profit after tax and historical cost profit after tax. The analysis of the Table indicates that at 5% significant level, the p-value is greater than 0.05, hence giving an indication that there is no evidence of statistical

significant difference in the fair value profit after tax and historical cost profit after tax. The null hypothesis is therefore accepted and concluded that fair value profit after tax does not significantly differ from profit after tax measured at historical cost in manufacturing companies in Nigeria. In their study, Jadi et al. (2021) equally came to the conclusion that fair value profit after tax and historical cost profit after tax do not significantly differ from each other.

5.0 CONCLUSION AND RECOMENDATION

5.1Conclusioan

The study focused on the effect of fair value and historical cost accounting on financial performance of manufacturing firms listed on the Nigerian Exchange Group using relevant data obtained from the annual reports of the selected companies between 2018 and 2022. Results of the findings indicated that with respect to return on equity (ROE), fair value accounting and historical cost accounting are not statistically different from each other, so fair value accounting and historical cost accounting do not have any significant effect on return on equity. With respect to profit after tax, results also showed that the two methods of accounting measurement are not statistically different from each other, hence the two of them have no significant effect on the profit after tax of manufacturing companies in Nigeria. In conclusion, fair value accounting and historical cost accounting do not have any statistical significant effect on financial performance of manufacturing companies in Nigeria.

5.2 Recommendations

Based on the findings of this study, the following recommendations are made:

- Since findings have revealed that there is no statistical difference between the two methods of accounting measurements, manufacturing companies should be allowed to adopt the accounting measurement approach of their choice. However, adequate disclosure concerning their preference should be made in line with generally accepted accounting standards and they should be mandated to follow consistently the approach of their choice for at least five years.
- Policymakers should consider new steps to strengthen institutional governance and control mechanisms that in turn support higher-quality FVA and HCA practices within manufacturing companies in Nigeria. The fidelity of accounting information is unlikely to exceed the quality of whatever institutional process generates it.
- Accounting standards setting bodies such as the International Accounting Standards Board (IASB) should be specific in their conceptual framework on which measurement should be used for different assets and be consistent across all borders.

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THE EFFECT OF THE IMPLEMENTATION OF VALUE-BASED MEASUREMENT APPROACHES ON FINANCIAL REPORTING IN NIGERIAN COMPANIES

Okpobo, Timinipre Joseph; Obalakumo, Anderson Pereowei; Disu, Sulaiman Babtunde
Department of Accountancy, Bayelsa State Polytechnic, Aleibiri, Ekeremor LGA.
Corresponding Author: 08066649767; perez2andy@gmail.com

Abstract
The purpose of this study was to investigate the effect of the implementation of value-based measurement approaches on financial reporting in Nigerian companies. Specifically, this study examined the effect of fair value measurement approach (as an indicator of value-based measurement approach) on four major qualitative characteristics of accounting information, namely: faithful representation, relevance, comparability and verifiability (which served as measures of financial reporting quality) of registered companies in Bayelsa State. The population of this study comprised all the registered companies in Bayelsa State, hence the population size was 264 registered companies while the sample size was 159 companies, with the senior accountants (or their representatives) of these companies serving as the respondents. Using purposive sampling method, questionnaires, designed on a four-point Likert scale, were administered to the respondents and the collected data was analyzed with SPSS. Findings revealed that value-based measurement approach has a significantly positive effect on financial reporting quality of companies. It was therefore, suggested that companies should establish new procedures and databases that are ideal for recording and reporting relevant information that will assure stakeholders that financial reporting qualities are maintained while measuring items in the financial statement based on IFRS 13.
Keywords: Fair Value Accounting, Deprival Value Accounting, Financial Reporting Quality

1.0 INTRODUCTION

It is an established fact that the publication of financial statements is the major medium through which corporate organisations convey their financial position and worth to various stakeholders of the organisations. Similarly, the relevance and reliability of entity's financial statements depends on the usefulness of information conveyed to the end users. Therefore, the choice of the accounting measurement adopted by a reporting entity in preparing its financial statements has become a significant challenge in accounting discipline, even as the scope of business entities' operations are becoming global and in the face of international harmonization of accounting. Moreover, entities' process and corporate methods are increasingly growing across borders, and corporate performances of entities are receiving its due recognition. This is accompanied by the flooding of financial markets by complex trade able financial products (physical products and financial instruments) (Osanyinbi et al., 2023).

Accordingly, Ohidoa and Otakefe (2019) maintain that the primary activity in the overall process of financial reporting is the value measurement. Thus, selecting a suitable measurement approach, such as the fair value at entry, historical cost, deprival value, replacement cost and fair value at exit (net realizable value), is open to the managerial discretion of the entity. In an attempt to address the challenges of financial statements reporting in the present global business environment, standard setters (International Accounting Standard Board and Financial Accounting Standard Board) have significantly re-modified financial statements reporting systems, with value-based measurement being at the forefront of their campaign. This development had resulted to a gradual shift from the historical accounting approach towards a more value-based approach, particularly the fair value accounting measurement approach (Ohidoa & Otakefe, 2019).

Ijeoma (2014) opines that the wave of financial reporting is moving towards 'relevance' of financial reporting to stakeholders. The International Accounting Standards Board (IASB) and the Financial Accounting Standards Board (FASB), which have motivated this transition from the traditional approach to the fair value accounting approach, thereby, signalling a significant shift in the underlying conceptual basis of financial reporting, are of the opinion that the appropriateness of matching income with the market place, using market based measure, has become a dominant discussion in financial reporting palace that has introduced the era of fair value accounting measure. It is this transition that has given rise to the contentious debate on the important role of accounting measurement in relation to the quality of financial reporting among companies in Nigeria (Abiahu et al., 2020). Despite the importance of measurement approaches in financial reporting, accounting measurement has received very little attention in the conceptual framework of financial reporting in countries, including Nigeria. This has become so as measurement decisions and choices reflect definitions ascribed on financial statement

elements and qualitative characteristics of accounting information in the context of the objective of financial reporting (Ibadin & Izedonmi, 2013). Interestingly, among researchers this issue has not been given the much attention it deserves, as there is little or no study on the effect of value-based accounting measurements on quality of financial reporting, apart from a few studies relating to fair value accounting and financial reporting (Hodder et al., 2014; Osanyinbi et al., 2023) and Ibadin and Izedonmi (2013) who conducted a study on measurements in accounting, with respect to issues and choices determinants. It is in view of this dearth in this area of research and the need to fill the knowledge gap identified that this study is set out to interrogate the effect of value-based measurements in accounting on quality of financial reporting in Nigerian companies. Specifically, this study intends to investigate the effect of fair value measurement on financial reporting quality of companies in Nigeria. It is on this basis that hypotheses are subsequently formulated and evaluated.

Hypothesis One

HO: There is no effect of fair value measurement on quality of faithful representations of items in the financial report.

Hypothesis Two

HO: There is no effect of fair value measurement on quality of relevance of items in the financial report.

Hypothesis Three

HO: There is no effect of fair value measurement on quality of comparability in financial reporting system.

Hypothesis Four

HO: There is no effect of fair value measurement on quality of verifiability of items in the financial report.

2.0 LITERATURE REVIEW

Value-Based Accounting Measurements Concepts

According to Ibadin and Izedonmi (2013), bases of measurement in financial reporting are not carved in stone. Therefore, the following present some value-based accounting measurements.

Fair value accounting

The concept of fair value is currently in transition. FASB's Statement of Financial Accounting Concepts No 7, Using Cash Flow Information and Present Value in Accounting Measurements, defines the fair value of an asset (or liability) as 'the amount at which that asset (or liability) could be bought (or incurred) or sold (or settled) in a current transaction between willing parties, that is, other than in a forced or liquidation sale.' Fair value is the amount for which an asset could be exchanged or a liability settled, between knowledgeable parties in arms' length transaction (IASB, 2008).

According to Ibadin and Izedonmi (2013), under the fair value accounting approach, companies report losses when the fair values of their assets decrease or liabilities increase. Those losses reduce companies' reported equality and may also reduce companies' reported net income. Similarly, the application of fair value accounting increases the likelihood of overstating the book value of assets, which, in turn, increases a company's (and its auditor's) risk of litigation and losing reputation. Litigation costs and the risk of losing reputation, however, are expected to decrease as the quality of fair value estimates increases. A commitment to fair value, then, can be viewed as a costly way for companies that are confident in the quality of their estimates to distinguish themselves from companies with less reliable fair value estimates. There is no doubt that fair value accounting has played a significant role in the practice of accounting, just as accounting standard that requires, fair value accounting has increased considerably in number and significance. To meet the objective of using fair value accounting, companies must fully incorporate information about future cash flows and current risk adjusted discount rates into their fair value measurements. The main issue in Fair value accounting is whether companies can and do estimate fair values accurately and without discretion. Hodder et al. (2014) add that when identical positions trade in liquid markets that provide unadjusted mark-to-market values, fair value is the most accurate and least discretionary possible measurement attribute though liquid markets get values wrong sometimes.

Fair value implies the recognition of assets and liabilities that are unrecognised under historical cost. If an asset or a liability has a fair value, this in itself is an argument for its recognition. Fair value also implies recognition of gains as they arise rather than as they are realised. This avoids the problem, which arises under historical cost, of asset disposals being timed so as to smooth reported earnings. Fair value income is the increase in the fair value of a business's net assets during the accounting period (Ibadin & Izedonmi, 2013; Hodder et al., 2014).

Deprival value

Deprival Value (DV) is the loss that the entity would suffer if it were deprived of the asset. It is measured as the lower of replacement cost and recoverable amount where recoverable amount is the higher of value in use and the net realizable value (NRV). Put differently, recoverable value is the higher of the value in exchange and the value in use. According to

the Canadian Accounting Standards Board (2005) cited in Hodder et al. (2014), the deprival value framework holds that the value of an asset to a business entity is the economic loss that the entity would suffer if deprived of it. The loss could not exceed the most economic current cost to replace its productive capacity or service potential. Deprival value can also be defined as the value by which a company would be worse-off if it were deprived of the asset. This is a logical guide for the company to following a rational value-maximizing decision. It is expected that when the recoverable value exceeds the replacement cost, then if the company were deprived of its assets, it could go out and buy another to replace it, if this is possible. The replacement cost would therefore set a maximum on the loss that the company can suffer. However, if the economic benefits that arise from ownership of the asset (termed the recoverable value) are less than the cost of replacing it, then the company would logically choose not to replace it (Hodder et al, 2014).

Ibadin and Izedonmi (2013) note that the calculation of recoverable values depend on how the company intends to maximize inflows-cash or other benefits. However, the company has two basic choices: value in exchange, defined as the asset's net realization value (the sales proceeds less the future costs of sale). On the other hand, the choice of value in use, which is the present value of the future cash flows obtainable as a result of the continued use of an asset, including those resulting from its eventual final disposal. In addition, Hodder et al. (2014) emphasize that the deprival value approach has particularly been popularized in the U.K and Australia and it is often seen as the value to the owner or value to the business; it provides a coherent principle for selecting the most defensible type of current value for each kind of assets and liabilities, and for finding the value's size. Its general use would make accounts more consistent and comprehensible. It also provides a means of selecting a measurement basis that is relevant in specific circumstances, as well as identifies the amount that would just compensate the entity for the loss of an asset.

Critics of deprival value argue that what is relevant to a business's owners is profit after maintaining financial capital, rather than profit after maintaining operating capability. A business can increase its owners' wealth while reducing its operating capability or increase its operating capability while reducing its owners' wealth. It may also be argued that information measured from the perspective of a potential market entrant does not provide the most relevant information on financial position or performance for users generally. Moreover, it may be felt that the concept of replacement which lies at the heart of deprival value has become less relevant in a modern economy, where there is usually significant change in markets and technologies. In addition, it is criticized on the grounds that all of the bases considered by the deprival value model are current, entity-specific bases. However, (apart from the consideration of transaction costs), the selected bases would not be expected to be significantly different from market values in the case of assets and liabilities that are widely traded on a market. Use of the deprival value model suggests a basis that is highly relevant. However, it is necessary to consider whether the basis that it implies adequately reflects the other qualitative characteristics of financial reporting. Such an analysis ensures that appropriate consideration is given to all the qualitative characteristics and the need to obtain an appropriate balance between them (Hodder et al., 2014).

Current cost accounting

Ibadin and Izedonmi (2013) opine that Current Cost Accounting (CCA) encompasses reproduction or replacement cost. It is defined as the process of determining the most economic cost of replacing an asset with an identical one (reproduction cost) or with an asset of equivalent productive capacity or service potential (replacement cost).

i. Reproduction cost

This is commonly equal to the historical cost on initial recognition. It could be different however from it: self-constructed assets require the allocation of costs incurred. In past periods, significant pre-recognition costs could be expensed as incurred, or the most economic current cost of reproducing an asset could differ from the fair value of the consideration given to acquire it. Reproduction cost purports only to measure the amount that would be expected on a measurement date. It does not measure value received and thus, must be supplemented by a recoverability condition (Ibadin & Izedonmi, 2013).

ii. Replacement cost

This is the most economic cost required for the entity to replace the service potential of an asset (including the amount that the entity would receive from its disposal at the end of its useful life) at the reporting date. It is the measurement basis that measures the most economic cost of replacing the productive capacity or service potential of asset. Proponents of replacement cost are of the opinion that replacement cost is an appropriate performance measurement because it shows whether the entity is able to recover its replacement cost or not from revenues especially in the period of changing or unstable prices. Besides, the proponents of this measurement believe that it

provides the basis of predicting future profitability of the firm by excluding holding gains or losses that may not be sustained. Replacement cost differs from fair value accounting when it (replacement cost) is based on entity specific expectation as to an asset's service potential or productive capacity, and its most economic replacement cost that differs from market expectations (Hodder et al., 2014). However, entity-specific determinations of replacement cost have significant limitations. This manifests itself when identifying and measuring the productive capacities or service potentials of many assets. It is subject to serious problems with respect to its capability for reliable estimation. This is itself stems from the lack of objective bases for defining the most economic service potential or productive capacity of assets in entity-specific contexts. Besides, in some cases the calculation of replacement cost is complex and confusing. This would reduce the timeliness, comparability and verifiability of information prepared on a replacement cost basis. Such a calculation may also be relatively costly. These limitations render replacement cost less relevant than fair value on initial recognition. However, replacement cost is conceptually more relevant than reproduction cost or historical cost on initial recognition (Ibadin & Izedonmi, 2014).

Realisable Value

According to Hodder et al. (2014), an asset's realisable value is the amount for which it could be sold, and a liability's realisable value is the amount for which it could be settled. Realisable value measurements are often made on a net basis, and in this report realisable value is considered in the sense of net realisable value, that is, net of selling costs (for assets) and grossed up for settlement costs (for liabilities). As the actual use of realisable value is limited, it is difficult to say exactly how it would be calculated in practice if it were applied to assets and liabilities generally. The view could be taken that, in substance, realisable value and fair value are the same except that the former is usually measured net of the costs of realisation. If an attempt were made to apply realisable value generally, therefore, alternative measures would need to be found to produce the numbers in situations where there is no active market to provide them. This would presumably result in the same kind of list of proxies for realisable value as that developed for fair value in IFRS 3. Ibadin and Izedonmi (2014) add that an alternative view of realisable value is that it should be measured on the basis of disposal in the ordinary course of business. However, this approach to realisable value is clearly limited to assets that would be disposed of in the ordinary course of business – such as inventories. It could not be applied sensibly to all of a business's assets. Another view of realisable value is that it reflects what could be received on a forced sale – if the business were liquidated, for example.

Where realisable value is measured on the basis of disposal in the ordinary course of business, sometimes its measurements would be more objective than fair value, sometimes less. For example, inventory subject to a contract-for-sale or actually sold shortly after the statement of financial position balance sheet date could be measured objectively in circumstances where a hypothetical market price might be more difficult to determine. In other cases, the adjustments required for an ordinary course of business basis might be more subjective. Information prepared on a realisable value basis might be more relevant for some purposes than information prepared on other bases. For example, where realisable value shows current market prices, net of realisation costs, it allows investors, lenders and regulators to see what could be realised (net) on disposal of the business's separable assets. Some may see it as more useful than fair value because it adjusts for known entity-specific factors, such as contractual terms that would apply to the disposal of assets. Also, where realisable value shows what could be realised in a forced sale, it is particularly relevant where a business is not a going concern or is perhaps intended to have a limited life.

Financial Reporting Quality

The quality of financial reporting is classified into two, namely: fundamental and enhancing qualitative characteristics. The essence of these qualitative characteristics is to avoid misrepresentation in financial reporting process. According to Osanyinbi et al. (2023), the expectation of users of financial reports is to obtain information that would aid in the evaluation of the state of affairs of a reporting entity. It is expected that financial reporting quality should lead to reduction in the risks associated with liquidity and information asymmetry. Further, it inhibits corporate management from exercising discretionary judgement for personal gains and as well guides corporate managers in strategic investment decisions. Specifically, the minimization of asymmetric information anomalies that arises due to incompatible interest of stakeholders is one of benefits of higher financial reporting quality. Firms release good quality financial reports to agents in the market so that the market could act at a high level of information thus gaining superior advantage over others. Moreover, financial reporting quality provides information of decision usefulness to existing and potential investors, lenders and other creditors (Ahn, 2022). Osanyinbi et al.

(2023) postulate that every financial reporting should have the fundamental and enhancing qualitative characteristics. These are further categorized as: relevance, faithful representation (fundamental characteristics), comparability, verifiability, timeliness and understandability (enhancing characteristics). These qualitative characteristics are essential in the financial reporting of any organization.

2.2 Theoretical Review

The theory underpinning this study is the management theory, otherwise known as the stakeholder theory. This theory, propounded by Freeman (1984) is based on the assumption that the management of an entity is focused on the satisfaction of stakeholders and not only on the shareholders of the company. Scholars portray stakeholders as "those people who can influence or be influenced by the activities associated with trade" or as "the people who depend on the firm to attain their individual objectives and on whom the firm depends on for its existence". The idea of stakeholder theory began to receive significant attention in organisational and management research after the publication of "*Strategic Management: A Stakeholder Approach*" by Edward Freeman in 1984. According to Freeman (1984), the stakeholder theory maintains that firms have stewardship role towards a variety of stakeholders, different from shareholders, i.e. creditors, customers, suppliers, employees, government, community, environment, future generations, etc. Valentinov (2022) espoused that the stakeholder's theory was criticized on the basis that the impact of the stakeholders differs in terms of their stake and the manner of measure of their risk level. Furthermore, he observed that the corporate stakeholders vary in relation to their influence. This indicates that while the presence of some corporate stakeholders represents a tangible real asset, others could constitute a bottleneck for an organization. Being insensitive to stakeholders' interests may detract firm's reputation, which would adversely affect its operational and financial performance. A firm understands the role the customers, suppliers, creditors, government, environment and the host community play towards the success of firms. Therefore, firms owe these stakeholders a lot including making adequate disclosure of financial and non-financial performance. By doing this, the stakeholders can conveniently assess the impact of firms' operations on the entire stakeholders; acknowledging the fact that firms operate in a system of stakeholders whom they cannot do without. This study is therefore anchored on this theory because the stakeholders depend on the end product of financial report for decision making.

2.3 Empirical review

Philander (2016) conducted a study to examine the impact of fair value measurement on the usefulness of financial statements in South African listed companies. This was done by means of analysing the differences between the results of historical cost and fair value used as a basis of measurement in financial statements. The findings of the study suggested that fair value, as a basis of measurement, provides relevant and reliable financial information that contributes to the usefulness of financial statements. In the empirical study, the financial information were used to gather data by calculating the selected financial ratios for the financial periods 2009 to 2015 of selected Johannesburg Stock Exchange (JSE) listed companies. The interest cover (IC), financial leverage (FL), net current asset value per share (NCAVPS), net tangible asset value per share (NTAVPS) and the equity to debt (ED) financial ratios indicated that fair value measurements had a statistical significant impact on these ratios, thereby affecting the usefulness of financial statements. The possible impact on the users' decisions based on debt management financial ratios may result in the inability for investors and shareholders to determine the future financial stability of the entity. The capital market financial ratios may cause that investors and shareholders are unable to identify the current capability of the entity to generate profits.

Ibidunni and Okere (2019), in their study, investigated the relationship between fair value accounting and reliability of accounting information of listed firms in Nigeria. Adopting survey research along with quantitative methods, primary data was collected through questionnaires and analyzed by means of Pearson product moment correlation technique at a significant level of 5% and 10%, using Statistical Package for Social Science (SPSS). The results revealed that there is a significant relationship between fair value accounting and reliability of accounting information of the firms in Nigeria. Therefore, it was recommended that because of the high level of subjectivity that comes with using fair value, there is a high tendency that prices can be distorted because of market inefficiencies, liquidity problems or investor's irrationality (especially level 3).

The study carried out by Osanyinbi et al. (2023) examined the concept of fair value measurement in relation to its influence on the financial reporting quality of items in the financial statement of insurance companies. The study used survey method and questionnaire as research instrument to gather relevant data from professional accountants in selected listed insurance companies in Lagos state, using convenience sampling technique. Using SPSS to

analyse the data collected, findings revealed that there is significant relationship between fair value measurement and the financial reporting quality and that the fair value measurement has significant influence on financial reporting quality at each level of the hierarchies. The study therefore, recommended that insurance companies should observe the qualities of financial reporting while preparing financial reports and during the process of fair value measurement.

3.0 METHODOLOGY

The research design adopted for this study is survey research design. It also adopted content analysis of relevant literatures on fair value accounting and quality of financial reporting. The population of this study comprised all the companies registered in Bayelsa State. As such, as per the Nigeria Business Directory website (www.businesslist.com.ng), there are 264 registered companies in Bayelsa State as of the time of this study. Using Taro Yamane formula, the sample size of this study was 159 registered companies in Bayelsa State. Primary data for the study was obtained through structured questionnaire to elicit responses from the accountants of the companies under study. The questionnaire was designed using the four-point Likert scale. The SPSS was used to analyse the data collected.

4.0 RESULTS AND DISCUSSION

4.1 Results

The results of reliability statistical analysis based on Cronbach Alpha reliability test are presented in Table 4.1. Reliability analysis is determined through the examination of the proportion of systematic variation in a scale. Cronbach alpha is a reliability test for internal consistency since it increases because of an increase in the inter correlations among the items in the analysis.

Table 4.1: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.550	.840	159

Source: Researchers' Computation (2024)**.**

Table 4.1 above shows that the coefficient of reliability is more than 50%. This shows that the measuring scales and the items of the research instrument show a high measure of internal con.

Data on the responses of the subject on the questionnaire items are presented in Table 4.2

Table 4.2: Level I

Item	**Financial reporting quality**	**Strongly agree (%)**	**Agree (%)**	**Disagree (%)**	**Strongly disagree (%)**
1	Understandability	60.3	37.1	2.6	-
2	Timeliness	58.4	40.3	1.3	-
3	Comparability	60.6	37.5	1.9	-
4	Faithful representation	49.5	40.4	10.1	-
5	Verifiability	70.9	29.1	-	-
6	Relevance	61.7	30.5	7.8	-

Source: Researchers' computation (2024)

Table 4.2 above indicates that at the level one hierarchy, above 90% of respondents are of the opinion that fair value measurement will enhance all the qualitative characteristics of useful financial information which will improve the quality of financial reporting. This indicates that fair value measurement ensures items that will influence users in decision situations are incorporated into the financial reports.

Results of the level analysis of the responses are presented in Table 4.3

Table 4.3: Level II

Item	Financial reporting quality	Strongly agree (%)	Agree (%)	Disagree (%)	Strongly disagree (%)
1	Understandability	59.2	32.9	6.2	1.7
2	Timeliness	59.5	30.7	5.1	4.7
3	Comparability	46.7	31.3	11.3	10.7
4	Faithful representation	16.3	39.9	27.3	16.5
5	Verifiability	10.4	26.3	50.6	12.7
6	Relevance	54.7	32.3	10.1	2.9

Source: Researchers' Computation (2024)

Table 4.3 above on the level two hierarchy of fair value measurement shows that 59.2% and 32.9% strongly agree and agree respectively that fair value measurement increases understandability of items in the financial report. The item 2 shows that more than 80% of the respondents are of the opinion that fair value measurement improves timeliness in financial reporting system. Furthermore, 78% of respondents believe that fair value measurement would engender comparability of items in the financial reports. In addition, 36.7% affirm that fair value does not impair verifiability of items in the financial report and over 85% equally agree that fair value measurement enhances relevance of items in the financial reports of companies in Nigeria. This proves that fair value measurement at level two of the hierarchy will influence the relevance and decision usefulness of the items in the financial reports.

Test of Hypothesis

Table 4.4: Chi-square Test Statistics

	Fair value measurement and faithful representation	Fair value measurement and relevance	Fair value measurement and comparability	Fair value measurement and verifiability
chi-Square	7.430[a]	54.861[b]	49.165[b]	54.215[a]
chi-square	1.424	2.195	2.195	1.424
DF	3	4	4	3
Asymp.	0.059	000	000	000

Source: Researchers' computation (2024)

Hypothesis One

H_O: There is no effect of fair value measurement on quality of faithful representations of items in the financial report.

Results

The result of the test of hypothesis in Table4.4 above shows that at the degree of freedom of three and 5% level of significance, the computed value is 7.430 while the tabulated value is 1.424. Therefore, since the computed value is more than the tabulated value, the null hypothesis is hereby rejected. therefore, it implies that there is effect of fair value measurement on the quality of faithful representation of items in the financial reports.

Hypothesis Two

H_O: There is no effect of fair value measurement on quality of relevance of items in the financial report.

Result

The result of the test of hypothesis in Table 4.4 above reveals that at the degree of freedom of four and 5% level of significance, the computed value is 54.861 while the tabulated value is 2.195. The null

hypothesis is hereby rejected since the computed value is more than the tabulated value. This implies that there is effect of fair value measurement on the quality of relevance of items in the financial report.

Hypothesis Three

H_O: There is no effect of fair value measurement on quality of comparability in financial reporting system.

Result

The test of this hypothesis reveals that at the degree of freedom of four and 5% level of significance, the computed value is 49.165 while the tabulated value is 2.195. Therefore, since the computed value is greater than the tabulated value, the null hypothesis is hereby rejected. This implies that there is effect of fair value measurement on the quality of comparability in financial reporting system.

Hypothesis Four

H_O: There is no effect of fair value measurement on quality of verifiability of items in the financial report.

Table 4.4 above shows that at the degree of freedom of three and 5% level of significance, the computed value is 54.215 while the tabulated value is 1.424. Since the computed value of 54.215 is greater than tabulated value of 1.424, the null hypothesis is hereby rejected. This implies that there is effect of fair value measurement on the quality of verifiability of items in the financial report.

4.2 Discussion of Findings

Table4.4 revealed the effect of fair value measurement on four individual qualitative characteristics of financial information, which represented the test of hypotheses. With respect to the first test of hypothesis, the study found that fair value measurement has a significantly positive effect on the quality of faithful representation of items in financial reports of companies. In the same vein, findings relating to hypothesis two indicated that fair value has a significant and positive effect on the quality of relevance of items in financial reports of companies. Furthermore, in relation to hypothesis three, findings showed that there is a significantly positive effect of fair value measurement on the quality of comparability of items in the financial reports of companies. Lastly, in hypothesis four, findings equally indicated that a positive and significant relationship exists between fair value measurement and the quality of verifiability of items in the financial reports of companies. On a general note, with respect to the general objective of the study, it can be inferred that fair value measurement (which served as an indicator of value-based measurement) has a significantly positive effect on financial reporting quality of companies. This result is in line with the findings of Osanyinbi et al. (2023) who conducted a related study on insurance companies in Lagos State and concluded that fair value measurement has a significantly positive relationship with the quality of financial reporting of insurance companies in Lagos State.

5.0 CONCLUSION AND RECOMENDATIONS

5.1 Conclusion and Recommendations

This study was conducted to interrogate the effect of value-based accounting measurement on quality of financial reporting of companies. There is no doubt that fair value measurement (as the most commonly used value-based measurement of accounting) improves the quality of financial reporting. Fair value accounting measurement approach requires an organisation to disclose comprehensive information about any relevant issue that would bring about the publication of a thorough and extensive financial report. In the light of this, the conclusion reached from this study is that there is a significant and positive effect of value-based measurement (represented by fair value measurement) on quality of financial reporting (proxy by faithful representation, relevance, comparability and verifiability of items in the financial reports of companies). In addition, it can be concluded that financial reporting qualities in the process of value-based measurement will facilitate the production of corporate financial reports that are useful and reliable to analysts and investors in evaluating the performance and prospects of any organisation.

5.2 Recommendations

Based on the findings of this study, the following recommendations are made

i. Companies should establish new procedures and databases that are ideal for recording and reporting of relevant information that will assure stakeholders that financial reporting qualities are maintained while measuring items in the financial statement based on IFRS 13.
ii. Standard setting bodies and other accounting regulatory bodies should consider developing international standards relating to other value-based measurement approaches (especially deprival value). This will promote comparability of accounting measurements.
iii. Standard setters should strive to limit uncertainty in financial markets by setting the necessary rules to value financial assets and liabilities in clear

guidelines, especially under level 3 of fair value hierarchy.

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SHELL PETROLEUM DEVELOPMENT COMPANY AND MOBIL PRODUCING NIGERIA UNLIMITED CORPORATE SOCIAL RESPONSIBILITY STRATEGIES AND COMMUNITY'S INVOLVEMENT IN COMMUNITY ASSISTED PROGRAMMES

Yabefa Faith Yancy and Paleowei, Zikena Cletus
Department of Mass Communication, Bayelsa State Polytechnic, Aleibiri
Yancyjeremiah2019@gmail.com 07065618863
manzeaky@gmail.com. 08037744

Abstract
Crises or conflicts in the relationship between multinational oil companies and their host and neighbouring communities have become common experience in Nigeria, particularly the oil rich Niger Delta. The sour relationship manifests in the form of violence, disruptions, youth disturbances and hostage taking. This study looked at the issues and strategies employed by Shell Petroleum Development Company and Mobil Producing Nigeria Unlimited in their involvement in community assisted programmes in communities in their areas of exploration in order to foster harmonious relationship with their host communities in the Niger Delta. The main aim of the study was to determine the extent to which these crude oil moguls have encouraged community's involvement, participation and implementation of corporate social responsibility strategies in achieving sustainable development of the environment within which they operate. The ex-post facto design was employed for this study. The population of the study consisted of a total of 5,908 subjects for both companies and the sample size of the study was 886 respondents, representing 15 percent of the study population. 886 questionnaires were administered to the respondents. However, 729 copies of the questionnaire were retrieved and found suitable for analysis. The study finds that the inability or refusal of multinational oil companies to engage their host communities as partners and stakeholders has been identified as the cause of the crises in the region. The conscious engagement of the communities is pertinent to the satisfaction of the needs of the communities. This involvement will significantly reduce rift between communities and multinational firms and will also improve the perception of the communities about the multinational companies- Shell and Mobil.
Key words: Corporate Social Responsibility, Community Involvement, Community Relation

1.0 INTRODUCTION

Large blue-chip companies are now finding it necessary to develop corporate social responsibility programmes and initiatives to comply with social expectations, voiced by sophisticated interest groups, often backed up by the media.

Oil is the main source of energy in the industrial world today and by any standard, it is Nigeria's main source of revenue, as it contributes nearly 90 percent of government's revenue (Tenjan, 2003). The Niger Delta area, prior to the activities of oil and gas, had abundant and diverse natural resources, good agricultural land coupled with flourishing oil palm trees, rubber trees and other economic crops.

The Niger Delta area of Nigeria has been engulfed in a crisis of instability caused by protesting oil producing communities against environmental degradation, palpable poverty, lack of basic amenities and employment opportunities. The communities have accused the oil companies of insensitivity based on their failures to address the problems occasioned by oil spillages such as clean-up of spilled oil, delay in assessment of impacted areas and failure to pay compensation for damaged economic crops and fish ponds. In many instances, the grievances have turned into outright antagonism, leading to abduction of company officials, sabotage of company properties and violence against companies.

In the last 20 years, there has been a radical change in the private sector's relationship with the state, civil societies and host communities. Globalization, conflict management, deregulation, privatization and a redrawing of the lines between states and markets have changed the basis on which private enterprises are expected to contribute to the public good. Within this period, the relationship between companies and civil societies and host communities had moved from paternalistic philanthropy to a re-examination of the roles, rights and responsibilities of businesses in society. These dynamics have led to the emergence of a new approach to corporate social responsibility (CSR) with companies recognizing that addressing wider social and environmental problems will be crucial in securing their long-term success

In distilling the position, corporate social responsibility is seen as a continuing commitment by businesses to behave ethically and contribute to economic development, while improving the quality of life of the workforce and their families as well as the local community and society at large.

However, shortly after large companies first emerged in the 1970s debate quickly emerged as to the

appropriateness of their conduct. The 1930s upon the heels of the Great Depression "signalled a transition from a primarily laissez faire economy with industrial power and might in control to a more mixed economy." Debates as to the appropriate role of business in society sharpened after World War II. Corporate philanthropy was well established by them, but the creation of public interest watchdogs and regulatory agencies such as the American Civil Liberties Union etc. "new interests in business ethics and the standard by which to judge corporate and individual behaviour with the moral framework of business and society." (Fox and Howard, 2012).

1.2 STATEMENT OF THE PROBLEM

Despite the signing of joint venture partners agreement for oil companies to participate in the sustainable development of their host communities, there is still complaints by the host communities about multinational oil companies failure or refusal to honour memorandum of understanding signed by parties. This work would determine the extent to which these crude oil moguls have encouraged community's involvement, participation and implementation of corporate social responsibility strategies in achieving sustainable development of the environment within which they operate.

Objectives of the Study

The objectives of the study are to:

1) ascertain the extent to which community groups participate in the planning, design, implementation and evaluation of Shell Petroleum Development Company and Mobil Producing Nigeria Unlimited community assistance programmes.
2) find out host communities' perception of communication strategies of Shell and Mobil community involvement in community assistance programmes.

Research Questions

The study sought to provide answers to the following research questions:

(1) To what extent do community groups participate in planning, design, implementation and evaluation of Shell and Mobil community assistance programmes?
(2) What is the community's perception of communication strategies of Shell and Mobil's community involvement in community assistance programmes?

2.0 LITERATURE REVIEW

2.1 Review of the concept of Community Relations

Community relations is a concept, which embodies corporate social responsibility. Seitel (1992:p.438) states that "the major objectives of community relations is to analyze the community. Help understand its make-up and expectations and communicate the organization's story in an understandable and uninterrupted way." Peak (2002:p.117), in its definition, states that, "a public relations function is an institution's planned and continuing participation with and within a community to maintain and enhance its environment to the benefit of both the institution and community. Wilson (1997:p.191) adds that while community relations may not on its own solve the problems of a particular community, it has the potential of creating an atmosphere of a gradual unfolding of growth which could bring about a more advanced or more highly organized state. Furthermore, he states that "today most organizations accept their role as agents for social change in the community. He insists that for an organization to coexist peacefully in its community, it requires three (3) skills in particular:

(i) Determining what the community knows and thinks about the organization.
(ii) Informing the community of the organization's point of view, and
(iii) Negotiating or mediating between the organization and the community, should there be a significant discrepancy.

Seitel (1992) stresses further that organizations must institute a clear and long-term policy detailing the manner of community involvement they wish to undertake. The plan must be in a strategic policy document arrived at through consultations and consensus. The policy must be implemented instrumentally and expressively. He states: "*Instrumentally when an organization actually implements projects aimed at improving the community and making it a better place to live and expressively when the organization promotes itself and shows its goodwill towards the community"*

Also, Wilson (1997:p.191) affirms that a company desiring long term business engagements must initiate and implement long and short-term community relations plans to sustain mutual interest and goodwill between it and its host communities. He stresses that a community plan is "not a haphazard thing, if it is to succeed. The plan must be comprehensive, sincere, clear, beneficial and should have a definite objective, subject to changes from time to time. He adds that it should be proactive rather reactive. For example, he writes that "a rapid

response to a natural disaster within the immediate community is crucial." While a belated presentation of relief materials long after the disaster had occurred may be seen as an afterthought, something which was not really planned for. A good way of initiating community relations plan is to find out the needs of the host community.

2.2 Community Expectations from Corporate Organizations

Seitel (1992:p.439) lists the following as what communities expect from their corporate neighbours:

i. **Appearance**:
Communities expect organizations to contribute positively to life in the community through sponsorship of projects, employment of community citizens and care for the environment and other worthy causes. Wilson (1997:p,192) laments that the living conditions of host communities in oil producing areas is scandalous, the people grapple with severe poverty, environmental degradation, lack of infrastructural amenities, etc. Awak Essien (1995:p.8) commenting on the needs of host communities, states: "*The needs and expectations of oil communities are quite straightforward and specific. They want a sustainable improvement in the quality of life in a secure and safe environment. The oil comes from their land and they expect that it should be produced with minimum disruption to their way of life. They expect that a large chunk of what is derived from their land should be reinvested in development of infrastructure. They expect their children to be educated. They expect schools, roads, portable water, electricity and lots of the good things of life to flow from the fact of oil activity on their land Many times, oil multinationals are slow to understand community needs because they may not have community relations plan arrived at through consultation and consensus"*

This may at times result in frosty relations and disruption of business activities.

ii. **Participation**:
As a community citizen, an organization is expected to participate responsibly in community affairs such as functions, parks and recreational facilities in support of worthy community causes.

iii. **Stability**:
A community expects stable organizations that will grow and enhance society. Business, which fluctuates in volume and number of transactions, number of employees and taxes paid, affect community fortunes adversely, Communities expect a stable and viable organization which will continue to add to the growth of the community.

iv. **Pride**
Communities cherish organizations which add to their pride and honour. They want organizations that are proud residents, able to render help when called upon to do so. Besides this, Wilson (1997) lists the major areas where communities require assistance of organizations to include: road construction and rehabilitation, healthcare facilities, provision of water supply, employment of community citizens, cheap supply of electricity, educational support, security of lives and properties, etc. Supporting this position, Post (1998:p.354) states that organizations can do this by giving assistance to educational institutions, awarding scholarships and general provision of infrastructure. The needs of the oil communities in these areas are awesome. For example, the Niger Delta master plan laments that; *Nearly all school facilities are in a state of extreme disrepair and require major rehabilitation. There are shortages of qualified teachers especially at secondary school levels. The majority of schools lack basic educational materials and equipment (p.28).*

With regard to health services, the master plan catalogues the problems to include poor hygiene, lack of health information and education, gross lack of service delivery and inadequate health institutions such as hospitals, clinics, primary health centres and trained health professionals. These are areas organizations need to explore and take positive actions to solve them.

2.3 Review of the Practice of corporate social responsibility

The growth and development of society through business activities has long been portrayed as beneficial to the wellbeing of society. Accordingly, organizational practice and concerns were geared towards the production and consumption of goods and services with little reflection on the impact of business activities on the environment and society generally. Growth and profit become the dominant concerns of organizations to the detriment of social wellbeing

This philosophy was supported by renowned economists such as Milton Freidman who wrote in the New York Times Newspaper of September 13, 1980, that: "the corporation's responsibility is to produce profits and the cost of corporate social goals amounted to a hidden tax on workers, customers and shareholders ...." (p.18). Wilson (1997 p.190) recalled that his philosophy soon resulted in industrial upheavals, as

the seeming conditions of towns and villages neglected by businesses became the subject of strident critical literature by such writers as Samuel Taylor Coleridge and Williams Wordsworth. These writers drew the attention of society to the neglect caused by business activities to the environment. These upheavals resulted in the establishment of a set of objectives by the 1980s, which Wilson (1997) outlines as follows:

1. The organizations agreed that community groups deserved to be beneficiaries of corporate involvement.
2 The organizations accepted that they had a role to play as agents of social change in their host communities.
3. The organizations realized that there is need for considerable interdependency and co-existence between them and their host communities for corporate interest to grow (Frederick, Davis and Post, 1988:p.152),

Peak (2002:p.118) stresses that as businesses have a responsibility to marry their communities in the way they share in community concerns and seek solutions to them. In the same manner, Fredericks, Davis and Post (1988:p.337) stress that "keeping the community alive, well and relevant is a task for today's businesses."

While the desire to refocus attention on community involvement is laudable, it did not come without controversy. Seite (2003:p.1) states that his philosophy is embodied in the widely accepted concept of corporate social responsibility. While proponents of the concept see it as a good way of calming frayed nerves and reducing tension, those opposed to its implementation see organization's involvement in improving communities as an additional burden, which diverted attention from the goals of profit making. However, despite these differing positions, SeIte (2003) maintains that businesses have responsibility beyond the production of goods and services and profit making. He states further that in the present global economy, businesses which are socially responsible can help solve important social problems. He believes that it is dangerous in an environment like the Niger Delta for businesses to abandon corporate social responsibility, which can ultimately lead to violence and disruption of business activities on a large scale. Corporate social responsibility can create a conducive environment for businesses to grow. Frederick. Davis and Post (1988.p.340) point out that: If community citizens, labour organizations or the government abuse business or take advantage of it, then successes for both business and the community becomes difficult.

In addition, these days, investors too are placing increased emphasis on socially conscious corporate practice. In 1999, over one trillion dollars was invested in socially responsible investments in the United States.

In relation to this, oil blue chips giants, SPDC started exploration in 1958 and MPN started producing crude oil in 1970 but the joint venture agreements towards participating in the sustainable development of the environment within which they operate was signed on June 30, 1989 and the memorandum of understanding by the various Joint Venture Operating Companies was signed on July 11th 1991.

3.0 RESEARCH METHODS

The study focused on assessing the community's involvement in Shell Petroleum Development Company and Mobil Producing Nigeria Unlimited assisted programmes. In meeting the demands of the study, it was necessary to employ the survey design technique. According to Infante, Rancer and Womeck (1997:p.491), the basic design of the survey research is "the selection of a sample from a population in order to show how frequently certain variables occur and how they are related in the population."

As a research technique, the survey is valuable in several instances. For example, surveys are useful in assessing the effectiveness of communication and benefits of reward systems. They are also used in measuring the gaps between the organization's stated values operating principles and actual management practices.

3.1 Research design

The ex-post facto design was employed. According to Asika (2002:p.24), this facto design is an aspect of survey which is systematic empirical study whereby the researcher does not in any way control or manipulate independent variables because the situation for study already exists or has taken place. It is most appropriate as the two (2) companies SPDC and MPNU have strategies for which they have gone ahead to implement in their various communities within their areas of operations.

The universe of the study was made up of four (4) communities each of SPDC and MPNU operational areas. The communities were chosen to enable the researcher to examine the strategies employed by the companies, while the various groups such as community development committees, chiefs, youth groups and women groups are better placed to do a proper assessment of CSR strategies of these companies

The population consisted of a total of 5,908 subjects for both companies and the sample size of the study was 886 respondents, representing 15 percent of the study population as suggested by Best and Kahn (2006:p.163). Therefore, 886 questionnaires were administered to the respondents. However, 729 copies of the questionnaire were retrieved and found suitable for analysis.

3.2 Data Presentation and Analysis

The aim of the study was to find out communities' involvement in SPDC and MPNU assisted programmes in the Niger Delta. It also aimed to find out the degree to which the community youths, women groups, chiefs and community leaders are involved in the selection and implementation of these assisted programmes.

Table 3.1: Mean Rating of Respondent on Shell and Mobil's Host Communities' Participation in Assistance Programmes

S/NO	ITEM	MEAN
1	The oil company ensures community participation in planning of community programmes	2.32
2	The oil company in the community ensures the design of community programmes	2.31
3	The communities participate in the implementation of community projects	2.85
4	The evaluation/assessment of community development programmes is done only by the company	2.35
5	The various community bodies such as CDCs, youth bodies, women groups and chiefs are involved in the initiation of projects	2.19

As shown in Table 3.I, only item 3 was above the mean rating of 2.5, while all others were below the mean rating value. This point to the fact the host communities sometimes participate in the implementation of community assistance projects.

Table 3.2: Mean Rating of Respondents on Host Communities' Perception of Shell and Mobil Corporate Strategies

S/NO	ITEM	MEAN
1.	The oil company's communication strategies and practice are effective	2.21
2.	The oil company's communication strategies are seen as very helpful in the community	2.35
3.	The oil company's communication strategies need improvement in the area	3.07
4.	The oil company's communication strategies are seen as a disappointment	2.88

Table 3.2 shows that items 3 and 4 mean rates were above the rating value of 2.5, while others were below the mean rating value. This reveals that host communities perceive Shell and Mobil's communication strategies as a disappointment and therefore needs improvement.

4.0 DISCUSSION OF FINDINGS

The data collected from the survey are discussed. The data were derived from 729 fully completed copies of the questionnaire. The study provided evidence of the fact that the communities are not sufficiently involved in the planning, design, and evaluation of Shell and Mobil assistance programmes except on implementation in which its mean rating is above 2.5, while others were below the mean rating value.

The foregoing points to the fact that Shell and Mobil's involvement of host communities in the planning, design, implementation and evaluation of community assistance projects is not regular. A significant number of respondents said the company rarely does so.

The study of Nglass (2008) supports this position. According to her, "the planning, design, implementation and evaluation of community assistance projects is not regular and largely piecemeal" (p.50). The finding also agrees with Ntia's (1998) and Foxeroft's (2004) findings. In view of the above, it is pertinent to note that the needs of the communities are similar, there is the need for partnership in the planning, design and execution of community assistance programmes as also suggested by Foxeroft (2004).

The researcher found out that Shell and Mobil needed to acknowledge the fact that the communities were stakeholders in the projects, thus the company should construct a base for close collaboration and consultation with the community as well as assist the

community in capacity building in all aspects of social and economic development.

To achieve this level of responsibility, a company must implement a transparent policy of working with the community to ensure that these core values are adhered to as the non-involvement of the host communities in the planning, implementation, design and evaluation gave rise to the liability to meet the needs of the communities. This indicates that the multinational company ends up in executing projects that do not have a direct bearing or impact on the lives of the people.

The response to the open-ended questions and discussion with some members of the population in the course of the distribution of the questionnaire indicated that the multinational companies (Shell and Mobil) initiate the programmes or projects without consultation with the communities, and the different companies have their design speculation which they handover to the contractors to implement. It is the contractors who inform the communities probably at the point of determining a location for the project. Apparently, this explains the uniform nature of projects in all the areas executed by a particular company. For example, school buildings executed by Shell Petroleum Development Company have the same outlook, including structural designs and painting.

The thinking of these multinational firms is that consulting the host communities on projects may make them request for projects that they may not afford and so it was safer to execute any project of their choice. These firms are at a risk of vulnerability to conflicts. Although corporations may have vested interest in minimizing, preventing and managing conflicts, the International Peace Academy (2002) argues that not all corporations share the same level of interest in promoting critical principles or participating conflict impact assessment Corporations may engage in "quiet diplomacy" or "closed door meetings" to ensure the security of their assets and personnel. Such actions, while on one hand providing the corporation with privileges to access, leverages and information which all can contribute to a conflict management strategy, can on the other hand, raise concern about the potential for corporation and government officials to engage in self-interested collective activities.

Equally of concern in this study is the host community's perception of Shell and Mobil's communication strategies. As shown in Table 3.2, items 3 and 4 mean rates were above the 2.5 value, while others were below the value. This implies that host communities perceive Shell and Mobil's strategies as a disappointment and therefore needs improvement.

The studies by Nglass (2008) and Foxeroft (2004) confirm this when they said that "in spite of the very loud media propaganda by the multinational firm (Mobil) that is maintained, a cordial relationship with 175 host communities, the host communities failed to clearly indicate their knowledge of Mobil's public relations strategies:

According to Ojenogar (2005), it is like paradise and hell. They have everything, we have nothing. They throw our petitions into the dustbin. They are the cause of all our problems. If we protest, they send soldiers. They sign agreement with us and ignore us. We have graduates going hungry without jobs: And they bring people from Lagos to work here. These sum the general feeling of an average Niger Deltans, a feeling of betrayal, deprivation, degradation and neglect.

The perception of the host communities of Shell and Mobil's communication strategies is poor. This assertion could be deduced from the response gotten from the questionnaire and an analysis of the various positions by the communities as well as the ethnic groups and the people of the Niger Delta region.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The study noted that crises or conflicts in the relationship between multinational oil companies and their host and neighboring communities have become common experience in Nigeria, particularly the oil rich Niger Delta. The sour relationship manifests in the form of violence, disruptions, youth disturbances and hostage taking. However, communities, governments and corporate organizations have been working out strategies to improve relationships. The research study has brought to the fore the need for Shell and Mobil, to enlarge their capacity for planning, design, implementation and evaluation of community assistance programmes. The inability of multinational oil companies to engage the host communities as partners and stakeholders has been identified as the cause of the crises in the region. The conscious engagement of the communities is pertinent to the satisfaction of the needs of the communities. This involvement will significantly reduce rift between communities and multinational firms and will also improve the perception of the communities about the multinational companies-Shell and Mobil.

5.2 Recommendations

The goal of every community, aside its different social groups, leaders and government is to engender a harmonious relationship with its corporate neighbours. Similarly, every corporate organization seeks

to portray itself as a socially responsible firm. But in real life situations, this is not always the case. The study confirms this reality and therefore makes the following recommendations based on its findings:

1. The companies should deliberately allow community groups and the relevant stakeholders to participate and get involved in the conception, planning, design, implementation and monitoring of community assistance programmes. There should be collaboration among multiple parties, transparency and accountability, joint decision making between the companies and the communities as well as community engagement. These will give all such programmes high success rates besides giving the community and the various groups a sense of importance.
2. Shell and Mobil should integrate the various segments of the communities into their information and communication apparatuses so that they can easily and readily become aware and knowledgeable about the companies' community related activities. This will improve the perception of the people or communities on their activities.

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PREPARATION OF CARBON AEROGEL / COBALT PHOSPHATE COMPOSITE FOR ENHANCED SUPERCAPACITOR PERFORMANCE

[1]Beke Michael Abraham., [2]Egbo W. Mansi and [3]Alagoa E. Emmanuel
Phone No: 08083411699

Abstract
The increasing demand for efficient energy storage systems has propelled research into supercapacitors, which offer high power density and rapid charge/discharge capabilities. This research aims to investigate the application of carbon aerogel cobalt phosphate composites [CA/$Co_3(PO_4)_2$] as electrode material for supercapacitor application. By leveraging on the unique properties of carbon aerogels and cobalt phosphate, we aim to enhance the electrochemical performance of the combined material. The carbon aerogel was synthesised by sol-gel method and pyrolyzed at 1000ºC. The composite material was prepared by impregnation of carbon aerogel in a solution of cobalt and phosphate precursor. The composite showed excellent electrochemical properties such as rapid charge transfer, a specific capacitance of 750 F/g and electrochemical stability over 2000 cycles of galvanostatic charge/discharge test. This shows that the composite will perform very well as a supercapacitor.
Keywords: Carbon aerogel, cobalt phosphate composites, Electrode materials, Supercapacitor,

1.0 INTRODUCTION

1.1 Background of the study

The global shift towards renewable energy sources necessitates the development of efficient energy storage systems. Supercapacitors have emerged as a promising alternative due to their high-power density, long cycle life, and rapid charge/discharge capabilities. However, the performance of supercapacitors is largely dependent on the materials used for energy storage. Carbon-based materials, particularly carbon aerogels, have gained the attention of researchers due to their high surface area, porosity, and electrical conductivity. However, challenges remain in optimizing the electrochemical properties of the carbon materials. These materials have low ion storage capacity and a poor charge transfer. This limits their application as supercapacitor materials. This research aims to address these gaps by exploring novel composite materials. The incorporation of metallic materials such as manganese oxide (MnO_2), Cobalt phosphate [$Co_3(PO_4)_2$] and nickel oxide (NiO), has been shown to significantly enhance the electrochemical performance of supercapacitors by providing additional pseudocapacitance. In this study, a carbon aerogel (CA) and cobalt phosphate composite is synthesized and researched as supercapacitor material. To the best of our knowledge, this composite has not been used for supercapacitor research. This makes our study novel.

The choice of these materials is borne of previously reported performance of CA, Co, and Phosphates. CA has been reported as a decent material for supercapacitor development, (Zhou et al. 2019) reported the successful application of cellulose CA as a component in the building of supercapacitor (Li F, Xie L et al. 2019) also reported the outstanding properties CA when used as a component of the storage material in supercapacitor construction in both cases, CA performed very well. They show large surface area and electrochemical stability. But ion storage capacity and charge transfer are relatively poor. In this study, we attempt to improve on the electrochemical performance of CA by combining it with materials that will boost its electrochemical properties. Cobalt phosphate is one of the materials that enhance ion storage capacity and charge transfer of supercapacitors. Due to these electrochemical qualities, we adopted the materials for this study.

2.0 MATERIALS AND METHODS

2.1 Materials:

Resorcinol, Formaldehyde, Cobalt nitrate hexahydrate [$Co(NO_3)_2.6H_2O$], Phosphoric acid (H_3PO_4), Ethanol, Deionized water, Hydrochloric acid.

2.2 Synthesis of Carbon Aerogel (CA).

To synthesize the CA, aerogel was first prepared by the sol–gel condensation of formaldehyde and resorcinol. 0.67g of resorcinol was dissolved in 24mL of acetonitrile, 0.94mL of formaldehyde was added, followed by 0.09mL of concentrated hydrochloric acid as catalyst; the mixture was stirred for 5min. The solution was then transferred into 50mL centrifuge tubes and left to age for three days. The sol–gel was then frozen to -80ºC, after which it was freeze-dried to form the aerogel. The aerogel was then carbonised in a tube furnace at 1000ºC for 4hrs. under nitrogen gas flow to give CA.

1.2 Synthesis of Carbon Aerogel/Cobalt Phosphate Composite [CA/$Co_3(PO_4)_2$]

$Co(NO_3)_2.6H_2O$ and H_3PO_4 were dissolved in ethanol solution in a 1:2 molar ratio. 2 molar portion of the

CA is soaked in the precursor solution for 10 hours. The composite formed is filtered off, washed with ethanol and dried. The composite was then heated to 350ºC under nitrogen gas. This converts the cobalt phosphate in the composite into nanoparticles.

3.0 RESULTS AND DISCUSSION

Characterization

FTIR Spectroscopy

The functional group in the materials prepared were analysed by FTIR spectroscopy. the absorption bands observed at ~3400 cm^{-1} indicate the presence of –OH on the surface of the material, while that at (~1630 cm^{-1}) is indicative of aromatic -C=C-, and the phosphate groups band is observed at ~1040 and 560 cm^{-1}. These observations shows that the composite material was successfully synthesized. Figure 3. 1, is the FTIR spectrum of the composite.

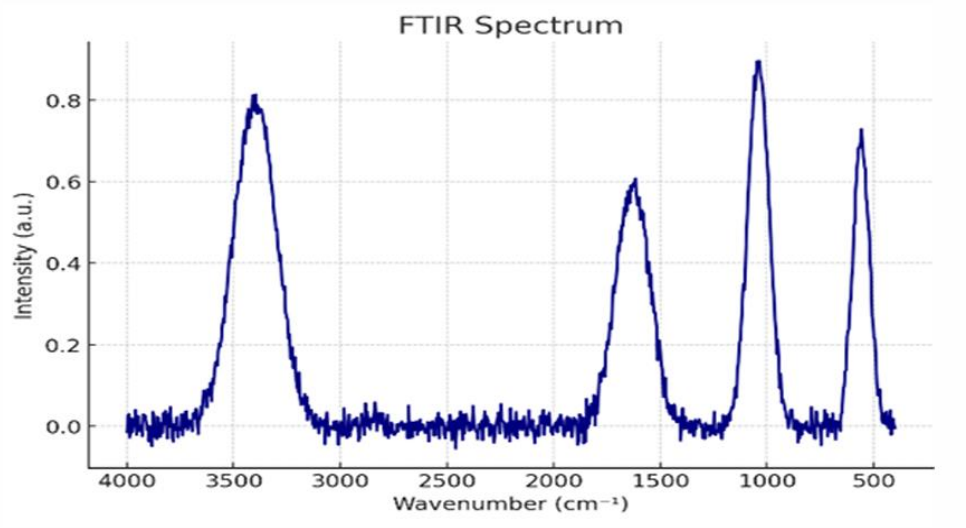


Figure 3.1: FTIR spectrum of composite.

X-ray diffraction (XRD) Analysis

The crystallinity of the material was analysed by XRD. Clear crystalline peaks of $Co_3(PO_4)_2$ are observed at (16.5°, 25.2°, 31.3°, 36.8°), while an amorphous carbon halo is observed at ~24°. Figure 3.2 shows the XRD pattern of the composite.

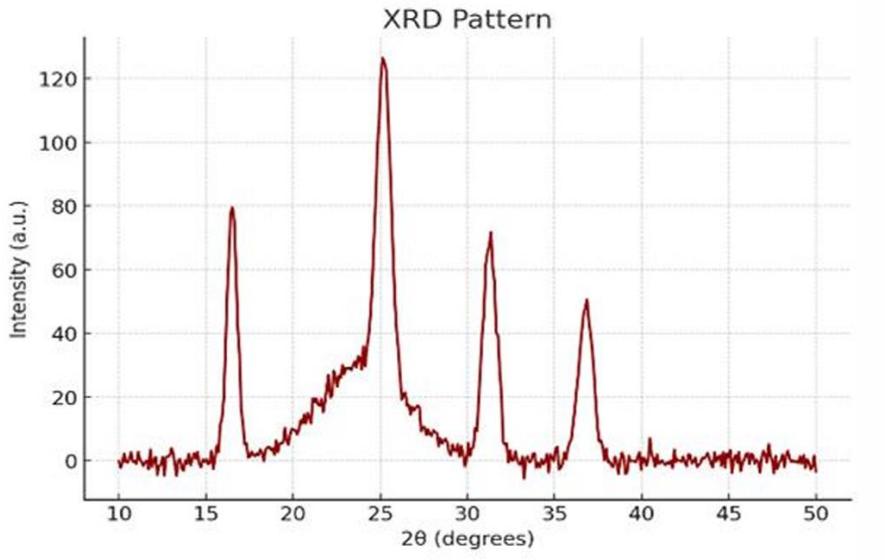


Figure 3.2: 0XRD of Composite.

Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) Analysis

The microstructure of the material was also studied by SEM and TEM. The SEM image shows a porous sponge-like structure which is associated with a well-developed CA structure that supports the cobalt phosphate. This morphology allows ion accessibility. Figure 3.3(A) shows the SEM image of the composite. The TEM image is shown in Figure 3(B). It reveals the nano size of the material with the cobalt particles dispersed within the CA matrix. The bright and dark patterns suggest a crystalline region that is consistent with cobalt phosphate materials.

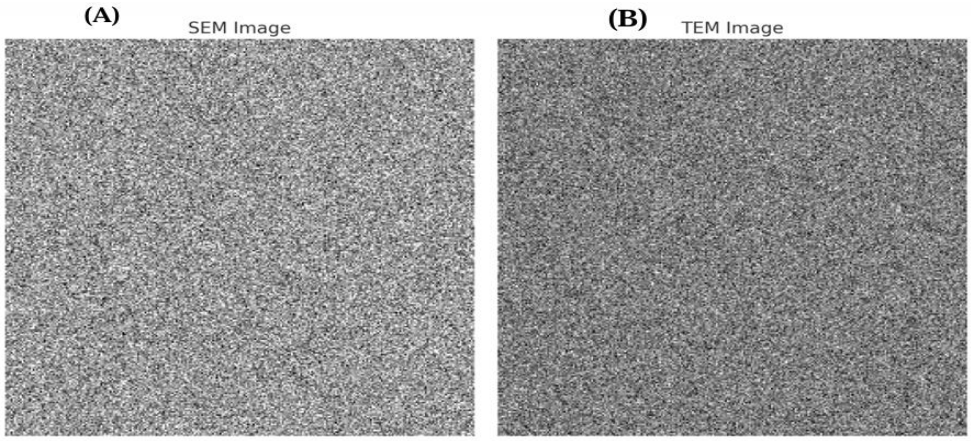


Figure 3.3: SEM and TEM images of Composite.

Brunauer-Emmett-Teller (BET) Analysis

The surface area and porosity of the material was analysed by N_2 adsorption /desorption measurements. The composite shows an IUPAC Type IV isotherm with a H_3 hysteresis loop. The data obtained from the analysis confirms that the composite is mesoporous, which will facilitate rapid ion diffusion, ideal for supercapacitor applications. The surface area, pore volume and average pore diameter is given in Table 1. The isotherm is shown in Figure 3.4.

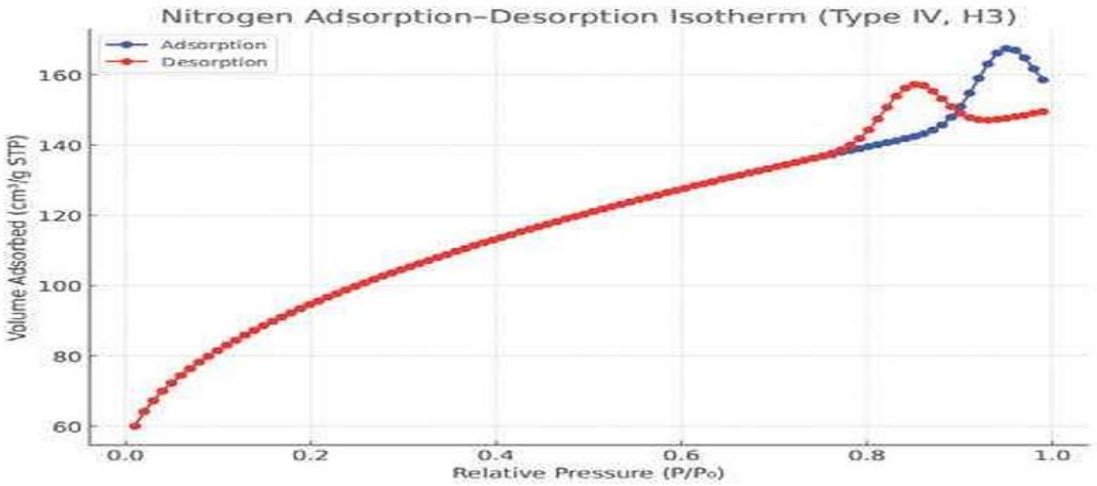


Figure 3.4: BET Isotherm of composite

Table 3.1: BET Surface Area analysis summary

parameters	Values
Surface area	520m^2/g
Pore volume	0.45cm^3/g
Average pore diameter	4.8nm

Electrochemical Analysis

Cyclic voltammetry (CV) and Electrochemical Impedence spectroscopy (EIS) were employed to analyse the electrochemical properties of the materials.

Cyclic Voltammetry (CV)

The CV curve of CA shows a quasi-rectangular shape which is typical ofelectric double layer capacitance (EDLC) behaviour. The slight slope and sinosoidial shape suggest the presence of graphitic component in the CA. This will support some pseudocapacitance through REDOX activity.

The duck shaped cyclogram of the composite is indicative of Fadadaic behaviour, which suggest enhanced power and energy density. The specific capacitance of the CA is 190 F/g while that of the composite material is 750 F/g. These values were calculated from the data of their cyclogram. This means the addition of the cobalt phosphate to the CA greatly enhanced the electrochemical properties of the composite as proposed. It also means that the material will be performance excellently when applied as a supercapacitors material.

The cyclogram of the CA and composite are shown in Figure3. 5.

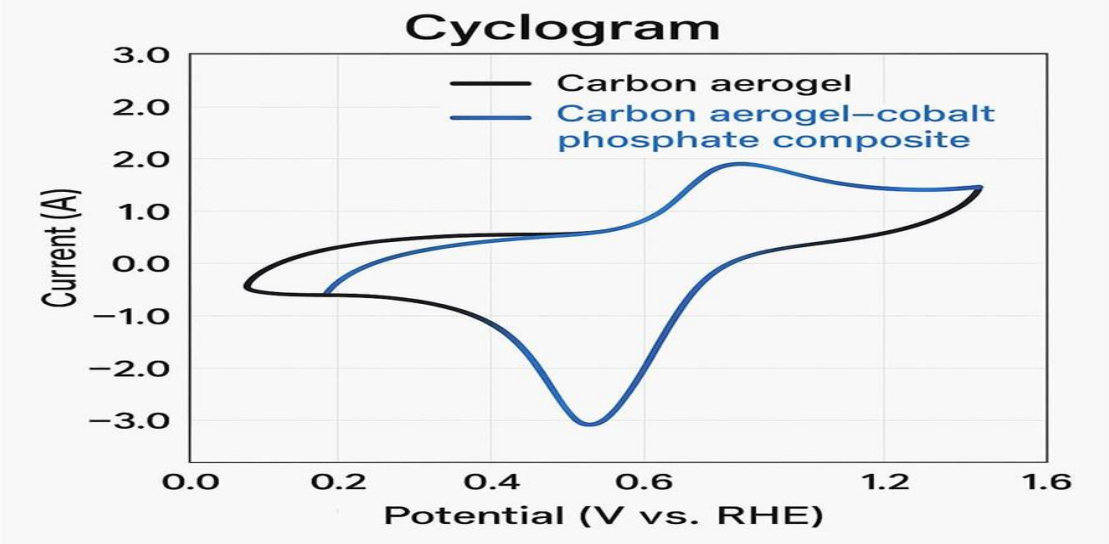


Figure 3.5, Cyclogram of CA and composite

Electrochemical Impedance Spectroscopy (EIS)

The charge transfer of the materials was analysed by EIS. The EIS was conducted at a potential of 0.22V and a frequency range of 10^5 Hz to 0.1 Hz. The result shows that the charge resistance of CA is 199Ω while that of the composite is 100Ω. The Nyquist plot shows that the composite has a better charge transfer, demonstrated by the smaller semi-circle of the composite. This supports the fact that the cobalt phosphate enhanced the electrochemical properties of the CA.

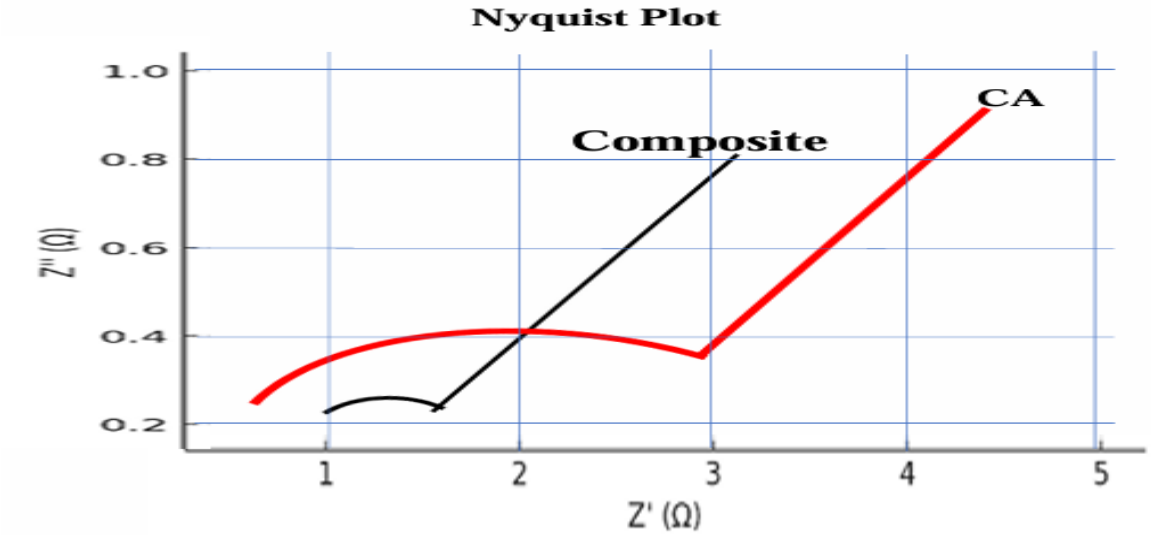
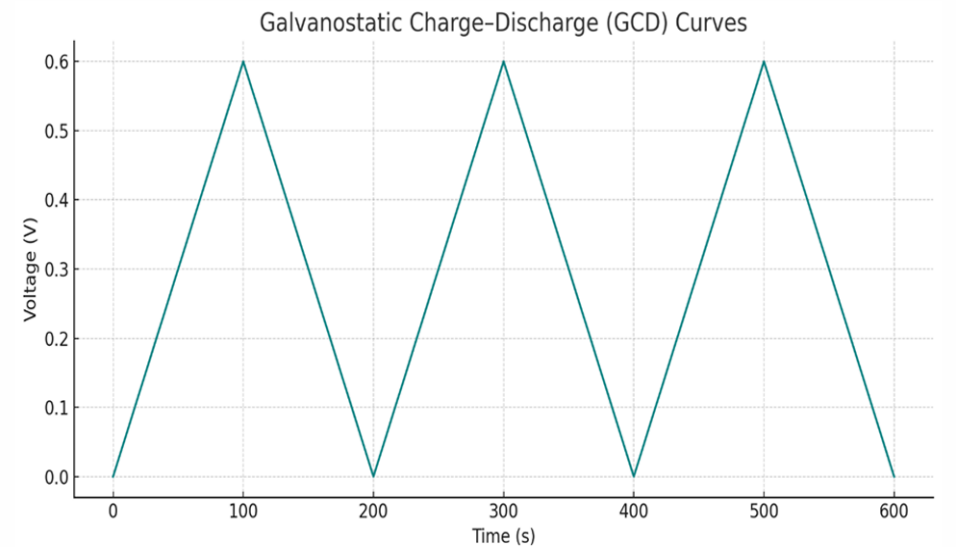


Figure 3.6: Nyquist plot of CA and Composite

Galvanostatic Charge/Discharge

The electrochemical stability of the composite was analysed by galvanostatic charge/discharge. The composite was stable over 2000 cycles of charge/discharge. This means that the material can withstand 2000 cycles of usage and still maintain its electrochemical properties. Hence it will be a very good material for the construction of supercapacitors.



Galvanostatic charge/discharge curve.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The composite material $Ca/Co_3(PO_4)_2$ was successfully prepared and its properties analysed. The results show that the composite has both electric double layer capacitance (because of the CA) and pseudo-capacitance due to the presence of the cobalt phosphate. The specific capacitance of the composite from the CV analysis is 750 F/g. The electrochemical stability analysis shows that the material is stable over 2000 cycles of charge/discharge. The data obtained from the study shows that the composite will perform excellently as a supercapacitor material and electrode material for desalination.

4.2 Recommendation

Tor future research, the optimal ratio of CA to cobalt phosphate should be investigated; this will enhance the electrochemical properties of the composite and lead to an improved supercapacitor.

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MARKOVIAN MODELLING OF INDUSTRIAL ACCIDENT DATA

[1]Abovie. Bokolo., [2]Omotehinse S.A. , [3]Egbo Mansi Walamam and [4]ALAGOA E.E
[1]Department of Electrical/Electronic Technology, Bayelsa State Polytechnic, Aleibiri Ekeremor, Bayelsa, Nigeria
[2]Department of Mechanical Engineering, Benson Idahosa University, Benin City, Nigeria.
[3,4]Department of Science Laboratory Technology, Bayelsa State Polytechnic, Aleibiri Ekeremor, Bayelsa, Nigeria
Authors Email: *****abovieg@gmail.com, somotehinse@biu.edu.ng
Corresponding Author: 08037462861

Abstract
Despite substantial investments in safety measures by oil and gas industries, accidents remain a significant problem. This research employed Markov Chain modeling to analyze safety records and understand how workers move through different safety-related states until reaching an absorbing state (final outcome). The study analyzed 16 years of primary data from eight NNPC subsidiary companies, integrating their safety records to provide a comprehensive view of organizational safety policies. The HSE statistical data demonstrated absorbing chain properties and stochastic regularity, making it suitable for Markov chain analysis. The research identified twenty transition states, including fatalities, third-party deaths, and permanent disabilities. The findings revealed that field workers typically experience 11-12 transitions before reaching an absorbing state. Notably, 24% of operations resulted in oil spills, causing ecosystem damage and work stoppages. Severe injuries affected 12% of staff over the study period, while 50% of workers experienced severe medical treatment cases due to occupational illnesses and injuries. To improve safety standards and reduce lost workdays, the study recommends decentralizing safety policies across subsidiary companies. Specifically, safety officers should be permanently assigned to individual units and departments to ensure proper job monitoring and help prevent industrial accidents. This approach aims to better align the organization's safety practices with global standards.
Keywords: Industrial accident, Markov Chain, HSE records, valued diagraph, Absorbing state.

1.0 INTRODUCTION

The persistence of industrial accidents, particularly in oil and gas facilities, remains a pressing issue despite various safety interventions. Two primary factors contribute to this challenge: the inadequate application of analytical models for accident record analysis and inconsistencies in organizational record-keeping. These disparities hinder effective industrial accident analysis, making conventional quantitative tools less effective. In Nigeria, for instance, while official statistics report approximately 3,000 industrial accidents annually, labor unions suggest that the true figure may be closer to 7,000, highlighting issues of underreporting and insufficient tracking methods.

The Markov Chain model presents an effective tool for analyzing historical safety data, uncovering patterns that simpler statistical models may overlook. Despite its extensive application in diverse fields, its use in industrial safety analysis, particularly within the oil and gas sector, remains underexplored. The foundation for Markov Chain applications in safety analysis originates from reliability engineering, dating back to early psychological studies on accidents (Geller, 2001) and Heinrich's scientific approach to industrial accident prevention in 1931 (Smith, 2014).

Markov models have demonstrated effectiveness in component diagnostics, prognostics, and maintenance optimization across industries (Rafael et al., 2015). In oil and gas, Zhang and Singh (2022) modeled equipment degradation using Markov Chains, highlighting their capability for risk assessment. Rommert et al. (2007) further explored Markov decision chains in maintenance modeling, emphasizing the interplay between theoretical advancements and practical applications. Similarly, Prunchnicki et al. (2011) and Bozena and Mariusz (2017) applied Markov models to aviation and construction safety, respectively, reinforcing their significance in accident prevention research. Fazard et al. (2014) extended Markov Chain applications to robotic safety, defining hazard rates for various system states. Omoyi and Omotehinse (2022) applied Markov Chain theory to industrial safety modeling in Nigeria's oil and gas industry. Their study uncovered hidden patterns in safety data, developing an effective predictive model for industrial accident occurrences. Within the oil and gas industry, Igboanugo (2010) and Okwu et al. (2016) also analyzed accident data using Markov Chains, though with differing methodological approaches. Other scholars who have applied Markov Chains, model to study industrial safety with significant results are (Zhang Sujiao, 2009; Kumar and Patel, 2023; Rodriguez et al. 2024; Okwuashi and Ndehedehe, 2021; Martins et al., 2021; Xiong et al., 2018; Gogunskii et al., 2017; Yedla et al., 2020 and Salas-Páez et al., 2022) This research underscores the potential of Markov Chain modeling in uncovering hidden patterns within industrial accident data. The aim of the study was analyze safety data of eight

NNPC subsidiaries using Markov Chain model to uncover hidden trend or pattern in their safety systems with view to reducing accident occurrences and improving workplace safety in high-risk sectors.

2.0 METHODOLOGY

2.1 Research design

The research employed analytical research design and focused on analysis industrial accident data spanning 16 years (2000-2015) from the Nigeria National Petroleum Company (NNPC). This includes data from eight subsidiaries: Warri Refining and Petrochemical Company (WRPC), Port Harcourt Refining Company (PHRC), Kaduna Refining and Petrochemical Company (KRPC), Nigerian Gas Company (NGC), Pipeline and Product Marketing Company (PPMC), Nigerian Petroleum Development Company (NPDC), National Engineering and Technical Company (NETCO), and Retail Service. The accident records are studied to identify Markov properties such as stochastic regularity, absorbing behavior, and the long-term distribution across different states. The fundamental assumptions in the model are clearly outlined, along with the relevant theorems and formulas that guide statistical computations and decision-making. Statistical analysis was carried out using MATLAB R2013a, and deductions and inferences drawn from the results inform the discussion and conclusions. A purposive sampling method was used, selecting firms where data was available, which also serves as a representative sample of similar oil industry companies. Primary data, as shown in Table 1, was sourced from HSE records for analysis, utilizing the Markov chain model, with sensitivity analysis employed to test the adequacy of the model.

Table 2.1: Integrated HSE Data from NNPC

S/N	STATES	TOTAL	REGIME	S/N	STATES	TOTAL	REGIME
1	Fatality	11	Absorbing State Regime	11	Lost time days (LTD)	158	Non- Absorbing State Regime
2	Third party fatality (TPF)	21		12	Injury(I(minor) I_m	786	
3	Permanent disability (PD)	4		13	Fire incidents (minor) FI_m	568	
4	Fire incidence (severe) FI_s	209		14	Medical treatment case (MTC_m)	11300	
5	Injury (severe) I_s	344		15	Restricted work case (minor) RWC_m	94	
6	Medical treatment case (severe) MTC_s	2029		16	Road traffic accident(minor) RTA_m	92	
7	Road traffic accident (severe) RTA_s	30		17	First aid case (FAC)	525	
8	Oil spill (call outs) OS	706		18	Unsafe conditions (UC)	6478	
9	Restricted work case (severe)RWC_s	47		19	Unsafe acts (UA)	9458	
10	Human error (HE)	94		20	Near misses (NM)	1134	
GRAND TOTAL: 34088							

2.1 Markov Chain Modeling Theoretical formulation

Markov chain is a simple concept which can explain most complicated real time processes based on a principle of "memorylessness". In other words, the next state of the process only depends on the previous state and not the sequence of states (Srinivisan and Parlikard, 2014).

A Markov Chain is considered an absorbing chain if:

1. There is at least one absorbing state, which means the probability of leaving the state is zero, and the probability of remaining in the state is one.
2. It is possible to reach at least one absorbing state from any other state in a finite number of steps.

a. Theorem

In this consideration, absorbing states are listed first and the standard form is expressed as:

$$T = \begin{array}{c} \\ \text{Abs} \\ \text{Nonabs} \end{array} \begin{array}{c} \begin{array}{cc} \text{Abs} & \text{Non-abs} \end{array} \\ \left(\begin{array}{c|c} I & O \\ \hline R & Q \end{array}\right) \end{array} \quad (1)$$

Fundamental Matrix (N) is developed arbitrarily and we shall state without proof that the transition matrix T,

$$= T \left(\begin{array}{c|c} I & O \\ \hline R & Q \end{array}\right) \quad (2)$$

$$T^2 = \left(\begin{array}{c|c} I & O \\ \hline (I-Q)^{-1}R & Q^2 \end{array}\right)$$

$$T^n = \qquad T^n = T \left(\begin{array}{c|c} I & O \\ \hline (I+Q+Q^2+Q^3+\cdots+Q^{n-1})R & Q^2 \end{array}\right)$$

We determine the long run distribution of T, i.e.
$T^n = \overline{T}$

$$T^n = T \left(\begin{array}{c|c} I & O \\ \hline (I-Q)^{-1}R & O \end{array}\right) \quad (3)$$

Equation (3) is vital to the development of the fundamental matrix, $N = (I-Q)^{-1}$, the long run distribution among the various absorbing states $B = (I-Q)^{-1}R = NR$, variance on number of steps (2N – I) Ʈ-Ʈ$_{sq}$ and the transient probabilities, $H = (N - I)N_{dg}^{-1}$

b. Probability of transition:
The probability of transitioning from i to j in exactly k steps is the j –entry of Q^k. Summing this for all K (0 to ∞) yields the fundamental matrix denoted by N, where

$$N = \sum_{k=0}^{\infty} QK = (I-Q)^{-1} \quad (4)$$

$$N = (I-Q)^{-1} \quad (5)$$

Equation (5) specifies the expected or average number of times the object starts in the ith non-absorbing state before being absorbed.

c. Absorbing probabilities:
Another property is the probability of being absorbed in the absorbing state j when starting from transient state i which is the (ij)-entry of the matrix

$$B = NR \quad (6)$$

$$B = (I - Q)^{-1} R \quad (7)$$

This specifies the long run distribution of subjects staff among the various absorbing states.

d. Expected number of step or movements:
The expected number of steps before being absorbed when starting in transient state i is the ith entry of the vector.

$$Ʈ = N\,\xi \quad (8)$$

Where $\xi = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$ is a column vector whose entries are all 1

e. Variance on number of steps:

$$T_2 = (2N - I)\,\tau = \tau_{sq} \quad (9)$$

This provides the associated variance on the number of steps before being absorbed.

f. Transient probabilities
This gives the probability of visiting transient state j when starting at a transient state i. It is the ij-entry of the matrix

$$H = (N\text{-}I)\,N_{dg}^{-1} \quad (10)$$

2.2 Statistical Computation
With reference to the diagraph of the 20 state structure in Table 2.1, the absorbing state are heuristically determined as follows.
The computation of probabilities for absorbing and non-absorbing state use different approaches. For absorbing state, the heuristic method is adopted. In other words, reasoning is used. Thus, by heuristic $P_{xx} = 1$, which is persistence. Others under absorbing state are similarly determined. On the other hand, determination of probabilities under non-absorbing state uses Bayesian method.

2.2.1 Absorbing State Computation
P_{11} =Pr (FT) =1: a staff who is wasted by fatality (death) remains dead (a case of persistence). By similar heuristic approach, other probabilities of persistence are as follows:

$$P_{22} = P_{33} = P_{44} = \ldots = P_{10,10} = 1$$

For instance, P_{12} represent subject transiting from fatality (FT) to third party fatality (TPF), it is a case

which is (impossible); which means transiting from a state considered absorbing to another state which is an absorbing or non-absorbing state is implausible. Then, by similar heuristic argument

$P_{12} = P_{21} = P_{13} = P_{31} = P_{14} = P_{41} = P_{15} = P_{51} = P_{16} = P_{61} = P_{17} = P_{71} = P_{18} = P_{81} = P_{19} = P_{91}, P_{1,10} = P_{10,1} = 0$, for reasons of implausibility.

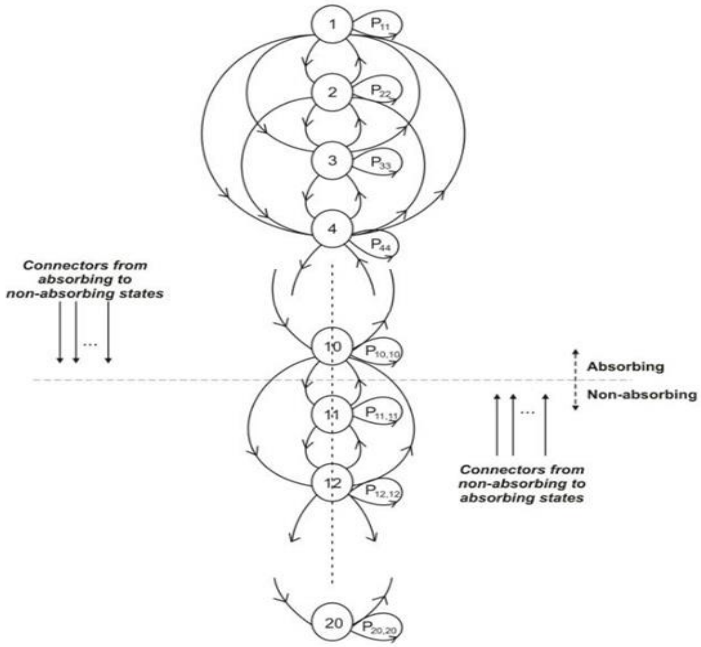


Figure 2.1: Diagraph of the 20–State structure Each state is linked to all the 20-states by an outflow and return lines

2.2.2 Non-Absorbing State Computation

There are ten (10) non - absorbing states considered namely, LTD, IM, FI_m, MTC_m, RWC_m, RTA_m, FAC, UC, UA, and NM. Ten different combinations of the 20 states structure were arranged in Table 2 with the columns indicating different combinations.

Table 2.2: Ten Different Combination of 20 states structure (Integrated HSE data Covering NNPC Subs)

S/NO	V_SET 1	V_SET 2	V_SET 3	V_SET 4	V_SET 5	V_SET 6	V_SET 7	V_SET 8	V_SET 9	V_SET 10
1	FT=11	FT=11	FT=11	FT=11	FT=11	FT=11	FT=11	FT=11	FT=11	FT=0
2	TPF=21	TPF=21	TPF=21	TPF=21	TPF=21	TPF=0	TPF=21	TPF=21	TPF=21	TPF=21
3	PD=4	PD=4	PD=4	PD=0	PD=4	PD=4	PD=4	PD=4	PD=4	PD=4
4	FIs=209	FIs=209	FIs=209	FIs=209	FIs=209	FIs=209	FIs=209	FIs=209	FIs=209	FIs=209
5	Is=344	Is=344	Is=344	Is=344	Is=344	Is=344	Is=344	Is=344	Is=344	Is=344
6	MTCs=2029	MTCs=2029	MTCs=2029	MTCs=2029	MTCs=2029	MTCs=2029	MTCs=2029	MTCs=2029	MTCs=0	MTCs=2029
7	RTAs=30	RTAs=30	RTAs=30	RTAs=30	RTAs=30	RTAs=30	RTAs=30	RTAs=30	RTAs=30	RTAs=30
8	OS_CO=706	OS_CO=706	OS_CO=706	OS_CO=706	OS_CO=706	OS_CO=706	OS_CO=706	OS_CO=706	OS_CO=706	OS_CO=706
9	RWCs=47	RWCs=47	RWCs=47	RWCs=47	RWCs=47	RWCs=47	RWCs=47	RWCs=0	RWCs=47	RWCs=47
10	HE=94	HE=94	HE=94	HE=94	HE=94	HE=94	HE=0	HE=94	HE=94	HE=94
11	LTD=158	LTD=158	LTD=158	LTD=158	LTD=158	LTD=158	LTD=158	LTD=158	LTD=158	LTD=158
12	Im=786	Im=786	Im=786	Im=786	Im=786	Im=786	Im=786	Im=786	Im=786	Im=786
13	FIm=568	FIm=0	FIm=568	FIm=568	FIm=568	FIm=568	FIm=568	FIm=568	FIm=568	FIm=568
14	MTCm=11300	MTCm=11300	MTCm=11300	MTCm=11300	MTCm=11300	MTCm=11300	MTCm=11300	MTCm=11300	MTCm=11300	MTCm=11300
15	RWCm=94	RWCm=94	RWCm=94	RWCm=94	RWCm=94	RWCm=94	RWCm=94	RWCm=94	RWCm=94	RWCm=94
16	RTAm=92	RTAm=92	RTAm=0	RTAm=92	RTAm=92	RTAm=92	RTAm=92	RTAm=92	RTAm=92	RTAm=92
17	FAC=525	FAC=525	FAC=525	FAC=525	FAC=525	FAC=525	FAC=525	FAC=525	FAC=525	FAC=525
18	UC=6474	UC=6474	UC=6474	UC=6474	UC=0	UC=6474	UC=6474	UC=6474	UC=6474	UC=6474
19	UA=9458	UA=9458	UA=9458	UA=9458	UA=9458	UA=9458	UA=9458	UA=9458	UA=9458	UA=9458
20	NM=0	NM=1134	NM=1134	NM=1134	NM=1134	NM=1134	NM=1134	NM=1134	NM=1134	NM=1134
TOTAL	**32954**	**33520**	**33996**	**34084**	**27610**	**34067**	**33994**	**34041**	**32059**	**34077**

It is noticed that for each set of 10 different combination of the 20 state structure, a state is taken off (initialize = 0) to allow for mathematical tractability. This will enable us to determine the 10 set of probability using Bayesian approach. Sample probability computations are shown in Table 3. Certain assumptions are being made in the use of Bayesian methodology to compute probabilities under non–

absorbing regime. The said assumptions are briefly outlined as follows:

Assumption 1: A staff member who is deemed to have a lost time day by management cannot simultaneously be available to commit Near miss (NM= 0), $P_{11,\ 20}$.

Assumption 2: A staff member who has recently sustained a minor injury (Im) and is receiving treatment cannot simultaneously be put in a situation where they are vulnerable to a fire accident. (FIm =0), $P_{12,13}$= 0

Assumption 3: A well-trained staff member who experiences a minor fire incident (FIm) in the workplace cannot simultaneously be involved in a minor road traffic accident (RTAm = 0, P13,16 = 0), as this is considered impossible. (a case of impossibility) RTA_m=0, $P_{13,16}$=0.

Assumption 4: A staff whose state is considered as a minor medical treatment case MTC_M cannot be said to be in a state of permanent disability PD =0, $P_{14,\ 3}$=0.

Assumption 5: A staff member in a minor restricted work case (RW_{CM}) will not be exposed to unsafe conditions (UC = 0), $P_{15,18}$=0.

Assumption 6: A healthy contract staff member who has a minor road traffic accident (RTA_M) cannot immediately transition to a third-party fatality (death) TPF=0, $P_{16,2}$= 0.

Assumption 7: A staff whose injury is considered to be a first aid case (FAC) cannot be said to have committed a major work related human error (HE = 0), $P_{17,10}$

Assumption 8: It is impossible for a staff to be at a state considered an un safe condition (UC) at the same time be said to be in severe restricted work case (RWCs = 0), $P_{18,9}$= 0

Assumption 9: A well-trained staff who is involved in an unsafe act (UA) cannot always be linked to a state of severe medical treatment case MTCs = 0, $P_{19,6}$ = 0

Assumption 10: A well-trained staff who commits Near miss cannot instantly transit to fatality FT= 0, $P_{20,1}$ = 0

Table 3 details the computation of transition probabilities using Bayesian methodology and Table 4 shows the mode of transition.

Table 2. 3: Computation of Transition Probabilities Using Bayesian Methodology

Probabilities Set1	Probabilities Set2	Probabilities Set3	Probabilities Set4
P(FT)=(11/32954)=0.0003	P(FT)=(11/33520)=0.0003	P(FT)=(11/33996)=0.0003	P(FT)=(11/34084)=0.0003
P(TPF)=(21/32954)=0.0006	P(TPF)=(21/33520)=0.0006	P(TPF)=(21/33996)=0.0006	P(TPF)=(21/34084)=0.0006
P(PD)=(4/32954)=0.0001	P(PD)=(4/33520)=0.0001	P(PD)=(4/33996)=0.0001	P(PD)=(0/34084)=0.0000
P(FI_S)=(209/32954)=0.0063	P(FI_S)=(209/33520)=0.0062	P(FI_S)=(209/33996)=0.0061	P(FI_S)=(209/34084)=0.0061
P(I_S)=(344/32954)=0.0104	P(I_S)=(344/33520)=0.0103	P(I_S)=(344/33996)=0.0101	P(I_S)=(344/34084)=0.0101
P(MTC_S)=(2029/32954)=0.0616	P(MTC_S)=(2029/33520)=0.0605	P(MTC_S)=(2029/33996)=0.0597	P(MTC_S)=(2029/34084)=0.0595
P(RTA_S)=(30/32954)=0.0009	P(RTA_S)=(30/33520)=0.0009	P(RTA_S)=(30/33996)=0.0009	P(RTA_S)=(30/34084)=0.0009
P(OS_CO)=(706/32954)=0.0214	P(OS_CO)=(706/33520)=0.0211	P(OS_CO)=(706/33996)=0.0208	P(OS_CO)=(706/34084)=0.0207
P(RWC_S)=(47/32954)=0.0014	P(RWC_S)=(47/33520)=0.0014	P(RWC_S)=(47/33996)=0.0014	P(RWC_S)=(47/34084)=0.0014
P(HE)=(94/32954)=0.002	P(HE)=(94/33520)=0.002	P(HE)=(94/33996)=0.002	P(HE)=(94/34084)=0.002

9	8	8	8
P(LTD)=(158/32954)=0.0048	P(LTD)=(158/33520)=0.0047	P(LTD)=(158/33996)=0.0046	P(LTD)=(158/34084)=0.0046
P(I_M)=(786/32954)=0.0239	P(I_M)=(786/33520)=0.0234	P(I_M)=(786/33996)=0.0231	P(I_M)=(786/34084)=0.0231
P(FI_M)=(568/32954)=0.0172	P(FI_M)=(0/33520)=0.0000	P(FI_M)=(568/33996)=0.0167	P(FI_M)=(568/34084)=0.0167
P(MTC_M)=(11300/32954)=0.3429	P(MTC_M)=(11300/33520)=0.3371	P(MTC_M)=(11300/33996)=0.3324	P(MTC_M)=(11300/34084)=0.3315
P(RWC_M)=(94/32954)=0.0029	P(RWC_M)=(94/33520)=0.0028	P(RWC_M)=(94/33996)=0.0028	P(RWC_M)=(94/34084)=0.0028
P(RTA_M)=(92/32954)=0.0028	P(RTA_M)=(92/33520)=0.0027	P(RTA_M)=(0/33996)=0.0000	P(RTA_M)=(92/34084)=0.0027
P(FAC)=(525/32954)=0.0159	P(FAC)=(525/33520)=0.0157	P(FAC)=(525/33996)=0.0154	P(FAC)=(525/34084)=0.0154
P(UC)=(6478/32954)=0.1966	P(UC)=(6478/33520)=0.1933	P(UC)=(6478/33996)=0.1906	P(UC)=(6478/34084)=0.1901
P(UA)=(9458/32954)=0.2870	P(UA)=(9458/33520)=0.2822	P(UA)=(9458/33996)=0.2782	P(UA)=(9458/34084)=0.2775
P(NM)=(0/32954)=0.0000	P(NM)=(1134/33520)=0.0338	P(NM)=(1134/33996)=0.0334	P(NM)=(1134/34084)=0.0333

Probabilities Set5	**Probabilities Set6**	**Probabilities Set7**	**Probabilities Set8**
P(FT)=(11/27610)=0.0004	P(FT)=(11/34067)=0.0003	P(FT)=(11/33994)=0.0003	P(FT)=(11/34041)=0.0003
P(TPF)=(21/27610)=0.0008	P(TPF)=(0/34067)=0.0000	P(TPF)=(21/33994)=0.0006	P(TPF)=(21/34041)=0.0006
P(PD)=(4/27610)=0.0001	P(PD)=(4/34067)=0.0001	P(PD)=(4/33994)=0.0001	P(PD)=(4/34041)=0.0001
P(FI_S)=(209/27610)=0.0076	P(FI_S)=(209/34067)=0.0061	P(FI_S)=(209/33994)=0.0061	P(FI_S)=(209/34041)=0.0061
P(I_S)=(344/27610)=0.0125	P(I_S)=(344/34067)=0.0101	P(I_S)=(344/33994)=0.0101	P(I_S)=(344/34041)=0.0101
P(MTC_S)=(2029/27610)=0.0735	P(MTC_S)=(2029/34067)=0.0596	P(MTC_S)=(2029/33994)=0.0597	P(MTC_S)=(2029/34041)=0.0596
P(RTA_S)=(30/27610)=0.0011	P(RTA_S)=(30/34067)=0.0009	P(RTA_S)=(30/33994)=0.0009	P(RTA_S)=(30/34041)=0.0009
P(OS_CO)=(706/27610)=0.0256	P(OS_CO)=(706/34067)=0.0207	P(OS_CO)=(706/33994)=0.0208	P(OS_CO)=(706/34041)=0.0207

P(RWC_S)=(47/27610)=0.0017	P(RWC_S)=(47/34067)=0.0014	P(RWC_S)=(47/33994)=0.0014	P(RWC_S)=(0/34041)=0.0000
P(HE)=(94/27610)=0.0034	P(HE)=(94/34067)=0.0028	P(HE)=(0/33994)=0.0000	P(HE)=(94/34041)=0.0028
P(LTD)=(158/27610)=0.0057	P(LTD)=(158/34067)=0.0046	P(LTD)=(158/33994)=0.0046	P(LTD)=(158/34041)=0.0046
P(I_M)=(786/27610)=0.0285	P(I_M)=(786/34067)=0.0231	P(I_M)=(786/33994)=0.0231	P(I_M)=(786/34041)=0.0231
P(FI_M)=(568/27610)=0.0206	P(FI_M)=(568/34067)=0.0167	P(FI_M)=(568/33994)=0.0167	P(FI_M)=(568/34041)=0.0167
P(MTC_M)=(11300/27610)=0.4093	P(MTC_M)=(11300/34067)=0.3317	P(MTC_M)=(11300/33994)=0.3324	P(MTC_M)=(11300/34041)=0.3320
P(RWC_M)=(94/27610)=0.0034	P(RWC_M)=(94/34067)=0.0028	P(RWC_M)=(94/33994)=0.0028	P(RWC_M)=(94/34041)=0.0028
P(RTA_M)=(92/27610)=0.0033	P(RTA_M)=(92/34067)=0.0027	P(RTA_M)=(92/33994)=0.0027	P(RTA_M)=(92/34041)=0.0027
P(FAC)=(525/27610)=0.0190	P(FAC)=(525/34067)=0.0154	P(FAC)=(525/33994)=0.0154	P(FAC)=(525/34041)=0.0154
P(UC)=(0/27610)=0.0000	P(UC)=(6478/34067)=0.1902	P(UC)=(6478/33994)=0.1906	P(UC)=(6478/34041)=0.1903
P(UA)=(9458/27610)=0.3426	P(UA)=(9458/34067)=0.2776	P(UA)=(9458/33994)=0.2782	P(UA)=(9458/34041)=0.2778
P(NM)=(1134/27610)=0.0411	P(NM)=(1134/34067)=0.0333	P(NM)=(1134/33994)=0.0334	P(NM)=(1134/34041)=0.0333

Table 2. 3: Computation of Transition Probabilities Using Bayesian Methodology (Contd)

Probabilities Set9	**Probabilities Set10**
P(FT)=(11/32059)=0.0003	P(FT)=(0/34077)=0.0000
P(TPF)=(21/32059)=0.0007	P(TPF)=(21/34077)=0.0006
P(PD)=(4/32059)=0.0001	P(PD)=(4/34077)=0.0001
P(FI_S)=(209/32059)=0.0065	P(FI_S)=(209/34077)=0.0061
P(I_S)=(344/32059)=0.0107	P(I_S)=(344/34077)=0.0101
P(MTC_S)=(0/32059)=0.0000	P(MTC_S)=(2029/34077)=0.0595
P(RTA_S)=(30/32059)=0.0009	P(RTA_S)=(30/34077)=0.0009
P(OS_CO)=(706/32059)=0.0220	P(OS_CO)=(706/34077)=0.0207
P(RWC_S)=(47/32059)=0.0015	P(RWC_S)=(47/34077)=0.0014
P(HE)=(94/32059)=0.0029	P(HE)=(94/34077)=0.0028
P(LTD)=(158/32059)=0.0049	P(LTD)=(158/34077)=0.0046
P(I_M)=(786/32059)=0.0245	P(I_M)=(786/34077)=0.0231
P(FI_M)=(568/32059)=0.0177	P(FI_M)=(568/34077)=0.0167
P(MTC_M)=(11300/32059)=0.3525	P(MTC_M)=(11300/34077)=0.3316
P(RWC_M)=(94/32059)=0.0029	P(RWC_M)=(94/34077)=0.0028

P(RTA_M)=(92/32059)=0.0029	P(RTA_M)=(92/34077)=0.0027
P(FAC)=(525/32059)=0.0164	P(FAC)=(525/34077)=0.0154
P(UC)=(6478/32059)=0.2021	P(UC)=(6478/34077)=0.1901
P(UA)=(9458/32059)=0.2950	P(UA)=(9458/34077)=0.2775
P(NM)=(1134/32059)=0.0354	P(NM)=(1134/34077)=0.0333

Table 2.4: Mode of Transition Tableau

From \ To	FT	TPF	PD	Fis	Is	MTCs	RTAs	Osco	RWCs	HE	LTD	Im	Fim	MTCm	RWCm	RTAm	FAC	UC	UA	NM
FT	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TPF	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PD	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fis	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Is	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MTCs	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RTAs	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Osco	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
RWCs	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
HE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
LTD	0.0003	0.0006	0.0001	0.0063	0.0104	0.0616	0.0009	0.0214	0.0014	0.0029	0.0048	0.0239	0.0172	0.3429	0.0029	0.0028	0.0159	0.1966	0.287	0
Im	0.0003	0.0006	0.0001	0.0062	0.0103	0.0605	0.0009	0.0211	0.0014	0.0028	0.0047	0.0234	0	0.3371	0.0028	0.0027	0.0157	0.1933	0.2822	0.0338
Fim	0.0003	0.0006	0.0001	0.0061	0.0101	0.0597	0.0009	0.0208	0.0014	0.0028	0.0046	0.0231	0.0167	0.3324	0.0028	0	0.0154	0.1906	0.2782	0.0334
MTCm	0.0003	0.0006	0	0.0061	0.0101	0.0595	0.0009	0.0207	0.0014	0.0028	0.0046	0.0231	0.0167	0.3315	0.0028	0.0027	0.0154	0.1901	0.2775	0.0333
RWCm	0.0004	0.0008	0.0001	0.0076	0.0125	0.0735	0.0011	0.0256	0.0017	0.0034	0.0057	0.0285	0.0206	0.4093	0.0034	0.0033	0.019	0	0.3426	0.0411
RTAm	0.0003	0	0.0001	0.0061	0.0101	0.0596	0.0009	0.0207	0.0014	0.0028	0.0046	0.0231	0.0167	0.3317	0.0028	0.0027	0.0154	0.1902	0.2776	0.0333
FAC	0.0003	0.0006	0.0001	0.0061	0.0101	0.0597	0.0009	0.0208	0.0014	0	0.0046	0.0231	0.0167	0.3324	0.0028	0.0027	0.0154	0.1906	0.2782	0.0334
UC	0.0003	0.0006	0.0001	0.0061	0.0101	0.0596	0.0009	0.0207	0	0.0028	0.0046	0.0231	0.0167	0.332	0.0028	0.0027	0.0154	0.1903	0.2778	0.0333
UA	0.0003	0.0007	0.0001	0.0065	0.0107	0	0.0009	0.022	0.0015	0.0029	0.0049	0.0245	0.0177	0.3525	0.0029	0.0029	0.0164	0.2021	0.295	0.0354
NM	0	0.0006	0.0001	0.0061	0.0101	0.0595	0.0009	0.0207	0.0014	0.0028	0.0046	0.0231	0.0167	0.3316	0.0028	0.0027	0.0154	0.1901	0.2775	0.0333

The above computation in Table 2.3 Probabilities set1, set2, set3, set4, set 5, set 6…..set 10 with each probabilities set computations adding up to one (1) and occupies row11,12, 13……to row20 of the non-absorbing regime of the TPM. Table2.4 shows the transition probability matrix tableau of Integrated HSE data covering NNPC Subsidiaries. It summarizes the computation of the absorbing state regime calculation through heuristic approach and the Non-absorbing state regime computations by Bayesian methodology. The Transition probability matrix Tableau is structured into two major parts, the absorbing state transition probability occupying the first ten (10 by 20) matrix of the (20 x 20)matrix, spanning from Fatality (FT) to Human Error (HE) on the rows and Fatality (FT) to Near misses (NM) on the column, while the non-absorbing state transition probability are arranged in the next (10 by 20) beginning from row 11 Lost Time Days (LTD) to row 20 Near miss (NM) and Fatality to Near miss (NM), column 1 to column 20. Basically, the row sum of the transition probability tableau should equate to one. Besides, the transition probability matrix can be viewed as having four sub-matrices. The Upper left hand side (2nd quadrant) that has a main diagonal of unity with upper and lower triangular matrix of zeroes represents the Identity matrix (I) and the upper right hand side (1st quadrant) with all zeroes is called the Null matrix or matrix of zeroes O, while the lower left hand side (3rd quadrant) and Right hand side (4th quadrant) of TPM represents arbitrary matrix R and Q which forms the non-absorbing state transition probabilities matrix. However, the transition probability tableau matrix is consonance to the standard transition matrix

3.0 RESULT AND DISCUSSION

The results from the markovian analysis and its accompanying matrices are interpreted. The fundamental matrix, N = (I – Q)-1 which provides an interesting information about the expected number of visits or average number of times before a particular subject in the non-absorbing state is absorbed were interpreted alongside the associated variance, N_2= N (2Ndg – I) - Nsq., which is the variance on number of visits before a staff is being absorbed.

The standard form of the transition matrix is presented as:

$$T = \left(\begin{array}{c|c} I & O \\ \hline R & Q \end{array}\right)$$

The transition probability matrix T presented above is a standard form of an absorbing Markov chain in which the rows and columns are designated in such a way that all the absorbing state probabilities precede all the non–absorbing state probabilities. In its standard form it is always partitioned into four sub matrices. The transition probability matrix is a type of the transition probability Tableau, but in matrix form. Transition matrix in its stabilized form gives the long-run distribution of the safety practice

$$T^n = \bar{T} = \left(\begin{array}{c|c} I & 0 \\ \hline (I-Q)^{-1}R & 0 \end{array}\right)$$

of the given organization. i.e. when the power of *n T* of *T* approaches where $(I-Q)^{-1}R=B$, gives the absorbing state probability matrix and $(I-Q)^{-1}$ is the fundamental matrix (N). In other words, the stabilized transition probability $\overline{T}$ can be obtain simply from $B=NR$

$T =$

1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
0.0003	0.0006	0.0001	0.0063	0.0104	0.0616	0.0009	0.0214	0.0014	0.0029	0.0048	0.0239	0.0172	0.3429	0.0028	0.0159	0.1966	0.287	0	
0.0003	0.0006	0.0001	0.0062	0.0103	0.0605	0.0009	0.0211	0.0014	0.0028	0.0047	0.0234	0	0.3371	0.0027	0.0157	0.1933	0.2822	0.0338	
0.0003	0.0006	0.0001	0.0061	0.0101	0.0597	0.0009	0.0208	0.0014	0.0028	0.0046	0.0231	0.0167	0.3324	0	0.0154	0.1906	0.2782	0.0334	
0.0003	0.0006	0	0.0061	0.0101	0.0595	0.0009	0.0207	0.0014	0.0028	0.0046	0.0231	0.0167	0.3315	0.0027	0.0154	0.1901	0.2775	0.0333	
0.0004	0.0008	0.0001	0.0076	0.0125	0.0735	0.0011	0.0256	0.0017	0.0034	0.0057	0.0285	0.0206	0.4093	0.0033	0.019	0	0.3426	0.0411	
0.0003	0	0.0001	0.0061	0.0101	0.0596	0.0009	0.0207	0.0014	0.0028	0.0046	0.0231	0.0167	0.3317	0.0027	0.0154	0.1902	0.2776	0.0333	
0.0003	0.0006	0.0001	0.0061	0.0101	0.0597	0.0009	0.0208	0.0014	0	0.0046	0.0231	0.0167	0.3324	0.0027	0.0154	0.1906	0.2782	0.0334	
0.0003	0.0006	0.0001	0.0061	0.0101	0.0596	0.0009	0.0207	0	0.0028	0.0046	0.0231	0.0167	0.332	0.0027	0.0154	0.1903	0.2778	0.0333	
0.0003	0.0007	0.0001	0.0065	0.0107	0	0.0009	0.022	0.0015	0.0029	0.0049	0.0245	0.0177	0.3525	0.0029	0.0164	0.2021	0.295	0.0354	
0	0.0006	0.0001	0.0061	0.0101	0.0595	0.0009	0.0207	0.0014	0.0028	0.0046	0.0231	0.0167	0.3316	0.0027	0.0154	0.1901	0.2775	0.0333	

(11)

The Standard Transition Probability matrix, T as depicted above is represented by four sub- matrices, the Identity I(2nd quadrant), the null matrix or Zeroes (O) (1st quadrant) and the arbitrary matrices R(3rd quadrant) and Q(4th quadrant) which are essential for the statistical computation of the fundamental matrix N and its derivatives.

Statistical computation

$$I=\begin{bmatrix}1&0&0&0&0&0&0&0&0&0\\0&1&0&0&0&0&0&0&0&0\\0&0&1&0&0&0&0&0&0&0\\0&0&0&1&0&0&0&0&0&0\\0&0&0&0&1&0&0&0&0&0\\0&0&0&0&0&1&0&0&0&0\\0&0&0&0&0&0&1&0&0&0\\0&0&0&0&0&0&0&1&0&0\\0&0&0&0&0&0&0&0&1&0\\0&0&0&0&0&0&0&0&0&1\end{bmatrix} \quad (12)$$

$$O=\begin{bmatrix}0&0&0&0&0&0&0&0&0&0\\0&0&0&0&0&0&0&0&0&0\\0&0&0&0&0&0&0&0&0&0\\0&0&0&0&0&0&0&0&0&0\\0&0&0&0&0&0&0&0&0&0\\0&0&0&0&0&0&0&0&0&0\\0&0&0&0&0&0&0&0&0&0\\0&0&0&0&0&0&0&0&0&0\\0&0&0&0&0&0&0&0&0&0\\0&0&0&0&0&0&0&0&0&0\end{bmatrix} \quad (13)$$

$R =$

$$\begin{bmatrix}0.0003&0.0006&0.0001&0.0063&0.0104&0.0616&0.0009&0.0214&0.0014&0.0029\\0.0003&0.0006&0.0001&0.0062&0.0103&0.0605&0.0009&0.0211&0.0014&0.0028\\0.0003&0.0006&0.0001&0.0061&0.0101&0.0597&0.0009&0.0208&0.0014&0.0028\\0.0003&0.0006&0&0.0061&0.0101&0.0595&0.0009&0.0207&0.0014&0.0028\\0.0004&0.0008&0.0001&0.0076&0.0125&0.0735&0.0011&0.0256&0.0017&0.0034\\0.0003&0&0.0001&0.0061&0.0101&0.0596&0.0009&0.0207&0.0014&0.0028\\0.0003&0.0006&0.0001&0.0061&0.0101&0.0597&0.0009&0.0208&0.0014&0\\0.0003&0.0006&0.0001&0.0061&0.0101&0.0596&0.0009&0.0207&0&0.0028\\0.0003&0.0007&0.0001&0.0065&0.0107&0&0.0009&0.022&0.0015&0.0029\\0&0.0006&0.0001&0.0061&0.0101&0.0595&0.0009&0.0207&0.0014&0.0028\end{bmatrix} \quad (14)$$

$$Q = \begin{bmatrix} 0.0048 & 0.0239 & 0.0172 & 0.3429 & 0.0029 & 0.0028 & 0.0159 & 0.1966 & 0.287 & 0 \\ 0.0047 & 0.0234 & 0 & 0.3371 & 0.0028 & 0.0027 & 0.0157 & 0.1933 & 0.2822 & 0.0338 \\ 0.0046 & 0.0231 & 0.0167 & 0.3324 & 0.0028 & 0 & 0.0154 & 0.1906 & 0.2782 & 0.0334 \\ 0.0046 & 0.0231 & 0.0167 & 0.3315 & 0.0028 & 0.0027 & 0.0154 & 0.1901 & 0.2775 & 0.0333 \\ 0.0057 & 0.0285 & 0.0206 & 0.4093 & 0.0034 & 0.0033 & 0.019 & 0 & 0.3426 & 0.0411 \\ 0.0046 & 0.0231 & 0.0167 & 0.3317 & 0.0028 & 0.0027 & 0.0154 & 0.1902 & 0.2776 & 0.0333 \\ 0.0046 & 0.0231 & 0.0167 & 0.3324 & 0.0028 & 0.0027 & 0.0154 & 0.1906 & 0.2782 & 0.0334 \\ 0.0046 & 0.0231 & 0.0167 & 0.332 & 0.0028 & 0.0027 & 0.0154 & 0.1903 & 0.2778 & 0.0333 \\ 0.0049 & 0.0245 & 0.0177 & 0.3525 & 0.0029 & 0.0029 & 0.0164 & 0.2021 & 0.295 & 0.0354 \\ 0.0046 & 0.0231 & 0.0167 & 0.3316 & 0.0028 & 0.0027 & 0.0154 & 0.1901 & 0.2775 & 0.0333 \end{bmatrix} \quad (15)$$

3.1 Computation of the fundamental matrix

$N = (I - Q)^{-1}$

where I is conformable to matrix Q through linear algebra by the definition of I.

$$I - Q = \begin{bmatrix} 0.9952 & -0.0239 & -0.0172 & -0.3429 & -0.0029 & -0.0028 & -0.0159 & -0.1966 & 0.287 & 0 \\ -0.0047 & 0.9766 & 0 & -0.3371 & -0.0028 & -0.0027 & -0.0157 & -0.1933 & -0.2822 & -0.0338 \\ -0.0046 & -0.0231 & 0.9833 & -0.3324 & -0.0028 & 0 & -0.0154 & -0.1906 & -0.2782 & -0.0334 \\ -0.0046 & -0.0231 & -0.0167 & 0.6685 & -0.0028 & -0.0027 & -0.0154 & -0.1901 & -0.2775 & -0.0333 \\ -0.0057 & -0.0285 & -0.0206 & -0.4093 & 0.9966 & -0.0033 & -0.019 & 0 & -0.3426 & -0.0411 \\ -0.0046 & -0.0231 & -0.0167 & -0.3317 & -0.0028 & 0.9973 & -0.0154 & -0.1902 & -0.2776 & -0.0333 \\ -0.0046 & -0.0231 & -0.0167 & -0.3324 & -0.0028 & -0.0027 & 0.9846 & -0.1906 & -0.2782 & -0.0334 \\ -0.0046 & -0.0231 & -0.0167 & -0.332 & -0.0028 & -0.0027 & -0.0154 & 0.8097 & -0.2778 & -0.0333 \\ -0.0049 & -0.0245 & -0.0177 & -0.3525 & -0.0029 & -0.0029 & -0.0164 & -0.2021 & 0.705 & -0.0354 \\ -0.0046 & -0.0231 & -0.0167 & -0.3316 & -0.0028 & -0.0027 & -0.0154 & -0.1901 & -0.2775 & 0.9667 \end{bmatrix} \quad (16)$$

In computing the fundamental Matrix N, the above matrix I-Q inverse is taken which gives N.

The matrix N specifies the number of habituation each subjects undergoes in the transient states before being finally absorbed. This is a basic property of an absorbing Markov chain and it represents the expected or average number of visits or number of times objects starts in the ith non-absorbing state to a state (transient) j' before being absorbed. Long-run distribution of system B = N R. is the multiplication of the fundamental matrix N obtained supra and the arbitrary R.

$$N = \begin{array}{c} \\ 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array} \begin{array}{c} \begin{array}{cccccccccc} 11 & 12 & 13 & 14 & 15 & 16 & 17 & 18 & 19 & 20 \end{array} \\ \begin{bmatrix} 1.0548 & 0.2725 & 0.1923 & 3.9177 & 0.0326 & 0.0314 & 0.182 & 2.2383 & 3.2791 & 0.3569 \\ 0.0548 & 1.2725 & 0.1754 & 3.9178 & 0.0326 & 0.0314 & 0.182 & 2.2383 & 3.2791 & 0.3913 \\ 0.0548 & 0.2725 & 1.1923 & 3.9178 & 0.0326 & 0.0287 & 0.182 & 2.2383 & 3.2791 & 0.3913 \\ 0.0548 & 0.2725 & 0.1923 & 4.9182 & 0.0326 & 0.0314 & 0.182 & 2.2386 & 3.2795 & 0.3913 \\ 0.0548 & 0.2724 & 0.1922 & 3.9165 & 1.0326 & 0.0314 & 0.182 & 2.003 & 3.2781 & 0.3912 \\ 0.0548 & 0.2727 & 0.1924 & 3.9202 & 0.0326 & 1.0314 & 0.1821 & 2.2397 & 3.2812 & 0.3915 \\ 0.0549 & 0.2733 & 0.1928 & 3.9286 & 0.0327 & 0.0315 & 1.1825 & 2.2445 & 3.2882 & 0.3924 \\ 0.0549 & 0.2729 & 0.1926 & 3.9232 & 0.0326 & 0.0314 & 0.1823 & 3.2414 & 3.2837 & 0.3918 \\ 0.0582 & 0.2898 & 0.2045 & 4.1657 & 0.0347 & 0.0334 & 0.1935 & 2.38 & 4.4867 & 0.416 \\ 0.0548 & 0.2726 & 0.1924 & 3.919 & 0.0326 & 0.0314 & 0.1821 & 2.239 & 3.2802 & 1.3914 \end{bmatrix} \end{array} \quad (17)$$

$(i) \qquad (j)$

$$B = NR = \begin{array}{c} \\ 1 \\ 2 \\ 3 \\ 4 \\ 5\ (i) \\ 6 \\ 7 \\ 8 \\ 9 \\ 10 \end{array} \begin{array}{c} \begin{array}{cccccccccc} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \end{array} \\ (j) \\ \begin{bmatrix} 0.0037 & 0.0073 & 0.0009 & 0.0725 & 0.1193 & 0.4959 & 0.0104 & 0.2448 & 0.0132 & 0.0321 \\ 0.0037 & 0.0073 & 0.0009 & 0.0725 & 0.1193 & 0.4959 & 0.0104 & 0.2448 & 0.0132 & 0.0321 \\ 0.0037 & 0.0073 & 0.0009 & 0.0725 & 0.1193 & 0.4959 & 0.0104 & 0.2448 & 0.0132 & 0.0321 \\ 0.0037 & 0.0073 & 0.0008 & 0.0725 & 0.1193 & 0.496 & 0.0104 & 0.2448 & 0.0132 & 0.0321 \\ 0.0037 & 0.0073 & 0.0009 & 0.0724 & 0.1192 & 0.4958 & 0.0104 & 0.2447 & 0.0135 & 0.0321 \\ 0.0037 & 0.0066 & 0.0009 & 0.0725 & 0.1193 & 0.4962 & 0.0104 & 0.2449 & 0.0132 & 0.0321 \\ 0.0037 & 0.0073 & 0.0009 & 0.0727 & 0.1196 & 0.4973 & 0.0104 & 0.2455 & 0.0132 & 0.0294 \\ 0.0037 & 0.0073 & 0.0009 & 0.0726 & 0.1194 & 0.4966 & 0.0104 & 0.2451 & 0.0118 & 0.0321 \\ 0.0039 & 0.0077 & 0.001 & 0.077 & 0.1268 & 0.464 & 0.0111 & 0.2603 & 0.014 & 0.0341 \\ 0.0034 & 0.0073 & 0.0009 & 0.0725 & 0.1193 & 0.4961 & 0.0104 & 0.2449 & 0.0132 & 0.0321 \end{bmatrix} \end{array} \tag{18}$$

The numbering by the sides and tops of matrices N, B and H is in consonance with the states which facilitates cross references (i, j). The B matrix gives the long-run transition of subjects (staff) within the system which shows the general trend. It is evident that the row entries in each column are the same showing that it actually represents a stabilized matrix (trend) and thus, can be interpreted column wise. Column 1, 2 represents state 1 which in fatality, while column2 state 2; third party fatalities, and so on. For example, column wise, column 6 represents medical treatment case Severe (MTCS). The accompanying graphical representation maps states to long-run probabilities of occurrence as discernable from the B- matrix depicted supra. Graphical representation of B- matrix

$$B = \begin{pmatrix} \textit{Fatality} & \rightarrow & 0.0037 & \textit{Third Party Fatality} & \rightarrow & 0.0073 \\ \textit{Permanent Disability} & \rightarrow & 0.0009 & \textit{Fire Incidence}(\textit{Severe}) & \rightarrow & 0.0725 \\ \textit{Injury}(\textit{Severe}) & \rightarrow & 0.1193 & \textit{Medical Treatment Case}(\textit{Severe}) & \rightarrow & 0.4949 \\ \textit{Road Trafic Accident}(\textit{Severe}0 & \rightarrow & 0.0104 & \textit{Oil Spill}(\textit{Call Outs}) & \rightarrow & 0.2448 \\ \text{Re}\textit{stricted Work Cases}(\textit{Severe}) & \rightarrow & 0.0132 & \textit{Human Error} & \rightarrow & 0.0321 \end{pmatrix} \tag{19}$$

Using Long-Run Distribution to test the above procedure

$NR = T^{n}$

Where n is the number of samples to obtain the final result

In this context, when $1 \leq n \leq 100$ all the states objects are not completely absorbs, but at $n \geq 101$ they are completely absorbed when transition probability matrix T approaches the power T^{101}.

$B = NR = T^{101}$

It takes about 105 iterations of the transition probability matrix T to have a stable matrix which gives the long-run probabilities of the system $\bar{T}$ as shown below with zeroes on the upper(1^{st} quadrant) and lower (4^{th} quadrant) extremes of the right hand side. Since B = $(I\text{-}Q)^{-1}R$., the matrix $\bar{T}$ lower left bottom (3^{rd} quadrant) is exactly the stable matrix previously gotten, B=NR which is a simplified method of obtaining the stabilized long run distribution transition matrix with column and rows entry exactly the same.

$$\bar{T} = \left(\begin{array}{c|c} I & O \\ \hline (I-Q)^{-1}R & O \end{array} \right)$$

$\bar{T} =$

$$\left[\begin{array}{cccccccccc|cccccccccc}
1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\hline
0.0037 & 0.0073 & 0.0009 & 0.0725 & 0.1193 & 0.4959 & 0.0104 & 0.2448 & 0.0132 & 0.0321 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.0037 & 0.0073 & 0.0009 & 0.0725 & 0.1193 & 0.4959 & 0.0104 & 0.2448 & 0.0132 & 0.0321 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.0037 & 0.0073 & 0.0009 & 0.0725 & 0.1193 & 0.4959 & 0.0104 & 0.2448 & 0.0132 & 0.0321 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.0037 & 0.0073 & 0.0008 & 0.0725 & 0.1193 & 0.496 & 0.0104 & 0.2448 & 0.0132 & 0.0321 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.0037 & 0.0073 & 0.0009 & 0.0724 & 0.1192 & 0.4958 & 0.0104 & 0.2447 & 0.0135 & 0.0321 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.0037 & 0.0066 & 0.0009 & 0.0725 & 0.1193 & 0.4962 & 0.0104 & 0.2449 & 0.0132 & 0.0321 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.0037 & 0.0073 & 0.0009 & 0.0727 & 0.1196 & 0.4973 & 0.0104 & 0.2455 & 0.0132 & 0.0294 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.0037 & 0.0073 & 0.0009 & 0.0726 & 0.1194 & 0.4966 & 0.0104 & 0.2451 & 0.0118 & 0.0321 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.0039 & 0.0077 & 0.001 & 0.077 & 0.1268 & 0.464 & 0.0111 & 0.2603 & 0.014 & 0.0341 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0.0034 & 0.0073 & 0.0009 & 0.0725 & 0.1193 & 0.4961 & 0.0104 & 0.2449 & 0.0132 & 0.0321 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0
\end{array}\right] \tag{20}$$

3.2 Calculation of variances and standard deviation

Variance on number of visit $N_2 = N(2N_{dg} - I) - N_{sq}$

This gives the associated variance on the expected number of visits or simply the variance on the number of visit to a non-absorbing state (transient) j starting at a transient state i(before being absorbed) is the (ij)- entry of the matrix. Where $N_{dg}$is the diagonal matrix with the same diagonal as the fundamental matrix N but with upper triangular and lower triangular matrix of zeroes, while N_{sq} is the Hadamard product of N with itself (i.e each entry of fundamental matrix N is squared) as reported in en.m.wikipedia.org/wiki/absorbing_markov_chaincanical_form.

$$N_{dg} = \begin{bmatrix} 1.0548 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1.2725 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1.1923 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 4.9182 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1.0326 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1.0314 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1.1825 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 3.2414 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 4.4867 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.3914 \end{bmatrix} \quad (21)$$

Multiplication of Matrix N_{dg} by the scalar quantity of 2, gives matrix $2N_{dg}$ which is a square matrix with a main diagonal having an upper and lower triangular matrix of zeroes.

$$2N_{dg} = \begin{bmatrix} 2.1096 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2.545 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2.3846 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 9.8365 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2.0652 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2.0628 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2.365 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 6.4828 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 8.9733 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2.7828 \end{bmatrix} \quad (22)$$

Subtracting the Identity matrix I from $2N_{dg}$ gives us

$2N_{dg} - I =$

$$\begin{bmatrix} 1.1096 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1.545 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1.3846 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 8.8365 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1.0652 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1.0628 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1.365 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5.4828 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 7.9733 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.7828 \end{bmatrix} \quad (23)$$

Then multiply the Fundamental matrix N with $2N_{dg} - I$ matrix

$N(2N_{dg} - I) =$

$$\begin{bmatrix} 1.1703 & 0.421 & 0.2663 & 34.6188 & 0.0347 & 0.0333 & 0.2485 & 12.2721 & 26.1454 & 0.6362 \\ 0.0608 & 1.9661 & 0.2428 & 34.6192 & 0.0347 & 0.0334 & 0.2485 & 12.2722 & 26.1457 & 0.6976 \\ 0.0608 & 0.421 & 1.6509 & 34.6191 & 0.0347 & 0.0305 & 0.2485 & 12.2722 & 26.1456 & 0.6976 \\ 0.0608 & 0.4211 & 0.2663 & 43.4597 & 0.0347 & 0.0334 & 0.2485 & 12.2736 & 26.1488 & 0.6977 \\ 0.0608 & 0.4209 & 0.2662 & 34.608 & 1.0999 & 0.0333 & 0.2484 & 10.9818 & 26.1372 & 0.6973 \\ 0.0608 & 0.4213 & 0.2664 & 34.6405 & 0.0347 & 1.0962 & 0.2486 & 12.2798 & 26.1618 & 0.698 \\ 0.0609 & 0.4222 & 0.267 & 34.7149 & 0.0348 & 0.0334 & 1.6142 & 12.3061 & 26.218 & 0.6995 \\ 0.0609 & 0.4216 & 0.2666 & 34.667 & 0.0348 & 0.0334 & 0.2488 & 17.7719 & 26.1818 & 0.6985 \\ 0.0646 & 0.4477 & 0.2831 & 36.8102 & 0.0369 & 0.0355 & 0.2642 & 13.0489 & 35.7738 & 0.7417 \\ 0.0608 & 0.4212 & 0.2664 & 34.6303 & 0.0347 & 0.0334 & 0.2485 & 12.2762 & 26.1541 & 2.4806 \end{bmatrix} \quad (24)$$

Matrix N_{sq} is a matrix which comprises the squares of elements of the fundamental matrix N

$N_{sq} =$

$$\begin{bmatrix} 1.1126 & 0.0743 & 0.037 & 15.3486 & 0.0011 & 0.001 & 0.0331 & 5.0099 & 10.7525 & 0.1274 \\ 0.003 & 1.6193 & 0.0308 & 15.3489 & 0.0011 & 0.001 & 0.0331 & 5.01 & 10.7527 & 0.1531 \\ 0.003 & 0.0743 & 1.4216 & 15.3489 & 0.0011 & 0.0008 & 0.0331 & 5.01 & 10.7527 & 0.1531 \\ 0.003 & 0.0743 & 0.037 & 24.189 & 0.0011 & 0.001 & 0.0331 & 5.0112 & 10.7553 & 0.1531 \\ 0.003 & 0.0742 & 0.037 & 15.339 & 1.0662 & 0.001 & 0.0331 & 4.0118 & 10.7458 & 0.153 \\ 0.003 & 0.0744 & 0.037 & 15.3678 & 0.0011 & 1.0638 & 0.0332 & 5.0162 & 10.766 & 0.1533 \\ 0.003 & 0.0747 & 0.0372 & 15.4339 & 0.0011 & 0.001 & 1.3984 & 5.0378 & 10.8123 & 0.1539 \\ 0.003 & 0.0745 & 0.0371 & 15.3913 & 0.0011 & 0.001 & 0.0332 & 10.5067 & 10.7825 & 0.1535 \\ 0.0034 & 0.084 & 0.0418 & 17.3532 & 0.0012 & 0.0011 & 0.0375 & 5.6643 & 20.1302 & 0.1731 \\ 0.003 & 0.0743 & 0.037 & 15.3588 & 0.0011 & 0.001 & 0.0332 & 5.0133 & 10.7597 & 1.936 \end{bmatrix} \quad (25)$$

Then, N_2= N ($2N_{dg}$ – I) - Nsq that is the variance on number of visits, is obtained by this mathematical expression N ($2N_{dg}$ – I) already computed and deducting Nsq to get N_2 eq.26

$$N_2 = \begin{array}{c} \\ 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array} \begin{array}{c} \begin{array}{cccccccccc} 11 & 12 & 13 & 14 & 15 & 16 & 17 & 18 & 19 & 20 \end{array} \\ \begin{bmatrix} 0.0578 & 0.3468 & 0.2293 & 19.27 & 0.0337 & 0.032 & 0.215 & 7.2621 & 15.3929 & 0.5089 \\ 0.0578 & 0.3468 & 0.2121 & 19.27 & 0.0337 & 0.032 & 0.215 & 7.2622 & 15.3929 & 0.5445 \\ 0.0578 & 0.3468 & 0.2293 & 19.27 & 0.0337 & 0.03 & 0.215 & 7.2622 & 15.3929 & 0.5445 \\ 0.0578 & 0.3468 & 0.2293 & 19.271 & 0.0337 & 0.032 & 0.215 & 7.2624 & 15.3935 & 0.5445 \\ 0.0578 & 0.3467 & 0.2292 & 19.269 & 0.0336 & 0.032 & 0.215 & 6.97 & 15.3914 & 0.5443 \\ 0.0578 & 0.3469 & 0.2294 & 19.273 & 0.0337 & 0.032 & 0.215 & 7.2636 & 15.3958 & 0.5447 \\ 0.0579 & 0.3475 & 0.2298 & 19.281 & 0.0337 & 0.032 & 0.216 & 7.2684 & 15.4057 & 0.5456 \\ 0.0579 & 0.3471 & 0.2296 & 19.276 & 0.0337 & 0.032 & 0.216 & 7.2653 & 15.3993 & 0.545 \\ 0.0612 & 0.3637 & 0.2413 & 19.457 & 0.0357 & 0.034 & 0.227 & 7.3846 & 15.6436 & 0.5686 \\ 0.0578 & 0.3469 & 0.2294 & 19.272 & 0.0337 & 0.032 & 0.215 & 7.2629 & 15.3944 & 0.5446 \end{bmatrix} \end{array} \quad (26)$$

(i) (j)

3.3 Expected number of steps and Variance of number of steps.

Expected number of steps gives or provides the total number of steps staff or subjects take within the non-absorbing states before being absorbed or the cumulative movements of staff or subject within the non-absorbing state before absorption.

$\tau = N\zeta =$

This is the multiplication of the fundamental matrix N and unit column matrix epsilon

$$\begin{bmatrix} 1.0548 & 0.2725 & 0.1923 & 3.9177 & 0.0326 & 0.0314 & 0.182 & 2.2383 & 3.2791 & 0.3569 \\ 0.0548 & 1.2725 & 0.1754 & 3.9178 & 0.0326 & 0.0314 & 0.182 & 2.2383 & 3.2791 & 0.3913 \\ 0.0548 & 0.2725 & 1.1923 & 3.9178 & 0.0326 & 0.0287 & 0.182 & 2.2383 & 3.2791 & 0.3913 \\ 0.0548 & 0.2725 & 0.1923 & 4.9182 & 0.0326 & 0.0314 & 0.182 & 2.2386 & 3.2795 & 0.3913 \\ 0.0548 & 0.2724 & 0.1922 & 3.9165 & 1.0326 & 0.0314 & 0.182 & 2.003 & 3.2781 & 0.3912 \\ 0.0548 & 0.2727 & 0.1924 & 3.9202 & 0.0326 & 1.0314 & 0.1821 & 2.2397 & 3.2812 & 0.3915 \\ 0.0549 & 0.2733 & 0.1928 & 3.9286 & 0.0327 & 0.0315 & 1.1825 & 2.2445 & 3.2882 & 0.3924 \\ 0.0549 & 0.2729 & 0.1926 & 3.9232 & 0.0326 & 0.0314 & 0.1823 & 3.2414 & 3.2837 & 0.3918 \\ 0.0582 & 0.2898 & 0.2045 & 4.1657 & 0.0347 & 0.0334 & 0.1935 & 2.38 & 4.4867 & 0.416 \\ 0.0548 & 0.2726 & 0.1924 & 3.919 & 0.0326 & 0.0314 & 0.1821 & 2.239 & 3.2802 & 1.3914 \end{bmatrix} \times \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 11.5575 \\ 11.5752 \\ 11.5894 \\ 11.5933 \\ 11.354 \\ 11.5986 \\ 11.6214 \\ 11.6067 \\ 12.2624 \\ 11.5955 \end{bmatrix}$$

The cumulative movements of subjects within non-absorbing state before absorption is represented by matrix τ in eq.27 below

$$\tau = \begin{bmatrix} 11.5575 \\ 11.5752 \\ 11.5894 \\ 11.5933 \\ 11.354 \\ 11.5986 \\ 11.6214 \\ 11.6067 \\ 12.2624 \\ 11.5955 \end{bmatrix} \quad (27)$$

Variance on number of steps $\tau_2 = (2N - I)\tau - \tau_{sq}$

Computing the associated variance of number of step, 2N is determined, in which the fundamental matrix N is multiplied by 2 as expressed in the mathematical equation. Squaring each element of the cumulative movements before absorptionτ, to get(τ_{sq})

$$2N = \begin{bmatrix} 2.1096 & 0.545 & 0.3846 & 7.8354 & 0.0652 & 0.0628 & 0.364 & 4.4766 & 6.5582 & 0.7137 \\ 0.1096 & 2.545 & 0.3507 & 7.8355 & 0.0652 & 0.0628 & 0.364 & 4.4766 & 6.5583 & 0.7826 \\ 0.1096 & 0.545 & 2.3846 & 7.8355 & 0.0652 & 0.0573 & 0.364 & 4.4766 & 6.5583 & 0.7826 \\ 0.1096 & 0.5451 & 0.3847 & 9.8365 & 0.0652 & 0.0628 & 0.3641 & 4.4771 & 6.559 & 0.7826 \\ 0.1095 & 0.5448 & 0.3845 & 7.833 & 2.0652 & 0.0627 & 0.3639 & 4.0059 & 6.5561 & 0.7823 \\ 0.1096 & 0.5454 & 0.3849 & 7.8404 & 0.0652 & 2.0628 & 0.3643 & 4.4794 & 6.5623 & 0.783 \\ 0.1099 & 0.5465 & 0.3857 & 7.8572 & 0.0654 & 0.0629 & 2.365 & 4.489 & 6.5764 & 0.7847 \\ 0.1097 & 0.5458 & 0.3852 & 7.8464 & 0.0653 & 0.0628 & 0.3645 & 6.4828 & 6.5673 & 0.7836 \\ 0.1165 & 0.5795 & 0.409 & 8.3314 & 0.0693 & 0.0667 & 0.3871 & 4.7599 & 8.9733 & 0.8321 \\ 0.1096 & 0.5452 & 0.3847 & 7.8381 & 0.0652 & 0.0628 & 0.3642 & 4.4781 & 6.5604 & 2.7828 \end{bmatrix} \quad (28)$$

Squaring each element of the cumulative movements before absorptionτ, to get τ_2 $or(\tau$sq)

$$\tau_{sq} = \begin{bmatrix} 133.577 \\ 133.9848 \\ 134.3132 \\ 134.4051 \\ 128.9138 \\ 134.5277 \\ 135.0562 \\ 134.7156 \\ 150.3676 \\ 134.4556 \end{bmatrix} \quad (29)$$

Subtracting the Identity Matrix I from 2N gives matrix 2N – I matrix below

$$2N - I = \begin{bmatrix} 1.1096 & 0.545 & 0.3846 & 7.8354 & 0.0652 & 0.0628 & 0.364 & 4.4766 & 6.5582 & 0.7137 \\ 0.1096 & 1.545 & 0.3507 & 7.8355 & 0.0652 & 0.0628 & 0.364 & 4.4766 & 6.5583 & 0.7826 \\ 0.1096 & 0.545 & 1.3846 & 7.8355 & 0.0652 & 0.0573 & 0.364 & 4.4766 & 6.5583 & 0.7826 \\ 0.1096 & 0.5451 & 0.3847 & 8.8365 & 0.0652 & 0.0628 & 0.3641 & 4.4771 & 6.559 & 0.7826 \\ 0.1095 & 0.5448 & 0.3845 & 7.833 & 1.0652 & 0.0627 & 0.3639 & 4.0059 & 6.5561 & 0.7823 \\ 0.1096 & 0.5454 & 0.3849 & 7.8404 & 0.0652 & 1.0628 & 0.3643 & 4.4794 & 6.5623 & 0.783 \\ 0.1099 & 0.5465 & 0.3857 & 7.8572 & 0.0654 & 0.0629 & 1.365 & 4.489 & 6.5764 & 0.7847 \\ 0.1097 & 0.5458 & 0.3852 & 7.8464 & 0.0653 & 0.0628 & 0.3645 & 5.4828 & 6.5673 & 0.7836 \\ 0.1165 & 0.5795 & 0.409 & 8.3314 & 0.0693 & 0.0667 & 0.3871 & 4.7599 & 7.9733 & 0.8321 \\ 0.1096 & 0.5452 & 0.3847 & 7.8381 & 0.0652 & 0.0628 & 0.3642 & 4.4781 & 6.5604 & 1.7828 \end{bmatrix} \quad (30)$$

Finally, when all major matrices in obtaining the variance of number of steps or variance on total movement before absorption are gotten, by applying the mathematical expression

$\tau_2 = (2N - I)\,\tau - \tau_{sq}$ we get

$(2N - I)\,\tau - \tau_{sq} =$

$$\begin{bmatrix} 1.1096 & 0.545 & 0.3846 & 7.8354 & 0.0652 & 0.0628 & 0.364 & 4.4766 & 6.5582 & 0.7137 \\ 0.1096 & 1.545 & 0.3507 & 7.8355 & 0.0652 & 0.0628 & 0.364 & 4.4766 & 6.5583 & 0.7826 \\ 0.1096 & 0.545 & 1.3846 & 7.8355 & 0.0652 & 0.0573 & 0.364 & 4.4766 & 6.5583 & 0.7826 \\ 0.1096 & 0.5451 & 0.3847 & 8.8365 & 0.0652 & 0.0628 & 0.3641 & 4.4771 & 6.559 & 0.7826 \\ 0.1095 & 0.5448 & 0.3845 & 7.833 & 1.0652 & 0.0627 & 0.3639 & 4.0059 & 6.5561 & 0.7823 \\ 0.1096 & 0.5454 & 0.3849 & 7.8404 & 0.0652 & 1.0628 & 0.3643 & 4.4794 & 6.5623 & 0.783 \\ 0.1099 & 0.5465 & 0.3857 & 7.8572 & 0.0654 & 0.0629 & 1.365 & 4.489 & 6.5764 & 0.7847 \\ 0.1097 & 0.5458 & 0.3852 & 7.8464 & 0.0653 & 0.0628 & 0.3645 & 5.4828 & 6.5673 & 0.7836 \\ 0.1165 & 0.5795 & 0.409 & 8.3314 & 0.0693 & 0.0667 & 0.3871 & 4.7599 & 7.9733 & 0.8321 \\ 0.1096 & 0.5452 & 0.3847 & 7.8381 & 0.0652 & 0.0628 & 0.3642 & 4.4781 & 6.5604 & 1.7828 \end{bmatrix} \times \begin{bmatrix} 11.5575 \\ 11.5752 \\ 11.5894 \\ 11.5933 \\ 11.354 \\ 11.5986 \\ 11.6214 \\ 11.6067 \\ 12.2624 \\ 11.5955 \end{bmatrix} - \begin{bmatrix} 133.577 \\ 133.9848 \\ 134.3132 \\ 134.4051 \\ 128.9138 \\ 134.5277 \\ 135.0562 \\ 134.7156 \\ 150.3676 \\ 134.4556 \end{bmatrix} \quad (31)$$

From the above computations the variance on numbers of steps is represented eq.32 and the standard deviation is obtained by taking the square root of the varianceτ_2 as depicted below we get the standard deviation eq.33

$$\tau_2 = \begin{bmatrix} 127.2041 \\ 127.223 \\ 127.2373 \\ 127.2418 \\ 126.937 \\ 127.2493 \\ 127.2808 \\ 127.2606 \\ 127.7431 \\ 127.2449 \end{bmatrix} \quad (32)$$

$$\text{Standard deviation } \sigma = \sqrt{\tau_2} \begin{bmatrix} 11.2785 \\ 11.2793 \\ 11.28 \\ 11.2802 \\ 11.2666 \\ 11.2805 \\ 11.2819 \\ 11.281 \\ 11.3023 \\ 11.2803 \end{bmatrix} \quad (33)$$

Transient probabilities of visiting transient states $H = (N - I)N_{dg}^{-1}$

$$N - I = \begin{bmatrix} 0.0548 & 0.2725 & 0.1923 & 3.9177 & 0.0326 & 0.0314 & 0.182 & 2.2383 & 3.2791 & 0.3569 \\ 0.0548 & 0.2725 & 0.1754 & 3.9178 & 0.0326 & 0.0314 & 0.182 & 2.2383 & 3.2791 & 0.3913 \\ 0.0548 & 0.2725 & 0.1923 & 3.9178 & 0.0326 & 0.0287 & 0.182 & 2.2383 & 3.2791 & 0.3913 \\ 0.0548 & 0.2725 & 0.1923 & 3.9182 & 0.0326 & 0.0314 & 0.182 & 2.2386 & 3.2795 & 0.3913 \\ 0.0548 & 0.2724 & 0.1922 & 3.9165 & 0.0326 & 0.0314 & 0.182 & 2.003 & 3.2781 & 0.3912 \\ 0.0548 & 0.2727 & 0.1924 & 3.9202 & 0.0326 & 0.0314 & 0.1821 & 2.2397 & 3.2812 & 0.3915 \\ 0.0549 & 0.2733 & 0.1928 & 3.9286 & 0.0327 & 0.0315 & 0.1825 & 2.2445 & 3.2882 & 0.3924 \\ 0.0549 & 0.2729 & 0.1926 & 3.9232 & 0.0326 & 0.0314 & 0.1823 & 2.2414 & 3.2837 & 0.3918 \\ 0.0582 & 0.2898 & 0.2045 & 4.1657 & 0.0347 & 0.0334 & 0.1935 & 2.38 & 3.4867 & 0.416 \\ 0.0548 & 0.2726 & 0.1924 & 3.919 & 0.0326 & 0.0314 & 0.1821 & 2.239 & 3.2802 & 0.3914 \end{bmatrix} \quad (34)$$

Since Nd_g have been determined previously supra when calculating variance on number of visits $N_2 = N(2N_{dg} - I)$-Nsq we only take the inverse of Ndg

$$N_{dg}^{-1} = \begin{bmatrix} 0.9481 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.7858 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.8387 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.2033 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.9684 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.9696 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.8456 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.3085 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.2229 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.7187 \end{bmatrix} \quad (35)$$

Hence, we obtain the transient probability or probabilities of likelihood or chances of occurrence, H in eq.36

$$H = \begin{array}{c} \\ 11 \\ 12 \\ 13 \\ 14 \\ 15 \\ 16 \\ 17 \\ 18 \\ 19 \\ 20 \end{array} \begin{array}{c} \begin{array}{cccccccccc} 11 & 12 & 13 & 14 & 15 & 16 & 17 & 18 & 19 & 20 \end{array} \\ (j) \\ \begin{bmatrix} 0.0519 & 0.2141 & 0.1613 & 0.7966 & 0.0316 & 0.0304 & 0.1539 & 0.6905 & 0.7309 & 0.2565 \\ 0.0519 & 0.2142 & 0.1471 & 0.7966 & 0.0316 & 0.0305 & 0.1539 & 0.6905 & 0.7309 & 0.2812 \\ 0.0519 & 0.2142 & 0.1613 & 0.7966 & 0.0316 & 0.0278 & 0.1539 & 0.6905 & 0.7309 & 0.2812 \\ 0.0519 & 0.2142 & 0.1613 & 0.7967 & 0.0316 & 0.0304 & 0.1539 & 0.6906 & 0.7309 & 0.2812 \\ 0.0519 & 0.2141 & 0.1612 & 0.7963 & 0.0316 & 0.0304 & 0.1539 & 0.6179 & 0.7306 & 0.2811 \\ 0.052 & 0.2143 & 0.1614 & 0.7971 & 0.0316 & 0.0304 & 0.154 & 0.691 & 0.7313 & 0.2814 \\ 0.0521 & 0.2147 & 0.1617 & 0.7988 & 0.0316 & 0.0305 & 0.1544 & 0.6924 & 0.7329 & 0.282 \\ 0.052 & 0.2144 & 0.1615 & 0.7977 & 0.0316 & 0.0305 & 0.1541 & 0.6915 & 0.7319 & 0.2816 \\ 0.0552 & 0.2277 & 0.1715 & 0.847 & 0.0336 & 0.0323 & 0.1637 & 0.7342 & 0.7771 & 0.299 \\ 0.052 & 0.2142 & 0.1613 & 0.7968 & 0.0316 & 0.0304 & 0.154 & 0.6908 & 0.7311 & 0.2813 \end{bmatrix} \end{array} \quad (36)$$

H, which is the Transient Probability gives the probability of visiting transient state j when starting at a transient state i, which is the (i j)-entry of the matrix. The numbering on the side and top represent

state as depicted in Table 1. supra to facilitate cross referencing. In summary, H- matrix estimates the probability (chances) or likelihood of occurrence of subjects transiting amongst the non-absorbing state. For instance, the column j-14. and j-19. The (i-j)th transiting to medical treatment case (minor) j-14 or Unsafe act j-19 the likelihood or chances are high, revealing a Propensity for a worst case scenario in the future if is not checked.

The Markov Chain model effectively predicted accident outcomes, identified trends, and revealed hidden patterns in industrial accident data. The study found a high prevalence of severe medical treatment cases and demonstrated that the transition probability matrix exhibited stochastic regularity and ergodicity. Personnel mobility across hazardous states was tracked to absorption points. In Nigeria's NNPC, field staff changed positions 11 times before reaching one of 10 absorbing states, with assshigh variance of 127. Low long-run probabilities of absorption were linked to strong safety culture or facility inactivity. The study provides a robust framework for accident trend analysis and prediction.

4.0 CONCLUSION AND RECOMMENDATION

4.1 Conclusion

This study successfully identified key state transitions — near misses, unsafe conditions, and unsafe acts — that significantly impact incident levels, providing insights for optimizing injury prevention policies. Findings reveal a hazardous work environment, where worker accidents stem from poor safety adherence, outdated machinery, and inadequate supervision. The Markov Chain model effectively analyzed accident trends, highlighting high-risk areas and warning both employers and employees of potential dangers. A high prevalence of severe medical treatment cases was noted across NNPC subsidiaries, leading to increased medical costs, lost productivity, and workload imbalances.

4.2 Recommendation

Based on the findings, the study recommends targeted safety measures, including improved training, retraining programs, and the assignment of safety officers to high-risk departments, particularly maintenance. By implementing these strategies, the organization can enhance safety culture, reduce accidents, and develop a robust safety system tailored to its strategic business units, ensuring long-term operational efficiency and worker protection.

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BEYOND THE STAGE: THE ROLE OF NIGERIAN THEATRE IN ENHANCING EDUCATIONAL DEVELOPMENT THROUGH CULTURAL NARRATIVES

[1]Margaret Oghie Zibaghafa and [2]Tarabina Veronica Pamo
[1,2] Department of General Studies, Bayelsa State Polytechnic, Aleibiri, Bayelsa State,
mzibaghafa @gmail.com
tarabinaveronica@gmail.com

Abstract
Despite its rich cultural significance, the role of Nigerian theatre in enhancing educational development has often been overlooked in formal education systems. While theatre serves as a vital medium for transmitting cultural narratives, its integration into educational curricula remains minimal. The underutilization of theatre in Nigerian schools and universities limits students' exposure to this dynamic tool for fostering critical thinking, social awareness, and cultural identity. This study sought to explore how Nigerian theatre could be effectively incorporated into education to promote cognitive, emotional, and social development. The study is anchored on Vygotsky's Socio-Cultural Theory, emphasizing the role of social interaction and cultural context in cognitive development. A qualitative research design was employed, with data analyzed using content analysis to identify key themes and patterns in the selected theatre performances and related literature. The findings revealed that Nigerian theatre significantly enhances students' understanding of cultural identity, moral values, and social issues. Through active engagement with cultural narratives, students developed critical thinking, empathy, and creativity. The study concluded that integrating Nigerian theatre into the formal education system could foster a more holistic cultural development in Nigerian theatre industries. It was recommended that Nigerian theatre should be integrated into the educational curriculum to enhance cultural understanding and promote critical thinking among students.

Keywords: Nigerian theatre, educational development, cultural narratives, socio-cultural Theory and critical thinking

1.0 INTRODUCTION

The Nigerian theatre has become a fundamental force to promote educational growth within communities, skilfully combining attractive narratives with rooted cultural lessons. This dynamic intersection serves not only to entertain but also to educate, transform traditional education modes into more shocking and community -oriented learning experiences. By taking advantage of the powerful storytelling, the Nigerian theatre offers the public identifiable narratives that resonate deeply with their cultural background, thus improving the learning process.

A significant aspect of Nigerian theatre is its ability to encapsulate complex social problems within its narratives, which serve as educational tools. For example, traditional stories are often transformed into theatrical actions that address issues such as morality, social justice and community values. In this way, the theatre acts as a mirror that reflects the social values of Nigeria and at the same time challenges the public to think critically about their own circumstances (Okam, 2016). The incorporation of entertainment education techniques in the actions helps to retain the attention of the audience, making the impart of cultural lessons more effective (Iwuchukwu, 2020).

In addition, the socio -economic effects of Nigerian theatre cannot be underestimated. The renewal and revitalization of institutions such as the National Theatre of Arts in Lagos has caused a renewed interest and sponsorship in the performing arts (Guanah and Ijeoma, 2023). This rebirth not only reinforces local economies but also facilitates educational opportunities for candidates and for artists. As such, the theatre becomes a center for community learning, where people of various origins can join to explore their shared heritage and learn from each other.

The narratives presented at the Nigerian Theatre are often full of folklore and local traditions, providing a rich tapestry of cultural lessons that inform the identity of the community. According to Adejube, et al. (2023), the use of entertainment modes within several Nigerian settlements has played an integral role in the preservation of cultural legacies through the narration of stories. This preservation not only encourages a sense of pride among community members but also serves as an informal education platform in which young people can learn about their history and cultural ethos of the elderly in a relatable format.

The impact of the Nigerian theatre on community learning extends beyond mere entertainment; It covers the transformation of traditional educational methodologies. Conventional educational systems often depend largely on memory memorization and theoretical knowledge, which can disconnect students (Okam, 2016). In contrast, the theatre introduces

experimental learning, in which the public is encouraged, especially students, to actively commit to the narrative. This form of commitment not only deepens understanding, but also encourages empathy and emotional intelligence, key components in holistic education.

In addition, theatre workshop initiatives within communities have been fundamental to promote literacy and critical thinking skills. These workshops often imply collaborative narration, where participants contribute their narratives, reflecting their own social experiences and challenges. Such commitment encourages dialogue and co-learning, reinforcing the idea that education is a collaboration process (Iwuchukwu, 2020). This participatory approach aligns well with the contemporary educational approach in the student -centered pedagogy, moving away from the master -centered paradigms.

Statement of the Problem

In contemporary Nigerian education, the role of theatre in academic development is often overlooked, despite its historical and cultural significance. Theatre has long been a key component of Nigerian society, used not only for entertainment but also as a vehicle for conveying important cultural narratives, moral lessons, and societal values (Ogunbiyi, 1981). However, its integration into formal educational systems, particularly in schools and universities, remains minimal. While the potential for theatre to enhance educational outcomes is widely acknowledged, it has not been systematically explored or implemented as an educational tool in many academic institutions across Nigeria (Akinyele, 2012).

The rich cultural narratives embedded in Nigerian theatre present a unique opportunity to promote educational development, yet these are rarely utilized within the context of formal education. Nigerian theatre, which draws heavily from diverse cultural traditions and historical events, offers a platform for students to engage deeply with their cultural heritage, while also developing critical thinking and empathy (Nwankwo, 2015). However, despite the significant cultural and educational potential of theatre, the current academic curriculum does not widely incorporate it as a formal part of the learning experience. Most educational systems still prioritize conventional academic subjects, sidelining the use of performing arts such as theatre to enhance intellectual and emotional development.

Moreover, while Nigerian theatre plays a central role in transmitting societal values and addressing contemporary issues, its educational impact remains under-researched. Studies have largely focused on its role as a medium for political commentary or social change, with limited attention given to its capacity for promoting educational development (Oloruntoba, 2009). Theatre performances have the ability to help students understand complex societal problems, engage in moral reasoning, and appreciate diverse cultural perspectives. Therefore, integrating Nigerian theatre into formal education could offer a holistic approach to student development by incorporating cognitive, social, and emotional learning (Nwankwo, 2015).

Given these gaps, there is a pressing need to explore how Nigerian theatre can be harnessed to enhance educational outcomes and integrated into academic curricula more effectively. This study aims to address the underutilization of theatre as an educational tool among students, fostering cultural awareness, critical thinking, and social engagement. To this end, this paper seeks to:

i. examine the role of Nigerian theatre in promoting educational development: This objective will investigate how theatre performances can enhance learning outcomes by promoting critical thinking, creativity, and social awareness among students.
ii. analyze the impact of cultural narratives in Nigerian theatre on students' cultural identity and social understanding: This will explore how cultural stories, traditions, and historical narratives presented in theatre performances contribute to students' understanding of their heritage and societal roles.
iii. identify the challenges and opportunities for integrating Nigerian theatre into the formal education system: This objective will assess the barriers to incorporating theatre into the curriculum and suggest strategies for its effective integration into educational practices.

2.0 LITERATURE REVIEW

2.1 Conceptual review

Educational Development

Educational development can be defined as the process to improve the knowledge, and skills of individuals within a company, thus promoting personal growth and allowing national progress. This multifaceted concept includes various components, including access to quality education, the relevance of the curriculum, the equitable allocation of resources and the opportunities for permanent learning. The meaning of educational development extends beyond individual learnings; It has a crucial role in promoting social cohesion and making economic growth advance. Stiglitz and Greenwald (2014) underline the importance of creating a "learning

company", which is essential for social progress and innovation supported.

In addition, the impact of education on personal growth is profound as it facilitates individual self-implementation and social mobility. Sanford (2017) argues that the interaction between oneself and society is fundamental in promoting both individual development and social change. The education acts as a catalyst for personal empowerment, equipping people with the tools necessary to navigate in complex social landscapes.

In terms of social progress, education contributes to the creation of committed and informed citizens capable of participating in democratic processes. Spiel et al. (2018) demonstrated that a well -educated population is more likely to support social justice, equity and sustainable practices. This is vital to face contemporary challenges such as inequality and environmental sustainability.

From an economic point of view, education is a key engine of national development. Fägerlind and Saha (2016) provide a comparative analysis of educational systems, illustrating how investments in education are related to economic progress in different global contexts. In addition, Bowen (2018) clarifies the individual and social value of higher education, strengthening the idea that the educational achievement is closely linked to the productivity of the workforce and, ultimately, to economic prosperity.

Finally, educational development is a global framework that has a significant impact on personal growth, the progress of society and economic progress, underlining the need for continuous investments and reforms in educational systems all over the world.

Cultural Narratives

The concept of culture is multifaceted, encompassing various elements, such as beliefs, values, customs and narratives that shape collective identity in various societies. The cultural narratives, defined as the stories and discourses that a community shares, play a critical role in building these identities. These narratives help individuals to understand their experiences and position themselves in their broader social context (McAdams & Guo, 2017). They serve not only as structures for personal identity, but also influence community values and collective memory, guiding social norms and behaviors (McLean & Syed, 2016).

Cultural narratives in the formation of identity; it is underlined by their power to integrate and articulate the experiences of various individuals within a society. According to Khattak (2023), narratives exert the power to shape individual and collective understanding, providing a unifying language through which communities can express their unique realities and shared stories. Moreover, as highlighted by Bonnell and Hunt (2023), contemporary studies emphasize the need to go beyond traditional approaches to culture, defending the examination of dynamic narratives that adapt and evolve in response to changes in social contexts.

However, it is essential to question the implications of cultural narratives critically. As discussed by Brook, O'Brien and Taylor (2020), culture can also perpetuate negative stereotypes and practices of exclusion, highlighting the need for a different exploration of narratives. Thus, while cultural narratives can forge collective identities and communicate shared values, they can also reinforce divisions. The interaction between these aspects reveals the complexity of culture as a force that can join and divide, pressuring more research on how societies can cultivate inclusive narratives that reflect a multiplicity of identities.

Beyond the Stage and Nigerian Theatre

Nigerian theatre has long been a dynamic force to shape cultural identity and promote social change, extending far beyond traditional stage performance. The evolution of this theatre reflects the complexities of Nigerian society, frequently approaching contemporary questions that resonate with the local and global public. Bakare (2018) provides a critical examination of socio-political performance in traditional Yoruba Allarinjo and modern itinerant theatre, focusing on the works of influential playwrights such as Hubert Ogunde, Wole Soyinka, Ola Rotimi and Femi Osofisan. This exploration underlines how these artists fill the gap between traditional and contemporary forms, thus creating a rich tapestry which influences cultural identity.

In addition, the impact of the Nigerian theatre is amplified by its incorporation of various supports, including cinematographic and digital platforms, which have become crucial to extend its scope. The importance of the metatheatrical elements in this context is highlighted by Anwar (2016), which explains how distancing techniques in the Nigerian drama force the public to reflect critically on societal issues. This reflexive commitment deepens not only the understanding of the spectator, but also improves cultural dialogue surrounding these questions, thus emphasizing the role of the theatre as a catalyst for social transformation.

In recent years, the contemporary Nigerian theatre has adapted to the challenges of a changing world, answering urgent social, political and economic questions. Olatunji and Ojo (2024) focus on the case

of "Night of Ijalo" by Oki, illustrating how director's choices in contemporary theatre can considerably affect the perceptions and interpretations of the public. Their work underlines the importance of innovative approaches in the practice of theatre, demonstrating how young directors reinvent traditional stories and incorporating modern sensitivities to resonate with a various audience. This evolution means not only a transition in the style of performance, but also contributes to continuous dialogue on cultural identity in a globalized context.

Digital platforms, including social media and streaming services, are still expanding the scope of Nigerian theatre, creating new opportunities for engagement and participation. Asagba (2014) maintains that the theatre must adapt to the challenges of the 21st century, in particular in response to a rapidly evolving global dynamic. The proliferation of digital media has enabled theatre practitioners to engage with a wider audience, facilitating not only the dissemination of cultural stories, but also the incorporation of various points of view which enrich the theatrical experience. This interconnection helps to shape a more nuanced understanding of Nigerian identity, illustrating how the theatre serves as a conduit to global prospects.

The intersection of various mediums improves the effectiveness of Nigerian theatre as a tool for cultural reflection and social criticism. By transcending traditional performances, the Nigerian theatre invites the public to reflect on their identity, their societal challenges and the broader world narrative. The integration of theatre with literature and cinema illustrates this multiple facet approach, creating a platform that promotes dialogue and understanding through cultures. The dynamic interactions between these forms highlight the adaptability of the theatre as a vital cultural expression, celebrating the richness of the Nigerian heritage while attacking universal themes that resonate through borders.

Finally, the transformative power of the Nigerian theatre lies in its ability to transcend traditional borders, to influence cultural identity, to cause social change and to promote global dialogue. Thanks to the works of pioneering artists and the use of various platforms, the Nigerian theatre continues to evolve, guaranteeing its relevance in an increasingly interconnected world. The exploration of performance through traditional, digital and cinematographic fields enriches both individual and collective identity, solidifying its role of cornerstone of cultural expression and societal reflection.

Theoretical Underpinning

The study is anchored in Vygotsky's **Socio-Cultural Theory** (1978), a foundational framework for understanding the connection between culture, society, and cognitive development. Lev Vygotsky, a Russian psychologist, developed this theory in the early 20th century, emphasizing that human learning occurs through social interactions and is deeply influenced by cultural contexts. Vygotsky's theory proposes that cognitive functions are not only shaped by the individual's personal experiences but also by the social interactions and cultural tools that surround them. In this sense, the theory underscores the role of language, symbols, and cultural practices in shaping how individuals think and learn. For Vygotsky, learning is a collaborative process, facilitated by teachers, peers, and community, through a process known as **scaffolding**, where more knowledgeable individuals provide guidance to learners. This theory is particularly relevant to the role of Nigerian theatre in education, as it emphasises how cultural narratives in theatre performances can foster social and cognitive development, enabling students to engage actively with their cultural heritage.

The **assumptions** of Socio-Cultural Theory are particularly important in understanding the educational benefits of theatre in Nigeria. Vygotsky argued that cognitive development is not solely an individualistic process but one that occurs within a cultural framework, mediated by language and social interactions (Vygotsky, 1978). One of the key assumptions is that learning occurs first at the **interpersonal level** (between individuals) and later at the **intrapsychic level** (within the individual). For instance, in Nigerian theatre, students can learn collaboratively through discussions and shared experiences of performance, which in turn shape their internal understanding of cultural narratives. Another assumption is the concept of the **Zone of Proximal Development (ZPD)**, which refers to the difference between what learners can do independently and what they can achieve with assistance from more knowledgeable individuals. In the context of Nigerian theatre, the ZPD can be seen in how students initially grasp cultural ideas through theatre and later internalise these concepts to form their own understanding of social issues, historical events, and moral values.

Vygotsky's **Socio-Cultural Theory** has a direct and powerful relevance to the study of Nigerian theatre's role in enhancing educational development through cultural narratives. In the context of Nigerian theatre, this theory provides a robust lens for analysing how theatre, as a cultural practice, serves as a vehicle for transmitting cultural knowledge and societal values. Theatre performances are a rich source of cultural

narratives, providing students with an opportunity to engage in meaningful social learning. Through the collaborative nature of theatre, students gain a deeper understanding of societal issues, develop empathy, and enhance their cognitive skills. These narratives allow learners to access culturally specific knowledge that may not be readily available through traditional textbooks or classroom instruction. By incorporating these cultural experiences into the educational system, Nigerian theatre can act as a tool for bridging the gap between formal education and cultural identity, thus fostering a more comprehensive approach to student development. Therefore, Vygotsky's theory underscores the importance of context and interaction in learning and highlights how Nigerian theatre can be a critical resource for educational growth in contemporary Nigerian classrooms.

3.0 METHOD

The study employed a qualitative research approach, relying on secondary sources of data. These sources included textbooks, newspapers, academic journal articles, government publications, and other scholarly materials. The collected data were then analyzed using both content and thematic analytical methods, allowing for a deeper understanding of the subject matter and the identification of key patterns and themes within the materials.

4.0 RESULTS AND DISCUSSION

Role of Nigerian theatre in promoting educational development

The Nigerian theatre serves as a powerful vehicle for educational development, significantly improving critical thinking, creativity and social awareness of students through attractive actions and active participation of the community. The dynamic nature of the Nigerian theatre, rooted in rich cultural traditions, has been established as a vital tool in educational environments, promoting essential skills and values that extend beyond the classroom. This document analyzes the multilayer influence of the Nigerian theatre in the educational scenario, focusing on its contributions to cognitive and moral development among students.

A significant impact area is the improvement of critical thinking skills. The theatre encourages students to analyze, criticize and interpret several stories, promoting a deeper understanding of social problems. Akínṣọlá (2023) underlines the effectiveness of the theatre programs in education in secondary schools, which demonstrates that participation in theatrical activities facilitates improved learning results not only in concepts of moral value but also of moral value. When evaluating characters and stories, students learn to evaluate different perspectives, allowing them to address problems more analytically. This critical commitment equips them with skills that are essential to navigate the complexities of contemporary society.

In addition, creativity is deeply improved through theatre practice. Participating in theatrical performances promotes imaginative thinking and innovation. This is repeated in the review of the artistic education of Lukaka (2023), which highlights the direct correlation between participation in creative arts and the development of critical and creative thinking skills. The immersive experience of the theatre invites students to express themselves artistically and at the same time foster an environment conducive to experimentation and self-discovery. As a result, students who participate in the Nigerian Theatre demonstrate greater creative abilities that can benefit several aspects of their personal and academic lives.

Social conscience is another critical dimension influenced by the Nigerian theatre. To commit to works that portray the social problems of real life allows students to develop empathy and a nuanced understanding of their community. Ugwuoke, Ikeokwu and Agbedo (2023) support this perspective by identifying drama and theatre as an instrumental in the promotion of social development. Through the representation of pressing problems such as corruption, gender inequality and poverty, the theatre actively involves students, which leads them to reflect on their social values and responsibilities. This reflection is crucial to cultivate a generation of socially aware individuals equipped to make change within their communities.

Community participation is inherent in the fabric of the Nigerian theatre, which often transcends classroom limits. When students participate in community theatre projects, they not only perfected their performance skills but also get involved with a broader audience. Okoye (2022) emphasizes the role of drama in cognitive development, specifically in theatre projects applied by Unizik. These projects serve as platforms for students to share their voices and concerns while contributing to local narratives. The process encourages collaboration, allowing students to work collectively towards common objectives and improve their sense of belonging within their communities.

In addition, Olayiwola (2023) analyzes the need to rethink the media arts instruction in Nigerian universities, indicating that an integrated approach that includes theatrical practices can generate significant benefits for students. As higher institutions evolve to meet the demands of a world that changes rapidly, the incorporation of practical

theatrical experiences in the curricula can help cultivate adaptable graduates and vision of the future. Similarly, an education focused approach that prioritizes the integration of the theatre can improve the skills sets required in several professional fields, including communication, public discourse and teamwork.

Students on stage also gain from the dynamics of school performances, as noted by Adedina (2024), who examines the narratives surrounding student participation in theatrical productions. These experiences not only foster individual growth but also strengthen community bonds, as they frequently engage family members and local residents. This blend of personal development and community involvement empowers students, providing them with a platform to address issues that matter to them and their peers. The performance becomes a tool for dialogue, which allows students to challenge social norms and promote awareness of critical problems.

We cannot ignore the challenges of teaching and learning dramatic arts in Nigerian tertiary institutions, as identified by Olaniyan (2015). However, the potential for the theatre to contribute significantly to educational development is still unanswered. It is essential that those responsible for formulating educational policies recognize and promote the integration of theatre in primary and secondary education systems, promoting an appreciation for the arts among students from an early age. Overcoming existing barriers, such as insufficient resources and lack of training in instructors, can further improve the positive theatre impact on educational results.

The Nigerian theatre plays a crucial role in the configuration of educational development by improving critical thinking, creativity and social awareness among students. Through attractive actions, community participation and a collective approach to real world issues, the theatre encourages the essential skills of life that train students to navigate their educational trips and make significant contributions to society. By adopting the potential of theatre, educators and policy formulators can promote a holistic and enriched educational experience that prepares students for personal and social challenges. The future of Nigerian education may depend on its ability to take advantage of the transforming power of the arts.

Impact of cultural narratives in Nigerian theatre on students' cultural identity and social understanding

The Nigerian theatre plays a fundamental role in modelling the cultural narratives that significantly influence the cultural identities of students and social understandings. Through stories, performances and traditions, the theatre acts both from mirror and a mold of social values, effectively cultivating connections to the heritage and outline of social roles. It is in this theatrical space that students explore their identities, promoting a deeper understanding of their cultural roots and the implications of those roots in contemporary society.

The integration of traditional narratives in the Nigerian theatre offers students a basis to engage with their cultural identities. The educational potential of the theatre is highlighted by James (2018), which discusses how the theatre in education can curb the negative effects of modernity on Nigerian youth. This commitment is essential as it affects values and knowledge that resonate with the cultural environment of students, preserving ancestral traditions while adapting to modern circumstances. Aguoru (2023) underlines this point, underlining how much the dramatic and theatrical arts redefine the cultural identity. By participating or witnessing theatrical performances, students meet stories that articulate their cultural narratives, allowing them to appreciate their inheritance and inform their identities in the wider social context.

In addition, historical and cultural contexts are fundamental to model Nigerian identities as discussed by Jonathan and Dantonka (2024). They say that the understanding of the intertwined nature of historical narratives and cultural expressions allows students to grasp their social roles more effectively. The reflections of the past that manifest themselves in theatrical services not only remind students of their roots but also push the critical speech on current social challenges. This alignment between historical narrative and contemporary experience allows students to see themselves as active participants in the history of their nation.

The impact of popular culture, in particular Nollywood, on the formation of identity cannot be overrated. Ndu (2024) explores the perceptions of the public of the role of Nollywood in redefining the Nigerian identity through the narrative, which parallel to the narratives depicted in the theatre. While students engage with these narratives, face various portraits of the cultural identity that challenge or affirm their understanding of themselves and society. Iseyen and Effeiong (2017) further articulate this notion, stating that the influence of Nollywood has permeated the educational sphere, accessible to students of different extraction. Therefore, these forms of the media and the theatre collectively model the perceptions of the students on the heritage and provide roads to explore the way these identities interact with social expectations.

The new wave of performance spaces has also favored innovative approaches to cultural pedagogy, as highlighted by Amonyeze et al. (2023). The Drive-in theatre, for example, revitalizes traditional performance by offering students a unique platform to engage with cultural narratives in ways that resonate with contemporary social dynamics. The transformation of the panorama of services invites an exploration of identity and social roles in an evolving digital era, allowing students to negotiate their experiences and heritage in this context.

The theatrical practices engaged further extend the educational implications of the Nigerian theatre. Adegbamigbe et al. (2020) provide insights on how theatre can work as a tool for social change and cultural reflection. By participating in shows that deal with social issues, students become aware of their civil roles and responsibilities, strengthening their connections with the needs of contemporary heritage and society. This element of commitment equips students with a nuanced understanding of the impact that they can have within their communities, underlining the bridge between cultural narratives and social action.

Challenges and opportunities for integrating Nigerian theatre into the formal education system

The integration of Nigerian theatre into formal education has both important challenges and notable opportunities. Its implementation in education programs could improve cultural assessment, creativity and critical thinking among students. However, substantial barriers hinder this process, requiring in-depth examination and strategies for effective incorporation.

One of the main challenges in the integration of Nigerian theatre into the programme is the lack of trained educators capable of providing quality instructions in this area. As Asen (2015) noted, the training of teachers in theatre arts in education colleges is responsible for difficulties. This gap in competent education can lead to a lack of understanding and appreciation of the subject among the students, subsequently affecting their commitment and their performance. In addition, the inadequate emphasis on the practical training of theatre in the program undermines experiential learning which is crucial in artistic education (Onyemucha, 2017).

In addition, the Nigerian education system often prioritizes the main subjects such as mathematics and sciences, marginalizing the arts, including theatre. Sani (2014) maintains that this exclusion limits the exposure of students to various forms of expression and to the development of critical thinking. The relegation of the theatre to a secondary status in the educational framework contributes to a lack of resources, such as funding and facilities, necessary to cultivate a dynamic theatrical culture in schools. Consequently, the opportunities for students to engage with their cultural heritage through the theatre are considerably reduced.

In addition to institutional obstacles, societal factors play a role in the challenges faced by the integration of theatre in education. There is often an omnipresent perception among parents and tutors that artistic education does not give practical advantages on a competitive labor market. This skepticism can influence the attitudes of students and educators towards the theatre as a precious academic prosecution, leading to an underestimation cycle (Falade and Adeyemi, 2015).

Despite these challenges, the integration of Nigerian theatre into formal education holds immense potential. It can serve as a powerful tool to enhance national identity and foster a cultural consciousness among students, promoting a sense of belonging and community. The theatre also introduces innovative teaching methods that can engage a diverse range of learners, particularly those in rural and underserved areas (Olaniyan, 2015). This integration can equip students with essential skills such as effective communication, collaboration, and creative problem-solving.

To effectively implement Nigerian theatre in the educational program, several strategies can be adopted. First, the increase in investments in the training of educators and professional development is vital. This not only includes traditional education qualifications, but also practical theatre experiences that allow teachers to provide quality education in dramatic arts (Aninye and Okome, 2024). The integration of mentoring programs where experienced theatre practitioners collaborate with teachers can fill this gap.

Another strategy involves a curriculum reform to raise the status of the arts in the global educational framework. By aligning theatrical education on fundamental subjects and demonstrating its relevance for the life of students, educational authorities can promote a more complete approach to learning. The integration of interdisciplinary projects that mix theatre with technology or social studies can illustrate the practical applications of theatrical skills (Onyema, 2019).

In addition, the commitment with parents and stakeholders in the community is crucial. Educators should defend the value of theatrical education by presenting successful programs and their impact on the results of students. The holding of community programs that celebrate local theatre can strengthen

the importance of cultural arts in the educational story, gradually changing societal perceptions.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1Conclusion

The study on "Beyond the Stage: The Role of Nigerian Theatre in Enhancing Educational Development through Cultural Narratives" explored the transformative power of Nigerian theatre as an educational tool, emphasizing its deep connection to cultural heritage and societal values. The findings revealed that Nigerian theatre plays a pivotal role in shaping students' understanding of their cultural identities, promoting critical thinking, and enhancing social awareness. Through performances that integrate rich cultural narratives, theatre provides students with an engaging platform to not only learn about historical and social issues but also to reflect on their personal and collective roles within society. This engagement with culture through theatre serves as an important tool for fostering empathy and emotional intelligence among students, enriching their learning experiences beyond the confines of traditional academic methods.

Furthermore, the study highlighted the significance of integrating Nigerian theatre into formal educational settings to maximize its educational potential. Despite the challenges faced, such as insufficient trained educators and a curriculum that prioritizes traditional subjects over the arts, the potential benefits of incorporating theatre into education are profound. The research underscores the importance of policy reforms that embrace arts-based education and the need for greater investment in training educators to effectively use theatre as a medium for teaching. It is through these strategic integrations that Nigerian theatre can foster a more holistic and culturally relevant educational experience for students, helping to bridge the gap between academic learning and cultural identity.

Thus, Nigerian theatre stands as a powerful medium for educational transformation, offering a unique and impactful way to enhance students' cognitive, emotional, and social development. As the study has shown, theatre's ability to communicate cultural narratives and societal issues through compelling performances makes it an indispensable tool in shaping a generation of socially aware, empathetic, and critically engaged individuals. By integrating Nigerian theatre more thoroughly into educational systems, there is a tremendous opportunity to cultivate a deeper connection between students and their cultural heritage, preparing them for the challenges of a rapidly evolving world.

5.2 Recommendations

Based on the major findings, the following recommendations were stated:

1. **Integration of Theatre into Education Curricula**: It is recommended that Nigerian theatre be formally integrated into the national education curriculum, particularly in secondary and tertiary institutions. This integration would foster a deeper connection to cultural heritage and enhance critical thinking, creativity, and social awareness among students. Schools and universities should prioritize the inclusion of theatre as both a subject and a tool for experiential learning, enriching the educational experience.
2. **Teacher Training and Professional Development**: To effectively utilize theatre as an educational tool, it is recommended that educators undergo specialized training in theatre arts. This would ensure that teachers have the necessary skills to integrate dramatic arts into their teaching practices. Professional development programmes should focus on practical theatre skills and methods for using theatre to teach critical thinking, social issues, and cultural identity, empowering teachers to foster an engaging learning environment.
3. **Community-Based Theatre Programmes**: It is recommended that community-based theatre initiatives be expanded to promote social and cultural education. These programmes can encourage active participation in storytelling and performance, enhancing students' connection to their communities and cultural history. By involving students, families, and local residents, these initiatives can foster a sense of shared identity and social responsibility, reinforcing the role of theatre as both an educational and community-building tool.

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