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FROM THE CHIEF EDITOR

OSCOTECH Journal of Science, Technology and Management (OJOSTAM) is produced bi-annually with TETFund assistance as an avenue to present researchers' finding, ideas and knowledge in the various fields to the outside world. This third edition is, as usual, a rich collection of well-researched articles by a wide spectrum of experienced, seasoned academics and practitioners in various fields of science, technology and management.

Our appreciation goes to the Executive Secretary and members of the Tertiary Education Trust fund (TETFund) Abuja for the Journal Research Grant to produce the Journal at no cost to the contributors.

The Rector, Dr. S.A.O. Adegoke, who is also the Chairman, Editorial Board, is appreciated for his purposeful leadership and unalloyed for the Journal. The College Management as well as the Publication Committee deserve commendation for their various roles in the success of this publication

This Third Edition is made possible through the efforts of our esteemed reviewers, external assessors, and editors who have given their time and energy to the publication processes. It is noteworthy to state that your contributions are commendable.

Finally, our appreciation goes to the various academics and scholars whose articles are enlisted in this current edition.

You are all appreciated.

Dr. J. L. Olajide
Chief Editor & Director, Research, Publications and Innovation,
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EDITORIAL POLICY and CALL FOR PAPERS
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-1-

IMPACT OF EXCHANGE RATE ON THE INFLOW OF FOREIGN DIRECT INVESTMENTS IN NIGERIA FROM 1986-2020

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Abstract

This paper analyzed the impact of the exchange rate on the inflow of foreign direct investment in Nigeria for the period from 1986 to 2020 making use of annual time series data sourced from the database of the World Development Indicator (WDI) and Central Bank of Nigeria (CBN) 2021 Statistical Bulletin. The method employed for this investigation was the Autoregressive Distributed Lag (ARDL) approach of estimation, the data analysis began with the finding out the unit root properties of the variables. The Philips-Perron (PP) unit root test was employed and the test reveals that the variables were either integrated of order $I(0)$ or order $I(1)$. This necessitated the use of the Bounds testing approach in finding out the cointegration among the variables. Analysis using the Bounds testing approach to co-integration revealed the existence of long-run relation among the variables of the models. In determining the impact of the exchange rate on foreign direct investment inflow in Nigeria, the study estimated an ARDL model and the finding revealed that the exchange rate affects FDI in both the long and short run. The study recommends that government should make the exchange rate stable to increase the inflow of foreign direct investment for desired economic growth in the country.

Keywords: Autoregressive Distributed Lag, Economic growth, Exchange Rate, Foreign Direct Investment

1.1 Introduction

The exchange rate is the price of a particular currency with the other. It can also be regarded as a means by which the prices of goods in two different countries are linked together. According to Obansa et al (2013), the exchange rate shows the extent of involvement of the external sector in international trade. The issue of the exchange rate system has been a key topic of debates in international finance especially in developing economies, with many economies trying to liberalize trade as means of achieving economic growth. The exchange rate can also be regarded as one of the vital and helpful macroeconomic variables that a country makes use of to achieve its macroeconomic objectives of economic growth.

The conventional school is of the view that depreciation of currencies will revamp trade balance; resolve the problems of balance of payment and increase output and employment if the Marshall-Lerner conditions are satisfied. The condition is that currency depreciation will result in the growth of output if the total sum of the price elasticity of demand for exports and the price elasticity of import demand is more than one. The basis of driving the direct effects is to boost the local production of tradable goods, strengthen the competitiveness of export firms in international markets and encourage local firms towards the utilization of more local raw materials (Iyoboyi & Muftau, 2014). One of the vital objectives of macroeconomic policy is significant growth in the economy of a country which is determined in terms of incessant growth in gross domestic product.

Growth is truly considered to have occurred when the productive capacity of a nation progresses (Akpan, 2008). Genuine production of goods and services enhances exports and sometimes requires the importation of inputs which involves transactions in foreign currencies (Oyovwi, 2012). Jin (2008) revealed that Nigeria's over-reliance on oil exportation implies that the economy is extremely prone to external shocks since in the event of any significant drop in oil price, foreign exchange earnings will fall and that will destabilize the exchange rate as there will not be sufficient stock of



foreign currencies to defend the local currency at the foreign exchange market. This major change in relative prices (exchange rate) would trigger a near-equal adjustment in the distribution of a country's local resources and eventually move the economic structure away from the production of commodities for exports especially agriculture into possibly the services sectors.

The structural adjustment program (SAP) was introduced due to the critical economic situation in the 1980s which gave rise to implementing the devaluation policy as part of the IMF conditions. This policy was introduced principally to discourage imports and encourage exports by rising the nations' productivity and income thereof; however, there has not been a visible increase in export since. The exchange rate between the naira and the United States dollar for instance continues to increase and imports also continue to increase which was not the original reason for implementing the devaluation policy. In addition, according to Nwosu (2016), exchange rates that come into view after the fall down of the Bretton Wood System have been unstable and have made academics and professionals to be cynical about its efficiency in stimulating economic growth. For example, the naira to US dollar exchange rate was N4 in 1987 whereas the real GDP was about N204.8 billion. In 1995, it depreciated to N21 to one US dollar whereas the real GDP was N281.4B. As of 2014, the exchange rate was N168 to one USD and the exchange rate depreciated to N365 in 2017.

Given the above, it is imperative to develop research whose objective is to evaluate the fundamental linkage between the exchange rate and the inflow of FDI in Nigeria. This study bridges the literature gap by answering the relevant research question of "How does exchange rate affects the inflow of FDI in Nigeria" making use of the latest available data. Results from the study will be helpful for policy-making aimed at attracting FDI from the exchange rate point of view.

2.1 Literature Review

The fluctuations and uncertainty in exchange rates appear to be significant factors investors consider in their decision to invest in a foreign country. Much of the scholarly writings on exchange rate and FDI focus on two issues: the level of the exchange rate, and the volatility of the exchange rate. Froot and Stein (1991) argued that the level of the exchange rate may influence FDI. This is due to the fact depreciation of the currency of the host country against that of the home currency raises the relative wealth of foreigners thereby increasing the investment climate of the host country as foreign investors can be able to acquire assets in the host country relatively cheaper. Therefore, the depreciation of the currency of the host country would increase the inflow of FDI into the host country, and on the contrary, an appreciation of the currency of the host country would decrease the inflow of FDI. However, it is often opined that the price of assets should not matter but only their rate of return. When the currency of a host country depreciates relative to the foreign investors' country, the price and nominal return of the assets in the currency of the host country go down. Since the prices of assets and returns on assets both go down exchange rate fluctuations should not impact on FDI.

Froot and Stein (1991) oppose this argument with the assertion that when capital markets are subject to information asymmetries, movements of exchange rates do affect foreign investment. Information asymmetry triggers a deviation between internal and external financing, making the external financing more expensive than the internal, because the lenders incur monitoring costs and therefore lend less than the full value of the asset. In this situation, should foreign investors hold their wealth in foreign currency; the local currency depreciation will increase the wealth of foreign agents concerning domestic agents, thus leading foreign investors to bid more aggressively for domestic assets. Froot and Stein (1991) made use of industry level data on the inward FDI of US for the 1970s and 1980s to justify their hypothesis (Jayaratnam, 2003).

Campa (1993), on the other hand, has a dissimilar argument for the linkage between level of exchange rate and inflow of FDI. In his assertion, the firm's resolution whether or not to invest in a foreign country depends on the expectations of profitability prospect. In such a situation, the higher the level of the exchange rate (that is calculated in terms of units of foreign currency per host

currency) and the more it is rising, the higher will be expectations of future profits from entering a foreign market. Hence, Campa's model projects that an appreciation of the host currency will enhance FDI in the host country, all things being equal, which is different from the prediction of Froot and Stein (1991). Campa's empirical findings that examine the number of foreign entrants entering the US confirm support his assertion according (Gorg and Wakelin 2001). Gorg and Wakelin (2001) made an important contribution. Contrary to other studies that have considered either inward or outward FDI, it considered both. The paper empirically examined both direct investments from the US to 12 countries and investments from these 12 countries to the US. The empirical findings revealed different results for US outward and inward FDI, which appear opposing. The study found a positive linkage between US outward investment and appreciation in the host country currency while there is a negative linkage between US inward investment and appreciation in the dollar.

Blonigen (1997), making use of data on Japanese acquisitions in the US from 1975 to 1992, recommended that exchange rates can impact the acquisition of FDI as this involves buying specific assets in the foreign currency that will generate returns in another currency. The assertion that the fall in the value of the real dollar increases foreign acquisitions that are asserted by Blonigen is different from the argument put forward by Froot and Stein (1991), though they both have the same outcome. Froot and Stein reveal that exchange rate movements are significant because capital markets are imperfect. However, Blonigen reveals that exchange rate movements matter since domestic and foreign firms may have the same opportunities to buy firm-specific assets in the domestic market, but domestic and foreign firms do not have the same opportunities to generate returns on such assets in foreign markets. As a result of uneven levels of access to markets, exchange rate movements may influence the relative level of foreign firm acquisitions.

2.2 Empirical Review

Robinson (2007) established good evidence of weak countries' currency rising foreign direct investment. This is in the context of the model in imperfect capital markets as currency depreciation (downward change in the exchange rate) makes goods in a host country less expensive than countries of export. Thapa (2002) opined that depreciation in exchange rate in host countries tends to increase inflows of foreign direct investment; also a strong exchange rate stimulates the incentives of foreign firms to make production at home for export instead of investing in a host country for export. Scholars such as Adeniran, Yusuf, and Ademeyi (2014) point out that the exchange rate system has not sustained an efficient policy that will increase the inflow of foreign investment and foreign exchange. Regrettably, in Nigeria, foreign exchange has witnessed inelastic supply both in the foreign exchange and domestic market with its attendant destabilizing speculative activities when compared with her counterparts in Asia and America where Nigeria was ranked ahead in the 70s in terms of exchange rate stability.

Mahmood, Ehsanullah & Ahmed (2011) argued that instability in the exchange rate of a country can influence investment in that country negatively, creating an unfavorable atmosphere for investment in that country and requiring that resources in that country should be reallocated among various sectors of the economy of that country. In another relevant investigation Benson, Eya, and Yunusa (2019) studied the impact of exchange and interest rates on foreign direct investment in Nigeria 2006-2018. Annual time series data was employed for the study from the period 2006-2018. The unit root property of the data was tested using the Augmented Dickey-Fuller and the variables were all stationary after taking the first difference. In addition, Johansen Co-integration test statistics were employed to test the co-integrating nature of the variables while the short-run and long-run linkage between the variables under study were analyzed using the error correction model. The data were tested for normality using the Jarque-Bera test statistics. The findings of the study reveal that a positive relationship exists between exchange rates and foreign direct investment.

Eregha (2017) examined the influence of exchange rate policies and inflationary expectations on the flow of foreign direct investment to the West African Monetary Zone (WAMZ). The investigation made use of the Arellano Panel Correction for Serial Correlation and Heteroscedasticity option of the within estimator for five of the WAMZ countries chosen based on the availability of data for the period 1980-2014. Findings revealed that exchange rate uncertainty hindered the flow of FDI while inflation expectation had an insignificant impact on the flow of FDI to WAMZ. The fixed exchange rate policy regime was found to hinder the flow of FDI in the zone while the intermediate policy regime had a significantly positive effect in stimulating the flow of FDI with periods of current account imbalances and variations in foreign exchange reserves as the channels since most of these countries use their reserves from the limited export earnings to interfere in the foreign exchange market to preserve the official rate.

Morrissey and Udomkerdmongkol (2014) analyzed the effect of exchange rates on US inflows of foreign direct investment (FDI) to a sample of 16 emerging market countries making use of panel data for the period 1990-2002. Three variables were made use of to capture separate exchange rate effects. The bilateral exchange rate to the US dollar captures the value of the local currency (a higher value signifies a cheaper currency and enhances FDI). Fluctuations in the real effective exchange rate index (REER) proxy for expected changes in the exchange rate: an increasing (decreasing) REER is interpreted as devaluation (appreciation) being expected so that FDI is postponed (encouraged). The transitory part of bilateral exchange rates is a proxy for the volatility of the local currency, which does not attract FDI. The findings affirm the 'Chakrabarti and Scholnick hypothesis that, all things being equal, there is a negative linkage between the expectation of local currency depreciation and inflows of FDI. Cheaper local currency (devaluation) enhances FDI as volatile exchange rates don't encourage FDI.

Jaratin et al (2014) examined the exchange rate fluctuations and foreign direct investment (FDI) linkage making use of annual data on ASEAN economies, that is, Thailand, Malaysia, Singapore, and the Philippines. By making use of the ARDL bounds test approach, the empirical findings reveal the existence of significant long-run co-integration between exchange rate and FDI for the case of Malaysia, Singapore, and the Philippines with all countries recording negative coefficient implying that the appreciation of the Malaysian ringgit, Singapore dollar, and the Philippine peso has a positive effect on FDI inflows. Making use of the ECM-based ARDL approach for the causality test, both Philippines and the Singapore reveal long-run bidirectional causality between the exchange rate and FDI while long-run unidirectional causality runs from the exchange rate to FDI in Malaysia. In addition, this study also revealed the short-run unidirectional causality running from the exchange rate to FDI in Singapore.

Cambazoğlu and Güneş (2016) study examined the nexus between FDI inflows in Turkey and the real exchange rate level. Annual time series data for the period from January 2007 to January 2015 were used to examine the effect of the real exchange rate on foreign direct investment in Turkey in the long run. For this reason, the study made use of a bound test co-integration approach that is based on the Autoregressive Distributed Lag Model (ARDL). The findings obtained from a long-term static analysis of the estimated ARDL model showed that there is a co-integration linkage between the exchange rate level and inflows of FDI in Turkey.

3.0 Methodology

This paper made use of annual time series data from 1986 to 2020. The data were sourced from the database of World Development Indicators and the Central Bank of Nigeria (CBN), 2021 Statistical Bulletin. The study employed the ARDL model to find out the impact of the exchange rate on foreign direct investment in Nigeria.

3.1 Empirical Model Specification

To analyze the impact of the exchange rate on foreign direct investment in Nigeria, a multivariate model is adopted from the empirical work of Morrissey and Udomkerdmongkol (2014) for this investigation, whereas the authors used FDI as a function of bilateral exchange rate and real effective exchange rate, this study expressed FDI as a function of the exchange rate, inflation, economic growth, and trade.

$$FDI_t = \alpha_0 + \beta_1 EX_t + \beta_2 INF_t + \beta_3 GDP_t + \beta_4 TRD_t + \mu_t \dots \dots (1)$$

Where FDI_t is the foreign direct investment at time t ; EX is the exchange rate at time t ; INF stands for inflation; GDP is the gross domestic product; TRD is the trade and μ_t is the error term at time t . Expanding Equation 1 and expressing the variables in the semi-logarithmic form leads to a baseline model of Equation 2.

$$LFDI_t = \beta_0 + \beta_1 EX_t + \beta_2 INF_t + \beta_3 LGDP_t + \beta_4 TRD_t + \mu_t \dots (2)$$

Where L is the natural log; β_0 is intercept term; β_1 to β_4 are the slope coefficients. The equation above assumes that FDI at a time depends on the current exchange rate, current inflation rate, current GDP, and current level of trade. This study, therefore argues that the impact of the exchange rate (EX); inflation (INF); gross domestic product (GDP), and trade (TRD) on foreign direct investment (FDI) may persist beyond the current period. Taking account of this fact, the study renders the model dynamic and obtains the estimable equation in semi-log linear form as follows:

$$LFDI_t = \beta_0 + \beta_1 LFDI_{t-1} + \beta_2 EX_t + \beta_3 EX_{t-1} + \beta_4 INF_t + \beta_5 LGDP_t + \beta_6 TRD_t + \mu_t \dots (3)$$

3.2 Estimation Techniques

This paper adopted Auto Regressive Distributed Lag (ARDL) as an estimation technique. This technique is used for both co-integration test parameter estimation (long-run and short-run estimates). But the order of integration of the variables employed is estimated using the Philips – Perron (PP) unit root test approach. If the variables are found to be integrated of the same order say $I(0)$ or different order $I(0)$ and $I(1)$, the study then proceed to apply the ARDL approach to co-integration.

3.3 Co-integration Test

The Autoregressive Distributed Lag (ARDL) model which employs the bounds testing approach to co-integration as proposed by Pesaran and Shin (1999) and Pesaran et al. (2001) is employed in the data analysis. This method has some features that many researchers give some advantages over the method suggested by Engel-Granger (1987) and the maximum likelihood-based method proposed by Johansen and Juselius (1990) and Johansen (1991). In the first place, the approach can be used with a mixed order of $I(0)$ and $I(1)$ data, that is, it can be used whether the variables are mutually co-integrated or not. In the second place, it involves just a single-equation setup, making it simple to implement and interpret. In the third place, different variables can be assigned different lag lengths as they enter the model. And, the model can be tested by using the OLS (ordinary least square) once the order of ARDL has been acknowledged (Pesaran & Shin 1999; Pesaran et al. 2001).

4.0 Results and Discussions

4.1 Descriptive Statistics

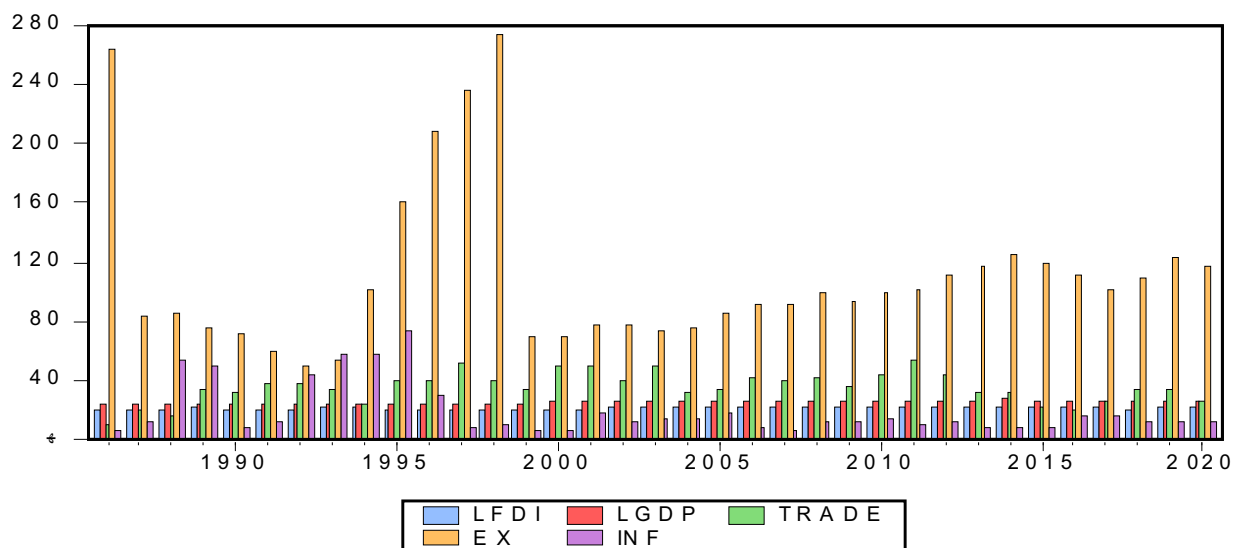
Table 1 below depicted the descriptive statistics of the variables under investigation. The variables statistics were presented in terms of their mean value, maximum value, minimum value as well as standard deviation. The maximum value of log (FDI) over the period under study is \$22.90267 which was recorded in 2011, while the minimum value is \$19.07931 which was recorded in 1986. The mean value log (FDI) is \$ 21.27034. Likewise, the maximum value of log (GDP) is \$27.02712 which was recorded in 2014 while the minimum value is \$24.04658 which was recorded in 1993. The mean value of log (GDP) over the period under study is \$25.61821. For the value of the exchange rate (EX), the maximum value stands at N273.0110 which was recorded in 1998 while the minimum value is N49.74991 which was recorded in 1992. The mean value of the exchange rate over the period under study is N110.2833

Table 1. Descriptive Statistics of the Variables

	LFDI	LGDP	TRADE	EX	INF
Mean	21.27034	25.61821	34.95288	110.2833	19.46086
Median	21.35680	25.37639	34.45783	99.56663	12.21778
Maximum	22.90267	27.02712	53.27796	273.0110	72.83550
Minimum	19.07931	24.04658	9.135846	49.74991	5.388008
Std. Dev.	1.075711	1.005781	10.29688	54.68121	17.84792
Skewness	-0.18405	0.078023	-0.36351	1.819858	1.704270
Kurtosis	1.991853	1.332982	2.836300	5.575783	4.546375
Jarque-Bera	1.679795	4.088146	0.809906	28.99485	20.43041
Probability	0.431755	0.129500	0.667008	0.000001	0.000037
Sum	744.4618	896.6374	1223.351	3859.917	681.1300
Sum Sq.	39.34323	34.39424	3604.874	101661.2	10830.64
Dev.					
Observations	35	35	35	35	35

Source: Author's Computation using E-view 9. LFDI= Log Foreign Direct Investment, LGDP= Log Gross Domestic Product, EX= Exchange Rate, INF= Inflation, TRADE= Trade

Figure 1: Chart showing the descriptive statistics of the variables



4.2 Unit Root Test

The unit root test as depicted in Table 2 below indicated that log (FDI), and log (GDP) were not stationary at the level until after taking the first difference at a 5% level of significance. Exchange rate (EX), trade (TRADE), and inflation (INF) were stationary at the level at a 5% level of significance even before taking the first difference. Consequently, the variables under this study were all stationary and therefore integrated into order I(I) and I(0).

Table 2. Summary of Phillip Perron Unit Roots Test.

Variables	Test Statistic at Level	5% Critical Value at Level	P-Value at Level	Test Statistic at First Diff	5% Critical Value at First Diff	P-Value at First Diff	Order of Integration
LFDI	-2.542906	-2.951125	0.1205	-8.806810	-2.954021	0.0000	I(I)
LGDP	0.176221	-2.951125	0.8612	-4.615437	-2.954021	0.0001	I(I)
EX	4.101034	-2.951125	0.0003	-6.982819	-2.954021	0.0000	I(0) I(I)
TRADE	-3.537843	-2.951125	0.0013	-7.084322	-2.954021	0.0000	I(0) I(I)
INF	-4.535808	-2.976263	0.0003	-5.130472	-2.954021	0.0000	I(0) I(I)

Source: Author's Computation using Eview 9 FDI=Foreign Direct Investment, GDP= Gross Domestic Product, EX=Exchange Rate, INF= Inflation, Trade=Trade, Log= Natural Logarithms

Table 3. Autoregressive Distributed Lag Bounds Test

Computed F Statistic	K	5% critical bound test value Lower Bound	Upper Bound
2.185749	4	2.56	3.49

4.3 Bounds Test to Cointegration

The variables employed for this study are integrated of order I(0) and I(1) as indicated by the result of the unit root test in Table 2 above. The study resolved to apply the bounds test to co-integration to find out whether the variables have a long-run relationship as depicted in Table 3 above. The F statistic value of 2.185749 from the result of the ARDL bound test depicted in Table 3 above is less than the lower bound value of 2.56 at a 5 percent level of significance. Hence, based on this, the null hypothesis that states no long-run relationship is therefore accepted and concludes that log (FDI) (foreign direct investment), log(GDP), (EX) Exchange Rate, (INF) inflation, and trade do not have a long run relationship over the period under study.

4.4. Autoregressive Distributed Lags (ARDL) Short-Run Estimate

To study made use of the Autoregressive Distribution lag (ARDL) model as formulated by Pesaran and Shin (1998) for the data analysis because of its fitness and the fact that the variables employed for this study are integrated into the order one of as revealed by the unit root test in Table 2 above. This method was applied based on its applicability irrespective of whether the repressors in the model are purely I(0) or I(1) or mixed. In addition, to estimate the variables in the model, the study selected ARDL (1, 0, 0, 0, 0,) as the result depicted in Table 4 below.

Table 4. Autoregressive Distributed Lag Result

D/Variable:	ARDL	(1,0,0,0,0)		
LFDI				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG (FDI (-1))	0.334008	0.165903	2.013266	0.0538
LOG(GDP)	0.509893	0.210985	2.416731	0.0224
EX	-0.006089	0.002061	1.355452	0.0063
INF	0.002016	0.007439	-2.953884	0.7884
TRADE	0.015858	0.011700	1.355452	0.1861
C	1.195243	3.410473	0.350462	0.7286
R-squared	0.757346			
Adj R-squared	0.714015			
Durbin Watson	2.227962			
st				
Prob (F-Statistic)	0.000000			

Source: Author's Computation making use of Eview 9.

Table 4 depicted above, has shown that the ARDL estimation has a good fit with an R-square value of 75 percent. It indicated that about 75 percent of the variation in FDI is explained by exchange rate, gross domestic product, trade, and inflation over the period under study while the remaining 25 percent is explained by other variables not captured by the model. The result also indicated that the explanatory variables are mutually significant to explain the impact on FDI being the dependent variable as shown by the significant probability value of the F statistic which is 0.00000 less than 5 percent.

Furthermore, results revealed that gross domestic product (GDP) has a significant positive relationship with foreign direct investment. Precisely, a unit increase in the log (GDP) will bring about a 0.509893 percent significant increase in FDI at a 5 percent level of significance. Furthermore, the results indicated that the exchange rate (EX) has a significant negative relationship with FDI. Precisely, a unit increase in the value of the exchange rate will bring about a -0.006089 percent decrease in FDI over the period under study. Also, the results showed that inflation (INF) has an insignificant positive relationship with FDI. Specifically, a unit increase in (INF) will bring about a 0.002016 percent increase in FDI. Similarly, trade (Trade) has an insignificant positive relationship with FDI. Specifically, a unit increases in log (Trade) will bring about a 0.015858 increase in FDI over the period under study.

5.0 Conclusion and Policy Suggestions

5.1 Conclusion

The study examines the impact of the exchange rate on foreign direct investment in Nigeria from the period 1986 to 2020. The study reveals that the exchange rate has a significant negative impact on foreign direct investment implying that when the exchange rate for the dollar increases, there will be a decrease in FDI. On the other hand, GDP shows a significant positive effect on foreign direct investment. The study also argues that inflation and trade have an insignificant positive impact on FDI over the period under study.

Given that the exchange rate has a significant negative linkage with foreign direct investment, it means that changes in monetary policy by the Central Bank of Nigeria (CBN) concerning the

exchange rate have influenced the inflow of FDI and further changes to these policies would likely translate into changes in the value of FDI in Nigeria.

5.2 Policy Suggestions

The findings from the study suggest for possible consideration by policymakers: that the Central Bank of Nigeria should maintain an adequate flow of foreign exchange in the foreign exchange market and ensure exchange rate stability to attract foreign investors for increased inflow of foreign direct investment. This study has shown that the exchange rate has an effect on attracting FDIs into Nigeria.

Therefore, exchange rate policy measures should focus on addressing Nigeria's exchange rate challenges. Efforts to reinforce the value of the naira should be made by focusing on the market forces rather than using measures that would only overstate the value of the naira. Rather than shielding the overstated value of the naira, certain issues like dependence on imports, low production, and non-oil exports should be addressed. This will translate in to increase in demand for the naira, and the exchange rate would thus reflect the realistic value of the country's economic performance, and foreign investors would be attracted to invest in Nigeria.

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VALUE RELEVANCE OF FINANCIAL REPORTING AND RETURN ON EQUITY OF QUOTED OIL AND GAS COMPANIES IN NIGERIA

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Abstract

This study examined the value relevance of accounting information derivable from financial reports of quoted oil and gas companies in Nigeria to determine the return on equity to investors in the industries from 2015 to 2020. Data from ten (10) (71.4%) out of (14) (100%) fourteen listed oil and gas companies in Nigeria were analyzed by adopting an ex post facto research design with Panel data analysis. The result obtained showed a significant effect of value relevance of accounting information (VR) on returns on equity (ROE) of oil and gas industries in the period as the P-value $0.0149 < 0.100$ level of significance which indicates that financial reporting quality proxied by the value derived has a significant effect on the return on equity of oil and gas companies in Nigeria. Based on this result, ROE – a prominent determinant of firm performance can be guaranteed by quality financial statements proxied by accounting information relevant to the industry, Thus, the article concluded that the value derived from financial reporting will enhance investment in the industry as return on equity will be enhanced. The study concluded among other factors that the value of accounting information derivable from quality financial reporting is significant in taken prudent investment decisions. In the industry. The study recommends enhancement of Financial Reporting Quality based on IFRS provisions, frequency in reporting, and avoidance of manipulation of accounting data that are contained in the financial statement of oil and gas industries in Nigeria

Key Words: Amortization, Value Relevance, ROE, Financial Impairment, Quality

INTRODUCTION

Value relevance can be described as the extent to which investors consider the information contained in a document that is available for existing and potential users for decision-making purposes. Relevant information must be capable of clear interpretation and comprehension to achieve intended purposes. Accounting information is prima facie information for a potential investor in any business especially when such business entity is registered and fully listing requirements of the Stock Exchange. A financial statement is a ready source of information for investors for making quality decisions. It is the extent to which changes in accounting information can explain the changes in the prices of shares and commodities. David and Macfubara (2018), defined value relevance as the strength of the relationship between accounting variables and the market value of equity of a firm. Francis and Schipper (1999) defined value relevance as the extent to which the financial information of an entity captures or summarizes information that determines firm value. To this end, value relevance is used to measure the degree of the statistical association between accounting information and market values of returns. In the same vein, Barth et al. (2001) state that value relevance examines the association between accounting figures and equity market values. In a more thorough discussion of the construct, Francis and Shipper (1999) offer four interpretations of value relevance. One, that financial statement information influences stock prices by capturing intrinsic share values toward which stock prices drift, that financial information is value relevant if it contains the variables used in a valuation model or assists in predicting those variables, while three and four are based on value relevance as indicated by a statistical association between financial information and prices or returns from the operation. According to IAS 1: Presentation of financial statement, paragraph 26, information is relevant when it influences the economic decisions of users by helping them to evaluate past, present or future events or confirming, or correcting, their past evaluations.



Accounting figures are assumed to have information content if the release of new information modifies investors' beliefs about future cash flows and thus causes price revisions. Information content studies use statistical association models to examine how a corporate firm can harness its return to satisfy its stakeholders, especially on return on equity.

Information about the Return on Equity (ROE) of an entity is used to measure the extent to which its net profit after tax is generated from shareholders' capital invested (Choiriyah et al. 2021). ROE reporting is used to show the success or failure of the management in maximizing the return on investment of shareholders. ROE measures the return on investment of shareholders, using the formula for net income available to common shareholders divided by the number of common equity shares.

Information on ROE is specifically vital because it serves as the window through which investors assess the ability of management to generate net income available to the shareholders from the amount invested. According to Choiriyah et al. (2021), The relationship between value relevance and return on the invested amount by investors becomes a serious issue in a growing economy as investors are often skeptical in taking decisions when dealing with an entity with asymmetry information. It is therefore expedient to know the extent to which value relevance drives a firm's performance in the corporate organization, especially in the oil and gas sector of the developing economy. The tendency to take prudent decisions precipitates the quality of information which will result in a quality of investment decisions. If accounting information provides a poor description of the firm, the value relevance of such information will likely be low and consequently, investors' confidence will be impacted negatively hence this study will unravel the obscurity that often surrounds the misleading concepts and low declaration of dividends in the oil and gas industries at any rate even though other developed country investors are enjoying a bountiful return on their investment decision.

Financial Report

Financial reports are produced by listed companies in compliance with necessary standards prescribed by the International Financial Reporting Standards (IFRS) to disclose the economic, social, and financial performance of entities in line with their established goals and objectives. It provides vital information to stakeholders of the entity, within a specific period, usually one accounting year. According to Muhibudeen and Abdulrahman (2020), the quality of the financial report of an entity depends on the quality of the information presented in the statement. Users of financial reports include managers, directors, employees, prospective investors, financial institutions, government regulatory agencies, media, vendors, and the general public (Saliu & Adetoso, 2018). Financial reports are prepared by companies to provide users with information about the entity's financial position, performance, and changes in equity (Obara & Nengih, 2017). To ensure transparency and credibility in the decision-making process by management and other users of accounting reports financial statements are often prepared according to national standards, professional ethics, code of ethics, and corporate governance (Saliu & Adetoso, 2018).

Accounting Rules/ Regulation

The amalgamation of global markets prompted the establishment of an acceptable set of accounting rules to facilitate better understanding and interpretation of financial statements, irrespective of the business location. Information about the Return on Equity (ROE) of an entity is used to measure the extent to which its net profit after tax is generated from shareholders' capital invested (Choiriyah et al. 2021). ROE reporting is used to show the success or failure of the management in maximizing the return on investment of shareholders. ROE measures the return on investment of shareholders, using the formula for net income available to common shareholders divided by the number of common equity shares. Information on ROE is specifically vital because it serves as the window through

which investors assess the ability of management to generate net income available to the shareholders from the amount invested.

Oil and gas companies in Nigeria are required to prepare their financial report in compliance with SAS 14: Accounting for Petroleum Industry (upstream Activities), and SAS 17: Accounting for Petroleum Industry (Downstream Activities). However, following the development and issuance of IFRS 6: Accounting for Exploration and Evaluation of Mineral Resources, oil and gas entities can now account for their exploration and evaluation cost according to the guidance provided by IFRS 6. In Nigeria, the contributions of the oil and gas sector to the development, growth, and stability of the economy cannot be over-emphasized. Historically, the industry came to the limelight in the year 1956, when oil was first struck, by Shell Group in commercial quantities, at Oloibiri Community, in present-day Bayelsa State (Daferighe & Edet, 2019). However, until the early 1990s, the sector was predominated by the International Oil Companies (IOCs). To stimulate local participation in the oil and gas industry, the Nigerian government through the Nigerian National Petroleum Corporation (NNPC) and other related agencies, formulated and implemented certain policies and regulatory reforms such as the National Oil and Gas Policy (NOGP), 2007, the Nigerian Oil and Gas Industry Content Development (NOGICD) Act, 2010 and the Petroleum Industry Act, 2020 (Oziri & Achinike, 2022). In addition, most of the policy initiatives in the Nigerian oil and gas sector were strategically designed to attract more investment, guarantee increased production capacity, and ensure sustainable economic development, since the sector contributes about 90% of the country's foreign earnings which constitute 60% of the total revenue of the country (Klynveld Peat Marwick Goerdeler (KPMG), 2021). Even though oil and gas companies in Nigeria are among the fastest growing and high-risk entities (Etim et.al., 2020), the contribution of the sector to the Gross Domestic Product (GDP) of Nigeria dropped drastically from 13% to about 7% in 2020 (Price Water house Coopers (PwC), 2020). According to Choiriyah et al. (2021), ROE is a profitability ratio from the perspective of the investors. Sitorus and Elinarty (2017) argued that the higher the rate of return on owners' equity investment, the better because this shows the amount of own capital in generating higher net profit after tax, on the other hand, lower ROE indicates that the amount of capital invested as operating cost only produced a small or low net profit after tax. Generally, shareholders of oil and gas companies will prefer higher ROE because this will mean that the management has efficiently utilized the equity capital invested in generating net income. Higher ROE will attract more investors, which will lead to a better performance of the company Specifically,

Accounting information in the Petroleum Industry-Upstream and Downstream

This standard was first issued in 1993 by the National Accounting Standard Board (NASB) to enhance the comparability of financial statements prepared by companies operating in the upstream sector of the petroleum industry in Nigeria (Barde, 2011). The standard deals with accounting and reporting for upstream activities which involve the acquisition of a mineral interest in properties, exploration (including prospecting), development, and production of crude oil and gas. The downstream sector of the Nigerian oil and gas comprises oil and gas activities such as storage, transportation, marketing, and distribution of refined products from crude oil and liquified gas. SAS 17: Accounting in the Petroleum Industry-Downstream Activities was issued by the NASB to guide accounting practices and reporting formats to be followed by companies operating in the sector. In the process of crude refining, catalysts are added to the crude to speed up the cracking process. Catalysts are expensed as consumed and accounted for as an inventory and recorded at the lower of cost or net realizable value (PwC 2011). NG-GAAP requires catalysts to be separated into short-life (lasts less than a year) and long-life catalysts (lasts a year or over). The costs of short-life catalysts are expensed in the year in which they are incurred while the costs of long-life catalysts are capitalized and written off over the life of the refinery.

Return on Equity (ROE)

Information about the Return on Equity (ROE) of an entity is used to measure the extent to which its

net profit after tax is generated from shareholders' capital invested (Choiriyah et al. 2021). ROE reporting is used to show the success or failure of the management in maximizing the return on investment of shareholders. ROE measures the return on investment of shareholders, using the formula for net income available to common shareholders divided by the number of common equity shares. Information on ROE is specifically vital because it serves as the window through which investors assess the ability of management to generate net income available to the shareholders from the amount invested. According to Choiriyah et al. (2021), ROE is a profitability ratio from the perspective of the investors. Sitorus and Elinarty (2017) argued that the higher the rate of return on owners' equity investment, the better because this shows the amount of own capital in generating higher net profit after tax, on the other hand, lower ROE indicates that the amount of capital invested as operating cost only produced a small or low net profit after tax. Generally, shareholders of oil and gas companies will prefer higher ROE because this will mean that the management has efficiently utilized the equity capital invested in generating net income. Higher ROE will attract more investors, which will lead to better performance of the company. Signaling theory indicates that asymmetric information between a company and its investors causes adverse selection. To avoid this situation, information that provides a signal to the market is disclosed voluntarily by companies (Watt & Zimmerman, 1986). Size, profitability, and growth are factors that affect the decision to disclose voluntary information to avoid adverse selection. Firms with higher profitability will tend to disclose more information to the market to boost investors' confidence and prevent undervaluation of their shares, thus this study supports the signaling theory.

Statement of Problem

The relationship between the value relevance of accounting information and return on investment to investors in the oil and gas industries cannot be underestimated as the investing decision of existing and prospective investors hinged strongly on this phenomenon. Every amount invested by any investor becomes a serious issue in a growing economy if adequate financial information is not available to the users.

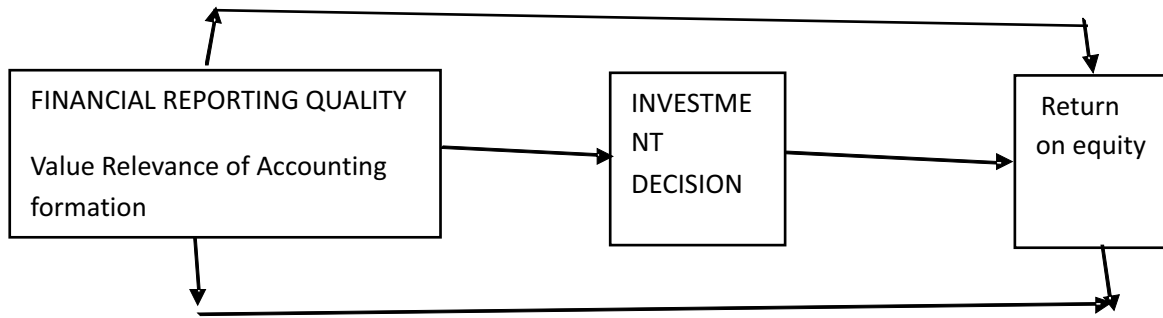
Many investors are often skeptical in taken decisions when dealing with an entity with asymmetry information. It has not been established and as such it is good to know the extent to which value relevance drives a firm's performance in the corporate organization, especially in the oil and gas sector of developing economies. The tendency to take prudent decisions precipitates the quality of information which will result in the quality of investment decisions of any interested in the goodies that this sector of the economy offers. If accounting information provides a poor description of the firm performance, the value relevance of such information will likely be low and consequently, investors' confidence will be impacted negatively. These problems need adequate attention and as such this study set out to unravel the obscurity that often surrounds the misleads and low declaration of dividends in the oil and gas industries at any rate in Nigeria

Conceptual Framework

This article is anchored by the design below to show the relationship between financial reporting proxied by its relevant information and the performance variable represented by return on equity in oil and gas industries in Nigeria.

Figure 1 depicts the relationship between the information relevance of accounting information which quality financial reporting provides to investors and other stakeholders that often relied on returns on earnings in taking investment decisions.

Figure 1:



Source: Author's Design, 2023

The paper is anchored on the signaling theory which explains the relevance of accounting information in two forms, both of which led to taking investment decisions that resulted in a positive return on equity and the other that yield a negative return on equity. Thus, either way, information derived from quality financial reporting will derive the returns expected by investors which will become relevant especially when there is the need to take investment decisions.

METHODOLOGY

The study adopted ex post facto research design - a systematic empirical study involving events that have already taken place since no attempt is made to control or manipulate relevant independent or dependent variables. It also utilized secondary data obtained from the Published Annual Reports of selected listed oil and gas companies operating in Nigeria, from 2015 to 2020. The population of the study consists of the Fourteen (14) oil and gas companies listed on the Nigerian Stock Exchange (NSE) as of 31st December 2015 and have remained listed and consistently submitted their annual reports to the NSE from 2015 to 2020. The companies are Ardova Plc, Mobil Plc, Anino International Plc, Capital Oil Plc, Conoil Plc, Eterna Plc, Forte Oil Plc, Japaul Oil Plc, MRS Oil Nigerian Plc, Oando Plc, Rak Unity Petroleum Company Plc, Seplat Petroleum Development Company Ltd and Total Nigerian Plc.

A judgmental or purposive sampling technique was applied to select Ten (10) (71.4%) companies with complete financial statements from 2015 to 2020.

Measurement of Variables

Variables	Types of Variables	Symbol	Measurement	Sources
Return on Equity	Dependent	ROE	Net profit after tax/Shareholders fund X100	Chakroun & Amar (2019)
Value Relevance	Independent	MVE	Market Value of Equity (MVE) = Market price of shares X Number of shares	Davies & Macfubara (2018)

Model Specification

Based on the previous discussion, the following empirical models as applied in Kasmawati (2019) are as follows:

$$ROE_{it} = \beta_0 + \beta_1 (DA)_{it} + \beta_2 (MVE)_{it} + \beta_3 (BMR)_{it} + \beta_4 (DEBT)_{it} + \beta_5 (OL)_{it} + \beta_6 (SIZE)_{it} + \beta_3 (SG)_{it} E_{it} \dots (2)$$

Where:

ROE_{it} = Return on Equity of firm i at year t

E_{it} = Error Term

RESULTS AND DISCUSSIONS

The analyzed data comprises ten companies out of fourteen oil and gas quoted on the stock exchange market with their various return on equity which is a prima facie financial performance indicator that accounting information drives in the oil and gas industries. The focus is on return on equity which asymmetric information can help to propagate to guide prospective investors in investment decisions in the oil and gas sector of Nigeria's economy.

Table 1.

Year	Ardo0yn Plc	Capital Oil Plc	Conoil Plc	Eternal Plc	Japaul Gold & vent	MRS oil plc	Oando Plc	Rak Unity Pet	Seplate Energy Plc	Total Energy Plc	Yearly AV.
2015	.458325	.08822	.098139	4.33779	.120723	.458325	.249095	.072113	.150857	.066607	.956943
2016	.144302	.098139	.101312	.051398	.186481	.144302	.183421	.150857	.034238	.664224	.886772
2017	.074809	.101312	.07378	.868641	.12642	.074809	.135216	.034238	.084481	.842899	.912459
2018	.287945	.07378	.145738	.696229	.964875	.287945	.4365	.084481	.539315	.527126	.909938
2019	.175521	.145738	.170948	-.77535	1.82235	.175521	.104542	.539315	.211814	.169082	.886317
2020	.153684	.170948	192897	.758502	.080185	.153684	.049627	.211814	.368971	1.90141	.870001

Source: Author's Computation, 2023.

Descriptive Statistics
Descriptive Statistics

This sub-section discusses the descriptive statistics of the data generated on the dependent and explanatory variables of the study. It provides the summary statistics relating to the measure of central tendency, such as the mean, and the measures of dispersion, such as the standard deviation, the minimum, and the maximum values of the study variables. The table below shows that on average the Financial Reporting Value Relevance (FRVR) of the listed oil and gas firms is 44.4295 with wide variation around the mean supported by the standard deviation of 64.9644. This wide variation was later supported by the minimum and maximum values of 0.2 and 279 respectively of the value relevance. The standard deviation of 0.7524 shows a low level of dispersion in the total assets of the sampled firms. Concerning Sales Growth (SG), Table 4.1 further reveals that on average, the sampled firms experienced moderate sales growth in revenue with a mean of 0.3916 which is a 39.16% increase. The minimum value of -0.3296 and the maximum value of 6.8648, when compared with the minimum value, represent a range of 6 times. This also shows that some of the firms in the sample experienced drastic growth in revenue from one year to the other during the period of this study due to the high demand for oil and gas in Nigeria. In addition, the standard deviation of 0.9786, which is higher than the mean value, attests to wide variation in the sales growth among the firms in the sample. The Leverage (DEBT) has a mean of 0.4436 which means that the average debt of the companies is about 44%. This indicates that most of the firms have moderate debts with a minimum debt of 0.000 which shows other firms do not have debts in their capital structure and maximum debts of about 1.8762 which shows other firms are highly geared. The standard deviation of 0.4301 indicates that there is no significant difference between the leverage of the selected firms since the mean is greater than the standard deviation.

Table 2 Descriptive Statistics

Variables	Observations	Mean	Standard Dev.	Minimum	Maximum
ROE	50	0.1342	0.7955	-1.8223	4.3378
EM	50	3.8823	0.2555	-0.5384	0.9781
MVE	50	44.4295	64.9644	0.2	279
BMR	50	11.5855	13.5495	-5.0000	53.53
SIZE	50	10.6289	0.7524	8.6819	12.1175
SG	50	0.3916	0.9786	-0.3296	6.8648
DEBT (%)	60	0.4436	0.4301	0.0000	1.8762
OL	60	1.1009	0.5227	0.3091	2.9752

Source: Author's Computation, 2023.

: Shapiro-Wilk test for Normal Data of Dependent variables Residual

Variables	Model e1
Obs	124
W	0.98636
V	1.350
Z	0.673
Prob>Z	0.25036

Source: Author's Computation, 2023.

Variables	Observations	Mean	Standard Dev.	Minimum	Maximum
ROE	60	0.1342	0.7955	-1.8223	4.3378
EM	60	3.8823	0.2555	-0.5384	0.9781
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DEBT (%)	60	0.4436	0.4301	0.0000	1.8762
OL	60	1.1009	0.5227	0.3091	2.9752

Source: Author's Computation, 2023.

The table shows that the ROE (the red row) of the sample firms on average is 0.1345 which is 13% and the standard deviation stood at 0.7955. This indicates wide variation around the mean. It also indicates the ROE of the sampled variance within the period of the study. The minimum value and maximum value are -1.8223 and 4.3378. Also, it reveals a large standard deviation of EPS amounting to 5.3678 suggesting that the observations are widely scattered around the mean which is 1.5687. This is also indicated in the wide difference between the maximum and minimum of the data which are 21.76 and -20.02 respectively.



Table 3: Correlation Matrix for Financial Reporting Quality and Return on Equity (Model 1)

VAR.	ROE	EM	MVE	BMR	SIZE	SG	DEBT	OL	VIF
ROE	1.0000								
EM	0.1919	1.0000							1.08
MVE	-0.0099	0.0764	1.0000						1.32
BMR	0.0371	-0.0335	-0.4619	1.0000					1.58
SIZE	0.1568	0.1863	0.3849	0.0851	1.0000				1.37
SG	0.0028	0.1489	0.1132	0.0405	0.4572	1.0000			1.53
DEBT	0.3575	0.1146	-0.1707	0.3478	0.2585	0.1995	1.0000		1.20
OL	0.1431	0.0031	0.2831	-0.5110	-0.1114	0.0302	-0.1280	1.0000	1.34

Source: Author's Computation,2023.

```

      |  ROE  EM  MVE  BMR  SIZE  SG  DEBT  OL
-----+-----
ROE| 1.0000
EM| 0.1919 1.0000
MVE| -0.0099 0.0764 1.0000
BMR| 0.0371 -0.0335 -0.4619 1.0000
SIZE| 0.1568 0.1863 0.3849 0.0851 1.0000
SG| 0.0028 0.1489 0.1132 0.0405 0.4572 1.0000
DEBT| 0.3575 0.1146 -0.1707 0.3478 0.2585 0.1995 1.0000
OL| 0.1431 0.0031 0.2831 -0.5110 -0.1114 0.0302 -0.1280 1.0000
regress ROE EM MVE BMR SIZE SG DEBT OL

```

```

Source|  SS      df    MS    Number of obs =    60
-----+----- F(7,52) =    1.66
Model| 6.80477688    7.972110982 Prob>F =    0.1408
Residual| 30.5347375    52.58720649 R-squared =    0.1822
-----+----- Adj R-squared =    0.0722
Total| 37.3395144    59.632873125 RootMSE =    .76629

```

```

ROE|  Coef. Std.Err.  t  P>|t|  [95% Conf. Interval]
-----+-----
EM|  .3887893 .4063572  0.96  0.343  -0.426626  1.204205
MVE| -0.0035014 .0017654 -1.98  0.053  -0.0070439 .0000412
BMR| -0.0071955 .0092678 -0.78  0.441  -0.0257927 .0114016
SIZE| .0388158 .1553283  0.25  0.804  -0.2728732 .3505047
SG| -0.071308 .125974 -0.57  0.574  -0.3240933 .1814774
DEBT| .4366891 .2541113  1.72  0.092  -0.0732226 .9466008
OL| .1476568 .2213448  0.67  0.508  -0.296504 .5918176
_cons| -0.3677624 1.71618 -0.21  0.831  -3.811529 3.076004

```

Variables: fitted values of ROE
chi2(1) = 2.09
Prob> chi² = 0.1481

Table 4: GLS Regression Results for Return on Assets, Return on Equity, Earnings Per Share, and Firm Performance.

Variables	Model 1 (ROA)			Model 2 (ROE)			Model 3 (EPS)		
	Coef.	Z	P> z	Coef.	Z	P> z	Coef.	Z	P> z
Constants	0.9166	2.71	0.009*	-0.3677	-0.21	0.830	17.4872	1.62	0.103** *
EM	-0.3119	2.52	-0.019*	0.3888	0.96	339	-0.6316	-0.25	0.805
MVE	0.0016	2.79	0.007*	-0.0035	-1.98	0.047**	0.0372	3.36	0.001*
BMR	0.0020	0.49	0.623	-0.0072	-0.78	0.438	0.1045	1.80	0.072** *
SIZE	-0.0086	-0.36	0.722	0.0389	0.25	0.803	-2.1699	-2.22	0.026**
SG	-0.0291	-1.97	0.048* *	-0.0713	-0.57	0.572	-0.4465	-0.56	0.572
DEBT	0.0848	1.28	0.201	0.4367	1.72	0.086** *	2.9582	1.85	0.064** *
OL	0.1431	4.34	0.000*	0.1477	0.67	0.505	2.8554	2.05	0.040**
Overall R ²	0.4365			0.1822			0.2917		
Wald chi2(7)	41.88			31.59			21.41		
Prob>chi2	0.0000			0.0149			0.0032		
Hetest	0.0000			0.1481			0.2529		
Hausman	0.6968			0.9614			0.5805		
LM	0.0001			0.0000			0.0000		
Unit root	0.0000			0.0000			0.0000		

Source: Stata 14.0 output based on data extracted from listed oil and gas firms.
*, **, and *** indicate 1%, 5%, and 10% levels of significance.

Regression results from Stata 14.0

Notes:

1. Unicode is supported; see help Unicode advice.
2. Maximum number of variables is set to 5000; see help set Maxar.

. use "\Users\USER\Desktop\ARCHIVE\Software\Stata_15.0x64\Financial reporting and firm performance. data"

The value Wald chi of 31.59 with a probability value of 0.0149 indicates that the model is of good fit and the explanatory variables used as determinants of firm performance are properly selected. It also indicates that the hypothesis of a significant linear relationship between the dependent and independent variables cannot be rejected at a 5% level. Hence, this finding provides enough evidence to reject the hypothesis that the value relevance of financial reporting quality does not significantly affect ROE.

CONCLUSION AND RECOMMENDATIONS

The study examined the relationship between the value relevance of financial reporting - accounting information and return on equity in the oil and gas sector of Nigeria's economy. Finds of the study showed a positive relationship between quality financial reporting proxied by value relevance based on the information derivable and the growth in the return on assets of the oil and gas industry which explained that with good financial reporting, returns on shareholder value will be on increase meaning that investment in this area will be lucrative to existing and potential investors in the economy. The return on equity has a positive significant impact on ROE The study shows that the value relevance of accounting information has a positive and significant impact on other related financial performance variables of the organization including return on asset The study conclude that the value of financial reporting is significant in taken prudent investment decisions as this will



culminate into positive or negative return on equity of an investor in developing economy. Based on the findings of the study, the following recommendations are made: enhancement of Financial Reporting Quality – a good source from where accounting information could be derived. in the oil and gas firms in Nigeria

Regulatory bodies such as the Financial Reporting Council of Nigeria (FRCN), and the Security and Exchange Commission (SEC) should monitor compliance with IFRS by companies to enhance financial reporting quality and that oil and gas companies should avoid engaging in dubious earnings management and accounting conservatism that would affect the returns that are meant for different categories of stakeholders.

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-3-

ASSESSMENT OF RESIDENTS' PERCEPTION OF CAUSES AND EFFECTS OF FLOODING IN OSOGBO, OSUN STATE, NIGERIA

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ABSTRACT

A common environmental problem today in Nigeria is flooding which has had negative implications not only on the environment but also from the economic point of view. The study however examines the residents' perception of the causes and effects of flooding in Osogbo. The study relied on both primary and secondary data. Primary data were obtained through questionnaire administration on the residents of the study area. The purposive sampling method was used to select five flood-prone areas in the study area. They are Malam Tope, Rasco, Gbodofon, Fiwasaye and Oke Baale. A 90m buffer was set around the residential buildings earlier identified and was marked into three strata. Out of 2701 buildings identified in the affected areas, 270 representing 10% were selected for this study. A systematic sampling technique was used to determine the sample size in the administration of the questionnaires in all the strata. Relative Severity Index (RSI) on the severity of flood disasters was sought using a five-point Likert scale with 1-5 weighted averages. Secondary data were sourced from journals, the internet, and environment planning agencies; OSSEMA. Data collected were analyzed using descriptive methods; measures of central tendency, tables, etc. Four major causes of flood, heavy rainfall, building along water channels, lack of drainage, and indiscriminate dumping of refuse were identified for all strata. The relative severity index (RSI) of flooding in the three strata indicated that loss of possession and household items have the highest mean weighted value of (2.7813), (2.0607), and (1.1943) respectively. The study concluded that flooding has negative implications on the environment, economy, and social lives of the residents in the study area. The study recommends the incorporation of physical planning policies, and development control enforcement among others.

Keywords: Residents, Flooding, Disasters, Perception.

INTRODUCTION

Flooding has become a major hazard in Nigeria and it is one of the most common natural and human-induced hazards that is responsible for death and other fatalities across the globe (Ducey and Coovert, 2013). Floods are a result of excess water flowing on land that used to be dry (Djimesah, Okine, and Mireku, 2018). Flooding also occurs when water particularly from rainfall, accumulates across an impermeable surface and cannot rapidly dissipate or evaporate. It can also occur when dams flood low-lying areas (Kingsley and Christopher, 2013; Adebayo, 2014).

The occurrence of flooding is severe, particularly in urban areas where there is intensity in land use, haphazard development, and unprecedented urbanization among others. According to Adeyinka, 2008, most of these cities are also characterized by uncontrolled development, substandard and inadequate housing, poor infrastructural provision and development, poor planning process and administration, weak urban governance, and poor land structure.

In Nigeria, flooding has remained a prevalent environmental problem. Available studies have shown that there is a frequent occurrence of flooding (Ishaya, Ifatimehin, and Abaje, 2009, Kolawole, Olayemi, and Ajayi, 2011, Olajuyigbe, Rotowa and Durojaiye, 2012, Ejenna, Amangabara and Chikwendu, 2014, Oloyede *et al* 2018, Bamidele and Badiora, 2019). Their studies pointed to the fact that flooding has negative impacts on the survival of livelihood, social and economic activities. Basically, in recent decades, flooding has led to the loss of thousands of lives and properties.

Specifically, flooding has affected the lives, properties, and sustainability of the environment as noted in available studies. Notably, floods being a natural hazard have negative implications not only



on the environment but also from the economic point of view. For instance, flooding affects housing, roads, and other physical structure making such areas not to be attractive to residents.

Agbonkhese *et al* make a classification of the effects of flood based on human resources, natural resources, physical resources, monthly incomes, and monetary asset-based. Their studies showed that flooding has negative returns on investment and can lead to massive destruction. Oruonye, Ahmed, and Yakubu, 2017, examined the effect of flood disasters on rural livelihood and coping mechanisms in the Lau local government area of Taraba state in Nigeria. Their findings revealed that floods have negative impacts on the socio-economic status and livelihood of the people in the local government area.

The effect of flooding on the economy of nations is catastrophic. Financial losses due to the flood run into billions every year. The amount of money spent on emergencies every year can be diverted for the development of the vital sectors of the economy. The Government is confronted every year with the need to repair damaged infrastructure such as roads, bridges, buildings, hospitals, schools, and culverts. The various government makes provisions every year to resettle the displaced people. The Lagos state government in Nigeria relocated about 681 people to the resettlement camp at Agbowa at the expense of the government providing them with three square meals daily (LASEMA, 2020). Flooding in most cases is accompanied by the outbreak of diseases such as typhoid, cholera, dysentery, skin diseases, and other food and water-borne diseases. In the developing countries of the world, the majority of people do not have access to safe drinking and potable water. The people's sources of water are the rivers, streams, and lakes which are normally polluted whenever there is a flood disaster. The hopeless situation has usually exposed people to various diseases (Adebayo, 2014).

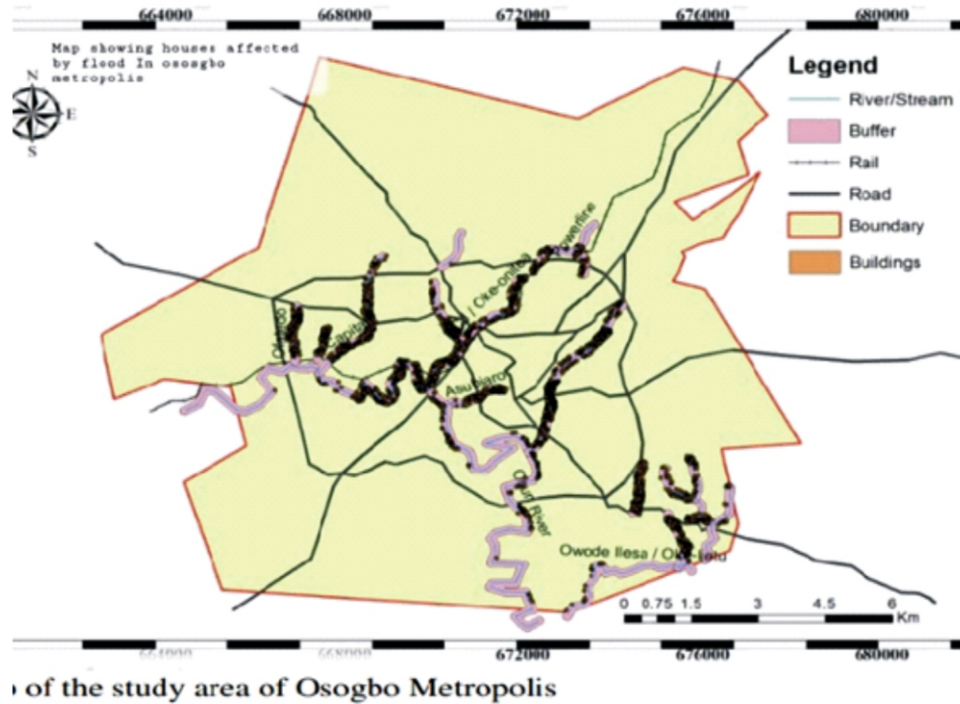
Oludare *et al* 2018, Olajuyigbe 2018, and Olabisi 2018, made a qualitative assessment of the cause and effect of floods in Nigeria but these works did not elaborate on how the people perceived the flood. Research on flood risk, vulnerability, cause, and effect should have a people center approach because of the need to address the issue of safety reality from flood risk. This paper however discusses the people's perceptions of the causes and effects of flood disasters in the study area.

Study Area

Osogbo is the capital of Osun state, it is located at latitudes $7^{\circ}42'10''$ and $7^{\circ}51'10''$ N, and longitude $4^{\circ}28'43''$ and $4^{\circ}40'12''$ E. It has an area of approximately 2,875 km². It is some 88km by road from northeast of Ibadan. It is about 195km or approximately three-hour drive from Lagos. Osogbo shares boundaries with Ikirun, Ilesha, Ede, Egbedore, and Iragbiji and it is easily accessible from any part of the state because of its central nature.

The projected population for Osogbo in 2023 was put at 771,515 (World Population Review, 2023). Most of the population are members of the Yoruba ethnic group. Osogbo has a tropical climate with rainfall and an average annual temperature of 25.5^o Celsius (77.8^o Fahrenheit) and 1361 millimeters (55.6 inches) of precipitation. The height is about 500m above sea level (Falade, 2000) and it is drained by the Osun River and its tributaries such as Gbonmi, Ogbaagba, and Omu. Osogbo is located in the tropical hinterland of Nigeria.

The Osun Osogbo sacred groove, a forested area with shrines and sanctuaries, harboring Osun State and other deities was designated as a UNESCO World Heritage site in 2015. Osogbo is the trade centre for a farming region; yam, cassava, grain, and tobacco are grown. About 27% of the population is engaged in farming as their primary occupation, 8% are traders and 30% are clerks, teachers, etc.



THEORETICAL CONCEPT AND LITERATURE REVIEW

Model of disaster occurrence; The model to be considered is the disaster pressure and release model. The pressure and release model (PAR model) is a simple tool for showing how disaster occurs when natural hazards affect vulnerable people. Their vulnerability is rooted in social processes and underlying causes which may ultimately be quite remote from the disaster event itself. The basic PAR idea is that a disaster is the intersection of two opposing forces, those processes generating vulnerability on one side, and the natural hazard event (or sometimes a slowly unfolding natural process) on the other. The image resembles a nutcracker, with increasing pressure on people arising from either side, from their vulnerability and the impacts (and severity) of hazards for those people. The release idea is incorporated to conceptualize the reduction of disaster, to relieve the pressure, vulnerability has to be reduced (Wisner *et al*, 2003).

The PAR model might suggest (in its image of two separate sides in the diagram) that the hazard event is isolated and distinct from the condition which creates vulnerability. Hazard events themselves also change the set of resources available to households (e.g. floods) and alter the patterns of recoverability of different groups of people. Hazards sometimes intensify some people's vulnerability and the incorporation of the insight improves upon those interpretations that see disaster simply as the result of natural events detached from social systems. Conversely, economic and political circumstances, and the specific situations affecting particular livelihood opportunities, often force or encourage people to engage in practices that worsen the impact of hazards (Wisner *et al*, 2003).

Types and Causes of Flooding

Various studies have been carried out by researchers on the types and causes of flooding globally (Agboola, Ajayi, Taiwo, and Wahab, 2012; Adejuwon and Aina 2014, Agbonkhesse *et al* 2014, Adebayo 2014; Dabara *et al*, 2014; Emeribeole, 2015), (Popoola, 2019) and Aina (2014).

Identified three types of flooding in Nigeria; Coastal flooding, River flooding, and Urban flooding. Coastal flooding occurs in the low-lying belt of mangrove and freshwater swamps along the coast. River flooding occurs in the flood plains of the larger rivers, while sudden, short-lived flash floods are associated with rivers in inland areas where sudden heavy rainfall can change them into destructive torrents within a short period. Urban flood on the other hand occurs in towns, on a flat or

low-lying terrain especially where little or no provision has been made for the surface drainage, or where existing drainage has been blocked with municipal waste and eroded soil sediments (Adeoye, Ayanlade, and Babatimehin, 2009). Similarly, the work of Adebayo (2014) identified six types of flood as follows;

- (a) Upstream floods; These are floods that affect small localized areas. These are often caused by sudden, locally intense rainstorms, and by events like dam failure. Even if the total amount of water involved is moderate, the rapidity with which it enters the streams can cause it temporarily to exceed the stream channel capacity.
- (b) Flash floods; These are a variety of upstream floods characterized by an especially rapid rise of stream stage. Flash floods will occur anywhere that surface runs off rapidly, is large in volume, and is fuelled into relatively restricted areas. It occurs in the urban city on the highways or roads as a temporary stream. It can also occur in a desert after a cloud burst but the water level quickly subsides as it sinks into parched ground. Flash floods occur primarily in hilly or mountainous areas due to prevailing connective rainfall mechanisms, thin soils, and high runoff velocities. The warning time for such an event is short. In general, the duration of this flood is also short but this flood type is also frequently connected with severe damage, mainly because it is narrow, fast flowing, and deep.
- (c) Downstream flood; These are the floods that result from prolonged heavy rain over a broad area or extensive regional snow melt. It usually lasts longer than the upstream flood because of excess water.
- (d) Coastal flooding; This is caused by higher sea levels than normal, largely as a result of storm surges. Coastal flooding may be caused by the combination of high tide levels, storm surges, and wave action.
- (e) Fluvial flooding; This occurs in the flood plains of rivers when the capacity of the water course is exceeded as a result of high rainfall or snow and ice melts within catchment areas further up streams. Blockage of water courses and flood channels or tide locking may also lead to ponding and rising water levels.
- (f) Pluvial Flooding: This is surface water flooding caused by rainwater run-off from urban and rural land with low absorbency. Increased intensity of development in the urban area has given rise to land with a larger proportion of non-permeable surface, a problem often exacerbated by overloaded and outdated drainage infrastructure. These circumstances combine with intense rainfall, can give rise to localized flooding.

On the other hand, the universal cause of floods according to Agbonkhese *et al* (2014) and Adebayo (2014), is heavy or excessively prolonged rainfall or even both. Floods can manifest along marine coasts from wind-driven storm surges and rain-swollen streams associated with tropical typhoons and hurricanes. Besides, flooding can also occur on the shorelines of the large inland lake (Agbonkhese *et al* 2014). According to Adebayo (2014), floods generally occurred during the period of heavy rainfall or snowfall. Water from rainfall or snow is distributed in many ways. Some of the water is retained by the soil, some are absorbed by vegetation and some evaporate. The water which remains and which reaches the stream channel is called runoff.

Flood occurs when soil and vegetation cannot absorb all the water. Whenever this happens, the water then runs off the land in quantities that cannot be carried in stream channels or retained in natural ponds and constructed reservoirs, periodic floods occur naturally on many rivers forming an area known as the flood plain. These river floods often result from heavy rain, sometimes combined with melting snow which causes the river to overflow its banks.

Climate change is also a major cause of flooding and it is an issue that is related to the economic, social, cultural, and physical environment of any nation. It is a vital environmental factor that shapes and re-shape various activities of human beings in society.

Other major causes of flood include; human interaction with the environment in the form of industrialization, technological development, urbanization, deforestation, burning fossils, and agricultural activities (Agbonkhese, 2014).

Flooding can also be caused by poorly constructed dams. The size of the dams is a function of the quantity of water to be retained and the usage.



Effects of flooding

Man and his environment are usually the victims of flood disasters. Flooding wherever it happens, as it annually, has adversely affected man more than any other natural disaster. For instance, the floods in southwestern Haiti in 2010, caused great devastation so the authorities stopped counting the dead, bodies were piled up in common graves 10 feet wide, 10 feet long, and 20 feet deep. The estimate shows more than 3000 deaths in Haiti, Asian countries like India, China, Japan, Philippines, Thailand, Korea, Indonesia, Srilanka, Pakistan, Afghanistan, and other eastern countries. CNN reported that the flood disaster across southeast Asia in 2011 led to the death of more than 139,580 people (Adebayo, 2014).

Apart from causing the loss of lives, flood disaster has the effect of destabilizing and displacing the people. People are naturally destabilized when their properties such as houses and crops are destroyed by flood.

Other effects of flood include; damages to roads, bridges, and culverts with the consequence of disrupting free flow of traffic. The flood in Sokoto state washed away several kilometers of access roads and bridges. Flood has the negative impact of rendering people jobless. People engaged in the agricultural sector are usually jobless during the period of severe flooding. The loss of jobs in the agricultural sector will invariably lead to a shortage of food in society (Adebayo, 2014). For example, in Jigawa state of Nigeria, about 20000 hectares of farmland were destroyed by flood in December 2010. Farm produce such as rice, guinea corn, millet, beans, sesame, and maize were washed away by flood. In the Bakura Local Government area of Zamfara state, a flood submerged about 2000 hectares of farmland (The Nation, 29th Sept. 2010). People engaged in agriculture usually finds it difficult to practice their occupation as happened in Haiti in 2008 after the flood, there were terrible landslides, a vast quantity of earth was washed into the sea, huge numbers of trees were uprooted, many fields and gardens were washed away and countless numbers of livestock were drowned (Adebayo, 2014).

The effect of flooding on the economy of the nation is a catastrophe. Financial losses due to flooding run into billions every year. The amount of money spent on emergencies every year can be diverted for the development of the vital sector of the economy.

RESEARCH METHODS

The study utilized primary and secondary data sources. Primary data were obtained through pretested structured questionnaires administered to residents of flood-prone areas of the Osogbo metropolis and oral interviews conducted by the head of household in the area. Osogbo has over 10 flood-prone areas as reported by Popoola (2019).

A random sampling method was used to select five flood-prone areas out of the identified flood-prone areas. The selected areas are; Mallain Tope, Rasco, Gbodofon, Fiwasaye, and Oke Baale.

The stratified random sampling method was used to stratify the residential buildings in the selected areas into three based on the maximum proximity of 90m to the major river/stream in the area. Therefore, buildings located within a distance of 30m to the river/stream constituted the first stratum, those between 31-60m to the river constituted the second stratum while the third stratum was comprised of those within 61-90m to the river/stream.

The choice of stratification is informed by the approved setbacks for major rivers in the Osogbo metropolis which stipulates a minimum of 15m for streams and a maximum of 45m for rivers as setbacks for different categories of rivers (Osun State Government of Nigeria, 2005).

The total number of buildings in the selected flood-prone areas was identified through fieldwork. The total number of buildings in the selected flood-prone areas was 2701. Two hundred and seventy questionnaires which are 10% of the total number of buildings identified in the areas were administered. But two hundred and forty-seven (247) questionnaires representing 92% of the administered questionnaires were recovered from the respondents.

The systematic sampling method was employed to select a residential building from each stratum which was based on the principle that once the initial household of 1 in every 5 buildings is selected,

others subsequently follow in a sequential pattern. One resident usually the head of the household was chosen in a building for questionnaire administration.

The secondary source of data was obtained from Osun State Emergency Management Authority (OSEMA), journals, and the Internet. The data was analyzed using descriptive statistical methods. Relative severity index (RSI) on the severity of flood disasters was sought using a Likert scale, i.e. (1) very severe (2) severe (3) neutral (4) not severe (5) not at all severe.

RESULTS AND DISCUSSION

Rate of Flood Disaster Occurrence in the Study Area

The result from Table 1 revealed that flood disasters occurred more frequently in the first stratum than second and third strata. In the first stratum, 61% of the respondents indicated that flood disasters occurred frequently while 39% of the respondents indicated that flood disasters occur occasionally. In the second stratum, 50.6% of the respondents indicated that flood disasters occurred occasionally while the proportion of respondents who perceived flood disaster occurrence as frequent was 49.4%. Also in the third stratum, the proportion of respondents who considered flood disasters to be occasional was 61.3% while 38.7% of the respondents indicated that flood disasters occur frequently. This implies that residents who live within the first stratum experienced flood disaster frequently than residents of other strata as a result of their proximity to the river/stream.

Table 1; Rate of flood disaster occurrence

Distance to River (M)		Rate of flood disaster occurrence		TOTAL
		Occasionally	Frequently	
Less than 30	Count	16	25	41
	%	39.0%	61.0%	100%
31-60	Count	44	43	87
	%	50.6%	49.4%	100%
61-90	Count	73	46	119
	%	61.3%	38.7%	100%
TOTAL	Count	133	114	247
	%	53.8%	46.2%	100.0%

Source; Authors' fieldwork, 2023

Causes of Flood Disaster in the Study Area

Presented in Table 2 are the causes of flood disasters in the study area as perceived by the respondents. Four major causes of the flood were identified in the study area; these are heavy rainfall, building along water channels close to the rivers, lack of drainage, and indiscriminate refuse dumping. Finding across the three strata revealed that heavy rainfall was the major cause of flood disasters with a proportion of 40.8% of the respondents. Lack of drainage facilities was ranked second with (31.8%) of the respondents while 17.3% and 10.1% of the respondents opined that building along water channels and river banks and indiscriminate refused dumping respectively were the causes of flood disasters in the area in the first stratum. 35.8% of the respondent indicated heavy rainfall as the cause of flood disaster, 22.9% of the respondents indicated indiscriminate refuse dumping while 22% and 19.3% of the respondents indicated building along water channels and close to river banks and lack of drainage facilities respectively as the causes of flood disaster. In the second stratum heavy rainfall was ranked as the major cause of flood disaster (46.1%) this was closely followed by a lack of drainage facilities which constituted 40.6% of the respondents while 10.9% and 24% of the respondents indicated building along water channel and river bank and indiscriminate refuse to dump respectively as the cause of flood disaster. Similarly, in the third stratum, 39.3% of the respondents opined that heavy rainfall was the cause of the flood disaster, this was followed by a lack of drainage facilities (31.4%) and building along water channels and river banks (19.7%) while the least ranked cause of flood disaster in the stratum was indiscriminate refuse dumping which

constituted 9.6% of the respondents. It is however evident from the result that heavy rainfall and lack of drainage facilities were the major causes of flood disaster in the study area as perceived by the residents.

Table 2; Causes of Flood Disaster

Distance to River(M)		Causes of flood disaster				TOTAL
		Heavy Rainfall	Building Along water Channel and Close to river	Lack of Drainage facilities	Indiscriminate Refuse Dumping	
Less than 30	Count	39	24	21	25	109
	%	35.8%	22.0%	19.3	22.9%	100.0%
31-60	Count	76	18	67	4	165
	%	46.1%	10.9%	40.6%	2.4%	100.0%
61-90	Count	90	45	72	22	229
	%	39.3%	19.7%	31.4%	9.6%	100.0%
TOTAL	Count	205	87	160	51	503
	%	40.8%	17.3%	31.8%	10.1%	100.0%

Source; Authors' fieldwork, 2023

*Normal totals were exceeded due to multiple responses

Relative Severity Index (RSI) of Flood Disaster on (0-30m)

Table 3 indicated that loss of possession and household items has the highest mean weight volume of (2.7813). This implied that loss of possession and household items is very consistent among the impact of flooding in less than 30m stratum. This situation is followed by the damage to household properties which has a mean weight value of (2.5182), disruption of electricity having a mean weight value of (2.3441), a high incident of health problem which is having mean weight value of (2.3157) and negative impacts on business and other sources of livelihood having mean weight value of (2.1093).

Furthermore, the impact of flooding which is the least severe within less than 30m is the loss of life with a mean weighted value of (1.2642). This implies that the impact of flooding on the loss of lives is not severe.

This is closely followed in decreasing order by traffic congestion and disruption of traffic flow with a mean weighted value of (1.2753). Road accidents with a mean weighted value of (1.7635) damage, to and loss of infrastructure with a mean weighted value of (1.9287).

It could however be deduced from the above analysis that loss of possession and household items is the most severe impact of flooding in the study areas this could be due to the proximity to the rivers.

Table 3; Relative severity index (RSI) of flood disaster on (0-30meters)

SN	IMPACT OF FLOOD	RANKING					NR	SWM	MWV	RANK
		5	4	3	2	1				
1	Damage to and loss of infrastructure	0	72	60	280	87	247	622	1.9287	6
2	Damage to household properties	0	0	362	160	280	247	427	2.5182	2
3	Traffic congestion and disruption of the traffic flow	0	12	33	80	190	247	315	1.2753	8
4	Loss of possession and household items	150	192	159	140	46	247	687	2.7813	1
5	Road accident	0	0	87	360	38	247	485	1.7635	7
6	Loss of life	0	16	60	26	209	247	311	1.2642	9
7	High incidence of health problems	90	200	135	26	121	247	527	2.3157	4
8	Negative impact on business and others	60	112	159	112	78	247	521	2.1093	5
9	Disruption of electricity	100	152	186	28	113	247	579	2.3441	3
	TOTAL								18.3003	

Source; Authors' fieldwork, 2023

$$\text{Mean of } \sum \text{MWV} / n = 18.3003 / 9 = 2.0333$$

Relative Severity Index (RSI) of Flood Disaster on (31-60m).

It was observed from Table 4 that loss of possession of household items has the highest mean weight value of (2.0607), this implied that loss of possession of household is very consistent among the impact of flooding in the 31-60m stratum. This is followed by damage to household property which has a mean weight average of (1.6963), negative impact on business and other sources of livelihood which is having mean weight value of (1.5263), and disruption of electricity having a mean weight value of (1.4291).

Furthermore, the impact of flooding with the least severity between 31-60 meters stratum is the high incidence of health problems with a mean weight value of (1.1568). This implies that the impact of the flood on the high incidence of health problems is not severe or does not occur. However, it could still be deduced from the above analysis that loss of possession and household items is the most severe impact of flood in the study area.

Table 4; Relative severity index (RSI) of flood disaster on (31-60 meters)

SN	IMPACT OF FLOOD	RANKING					NR	SWM	MWV	RANK
		5	4	3	2	1				
1	Damage to and loss of infrastructure	0	0	15	324	80	247	419	1.6963	3 rd
2	Damage to household properties	0	40	117	158	119	247	434	1.7470	2 nd
3	Traffic congestion and disruption of the traffic flow	0	4	45	140	161	247	350	1.4170	7 th
4	Loss of possession and household items	55	60	120	184	89	247	509	2.0607	1 st
5	Road accident	15	20	30	72	193	247	330	1.3360	8 th
6	Loss of life	5	12	54	113	169	247	352	1.4251	6 th
7	High incidence of health problems	0	8	90	154	138	247	387	1.1568	9 th
8	Negative impact on business and others	0	0	105	80	192	247	377	1.5263	4 th
9	Disruption of Electricity	0	12	63	110	168	247	353	1.4291	5 th
Total									13.7943	

Source; Authors' fieldwork, 2023

$$\text{Mean of } \sum MWV/n = 13.7943 / 9 = 1.5327$$

Relative severity index (RSI) of flood disaster on (61-90m)

From Table 5, it was discovered that loss of possession and household items has the highest mean weight value of (1.1943). This implies that loss of possession and household items is very consistent among the impact of flooding between 61-90m stratum. This is however followed by damage to and loss of infrastructure which has a mean weight value of (1.8097). Whereas damage to household property was having mean weight value of (1.7004). Disruption of electricity which is also having a mean weight of (1.6437) and a negative impact on business and other sources of livelihood has a mean weight value of (1.0728). Furthermore, the impact of flooding with the least severity between 61-90m is road accidents with a mean weight value of (0.7935). This also implies that the impacts of flooding on road accident in this stratum is not severe or do not occur. This is closely followed in decreasing order by loss of life with a mean weight value of (1.0445). Traffic congestion and disruption of traffic flow with a mean average of (1.0249), high incidence of health problems with a mean weight value of (1.0485). It could however be deduced from the analysis that loss of possession and household items is the most severe among the impact of flood in the study area.

Table 5; Relative severity index (RSI) of flood disaster on (61-90m)

SN	IMPACT OF FLOOD	RANKING					NR	SWM	MWV	RANK
		5	4	3	2	1				
1	Damage to and loss of infrastructure	0	0	0	400	47	247	447	1.8097	2 nd
2	Damage to household properties	0	0	141	158	121	247	427	1.7004	3 nd
3	Traffic congestion and disruption of the traffic flow	0	0	0	12	241	247	253	1.0247	7 th
4	Loss of possession and household items	0	0	3	92	200	247	295	1.1943	1 st
5	Road accident	5	8	33	36	114	247	196	0.7935	9 th
6	loss of life	0	0	3	22	233	247	258	1.0445	8 th
7	High incidence of health problems	0	0	0	24	235	247	259	1.0485	6 th
8	Negative impact on business and others	0	0	6	20	231	247	265	1.0728	5 th
9	Disruption of electricity	15	16	36	222	177	247	406	1.6437	4 th
TOTAL									11.3323	

Source; Authors' fieldwork, 2023

Mean of $\sum MWV$ $n = 11.3323$ $9 = 1.2591$

Discussion

Responses from Table 1 shows that the rate of flooding in the study area is occasional and the major causes of flooding that were identified in Table 2 in the study area include; heavy rainfall, building along water channel and close to river, lack of drainage facilities and indiscriminate refuse dumping for all the strata. The ranked RSI value shows the order of magnitude of the severity of flooding in the study area. Table 3 which represents (0-30m) has a 2.7813 mean weight value (MWV) as the highest order which is loss of possession, this is followed by 2.518, 2.317, and 2.1093 respectively.

Table 4 representing (31-60m) has the highest mean weight value (MWV) of 2.0607 representing a loss of possessions and 1.7470, 1.5263 respectively representing damage to household properties and negative impacts on business. Table 5 representing (61-90m) has the highest mean weight value of 1.1943 and others subsequently follow. It is however concluded that the loss of possession has the highest mean weight value (MWV) for all the strata.

CONCLUSION AND RECOMMENDATION

Based on the finding from the study, it was concluded that the causes of flood disasters in the study area were heavy rainfall, lack of drainage facilities, indiscriminate refuse dumping, and building along river channels. However, it was also observed that flooding has negative implications on the environment, economy, and social lives of the residents in the study area. As noted in the study, flooding affects physical development such as houses, roads, and structures. In case of a serious flood, lives can be lost in the process. With the observation that flooding is a serious environmental threat, it was suggested that appropriate measures be put on the ground to stem the level of its occurrence in the study area. Specifically, the government should ensure that environmental management policies are properly enforced in the study area.

Flood disaster risk reduction planning guidelines should be incorporated into physical planning policies to ensure that flood prevention and management are not an after taught in the planning process.

The Development Control Department should carry out effective supervision to prevent development in areas close to river bodies. This will reduce the incidence of flooding in the area. Waste management in the study area should be improved upon. A flood monitoring and warning system should be established and effectively manage to solve the problem of inadequate flood warnings to the residents in the area.

Public sensitization should be embarked upon by authorities to increase the level of awareness of residents about flooding, its causes and effects, and preventive and post-recovery measures.

Residents should participate in the identification of problems, initiation of solutions, and implementation of flood disaster risk reduction strategies.

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ASSEMBLING, TESTING, AND CALIBRATION OF A SOLAR MEASURING INSTRUMENT

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Abstract

The work "Assembling, testing, and calibration of a solar measuring instrument" is aimed at providing quick information on solar irradiance. The construction was carried out at the Department of Works, Nigeria Institute of Leather and Science Technology (NILEST) using materials such as plywood, a transparent rectangular glass sheet, hardwood, multimeter (0-50mA), an 82KΩ resistor, conducting wires on a solar cell (12V). The assembled colorimeter was tested and calibrated with the standard solar meter (pyranometer) at the electrical laboratory. The assembled instrument was found to measure currents 2.972×10^6 times the value of solar irradiance on the standard solarimeter. The knowledge of solar radiation is applicable in areas such as Agriculture, Atmospheric science, Climate change, Health, Hydrology, Oceanography, Renewable energy, to mention but a few.

Keywords: solarimeter, solar irradiance, and calibration.

Introduction

The wide use of solar energy in this modern dispensation has brought about the great need to collectively measure solar radiation hence, the need for this work. The World Meteorological Organization uses the term "Sunshine duration" to mean the cumulative time during which an area receives direct irradiance from the sun of at least 120 watts per square meter (World Meteorological Organization, 2008; Julian, 2011). We can use the sun directly as in solar heating systems or indirectly as in hydroelectric power, wind power, and power from biomass fuel. Solar energy is derived from the sun's rays. It is converted directly to electricity through solar photovoltaic panels (Musa, 2006). The amount of solar power available per unit area is known as Irradiance. Irradiance is a radiometric term for the power of electromagnetic radiation at a surface. It fluctuates according to the weather and the sun's location in the sky. This location constantly changes through the day due to changes in both the sun's altitude (elevation) and its azimuth (compass) angle (Jayakumar, 2009). The results of the earth's motion and atmospheric effects at various locations have led to essentially two types of solar insolation data. These are daily and hourly. Solar irradiance is related to power per unit area whereas solar insolation is related to radiant energy per unit area. Solar insolation is determined by summing solar irradiance over time and is usually expressed in units of kWh/m²/day, this renewable energy is available in abundance in most parts of the world. The amount of solar energy incident on the earth surface is approximately 1.5×10^{18} W h/year, which is about 10,000 times the current annual energy consumption of the entire world. The density of power radiated from the sun (referred to as solar energy constant) is 1373 KW/m² (Jayakumar, 2009).

Solar Radiation Measurement

Solar radiation is a term used to describe visible and near visible (ultraviolet and near infrared) radiation emitted from the sun (Antonia et al., 2001). The different regions are described by their wavelength range within the broad band range of 0.20 to 4.0 μm (micron). Terrestrial radiation is a



term used to describe infrared radiation emitted from the atmosphere. The following is a list of the components of solar and terrestrial radiation and their approximate wavelength ranges: Ultraviolet: 0.20-0.39 μm , visible: 0.39-0.78 μm , near infrared: 0.78-4.00 μm and infrared: 4.00-1.00 μm . As solar radiation passes through the earth's atmosphere, some of it is absorbed or scattered by air molecules, water vapor, aerosols and clouds. The solar radiation that passes through directly to the earth surface is called Direct Normal irradiance (DNI). The radiation that has been scattered out of the direct beam is called Diffuse Irradiance (Falayi et al., 2008). The direct component of sunlight and the diffuse component of skylight falling together on a horizontal surface make up Global Irradiance. The three components have a geometrical relationship. Direct radiation is measured by the use of a pyrheliometer which measures radiation at normal incidence. The normal incidence pyrheliometer consists of a wire wound thermopile at the base of a tube with a viewing angle of approximately 50° which limits the radiation that the thermopile receives to direct solar radiation only. The Pyrheliometer is mounted on a solar tracker or an automatic solar tracker for continuous readings (Garg et al., 1986).

Most solar measuring instruments are imported into the country and are often used in 'Big' organizations, for example in Agricultural institutes, Universities, Meteorological Organizations, and other research institutes. They are scarcely found in remote domestic settings. This is mostly because such instruments are expensive and difficult to procure by individuals. People in rural areas whose main activity is agriculture are unable to obtain solar measuring instruments which could have saved them a lot of stress and damage even to their agricultural activities. Also, most solar measuring instruments are space-consuming and also so large that it is almost difficult to convey them from one place to another. Some of the instruments are connected to digital display equipment which depends on an electric power supply. There is a need for individuals to be able to measure solar intensity even within the confines of their desired places to be able to predict the weather by themselves without having to go far distances to do that. This paper provides individuals with an opportunity to measure the solar intensity by themselves and within the confines of wherever they want to do it as long as there is sunlight. People in the rural areas can also access these instruments as they would be able to construct a simpler and cheaper solar instrument by themselves. This work is also aimed at constructing a cheaper and obtainable solar measuring instrument and also reducing the high level of importation thereby helping to boost the nation's economy. Another advantage of this technology is that it requires low maintenance because of the lack of moving parts. Also, it can be expanded on a larger basis.

In 1990 according to H. Suercke, conventional thermal pyranometers and pyrheliometers were meant for measuring global and direct radiation respectively. But their limitation is that they are unable to follow rapid changes of radiation associated with clear/cloudy transitions during partly cloudy conditions. In 1992 Belt described the spherical densitometer and an angular canopy densitometer. But the limitation of this work is that none of these met the requirements of low cost, convenience, speed and accuracy. The Campbell-Stokes sunshine recorder which was invented for the purpose of measuring the solar radiation by using scorch on the recorder card. The weak scorch and the strong scorch represent the different solar radiation. But the limitation of this instrument is that the weak scorch is so hard to extract that the solar radiation represented by the weak scorch is always neglected. So this method reduces the accuracy of extraction because it only extracts the strong scorch and falsely treats the weak scorch as background (IEE, 2013). The objective of this paper is to assemble, test and calibrate a solar measuring instrument by the use of the photovoltaic effect.

METHODOLOGY

Casing

The Plywood, ceiling board, and 2-inch nails were used to construct the case in which the instrument was put. The Plywood was cut into four pieces with each pair of the same length. But a

pair of the pieces has a longer length than the other pair to produce a hollow rectangular shape. The edges were fastened together using the two-inch nails and adhesive (super glue) to prevent the entrance of dust, At the bottom of the case, an appropriate size of ceiling board was used to cover the bottom of the hollow box using plywood which could be slid in case the instrument needs to be brought out. The top of the box was also covered with a sheet of glass for transparency. The case of the instrument contains the multimeter and the solar cell.

The Circuit

The soldering iron was used to connect the meter to the terminals of the cell by soldering. When the meter inserting pin was connected, the response was observed at normal solar intensity. If the pointer indicates a full-scale deflection, it implies that the solar intensity is too high for the meter to give an accurate reading. A Resistor was connected in series between the cell and the multimeter to limit the current. Various resistors were tested in this arrangement until the value of $82k\Omega$ gave a good response on the multimeter. With a working combination of solar cell and a multimeter, a glass was permanently mounted over the instrument to avoid the instrument from being tampered with.

Testing of the Instrument

Having constructed the instrument using the features described above, the solarimeter was exposed to solar radiation and there was a deflection on the multimeter showing that the instrument is working. The experiment was carried out on a sunny day and the readings were obtained for current (in milliamperes (mA)) and the solar irradiance (in Watts per square meter Wm^{-2}) at the same time from the standard solarimeter.

RESULTS AND DISCUSSION

The solar intensity (Irradiance) of day 22 in June 2016 was taken, and also the current at different times of the day in Zaria, Kaduna State. The following results were obtained:

Current (mA)	Solar Irradiance (Wm^{-2})
0.8	109
2.2	580
2.6	689
2.8	708

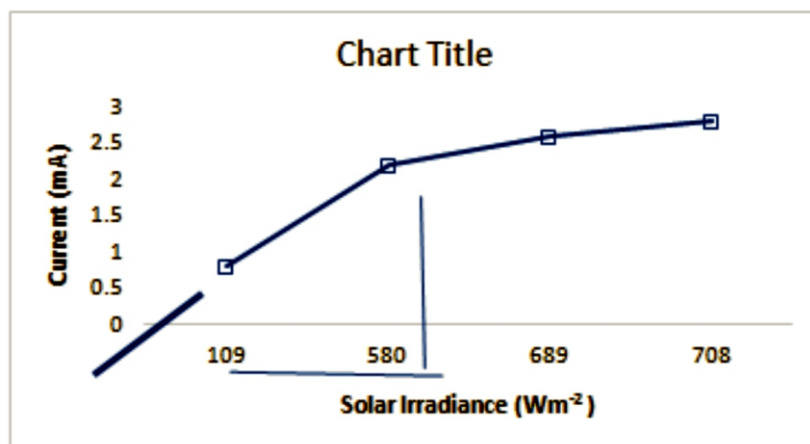


Fig.1 Graph of Current (mA) vs Solar Irradiance (Wm^{-2})

From the graph plotted above, the relationship between the Current and Solar intensity was found to be linear within the range of 109 and 580 watts per square meter on the standard solarimeter. This means that the constructed instrument would work effectively within the range of 0.8 and 2.2 mA.

Calibration of the instrument

The simple solar measuring instrument was calibrated by placing it alongside a standard solar measuring instrument (pyranometer). With the increase in solar intensity, the current on the constructed solarimeter also was increasing.

From the graph, a slope was determined as follows;

$$\text{Slope (S)} = \delta I / \delta S = (2.2 - 0.8) \text{mA} / (580 - 109) \text{Wm}^{-2} = 1.4 \text{mA} / 471 \text{Wm}^{-2}$$

$$0.002972 \times 10^{-3} \text{A/Wm}^{-2} = 2.972 \times 10^{-6} \text{A/Wm}^{-2}, \text{ Therefore, the slope obtained is } 2.972 \times 10^{-6} \text{A/Wm}^{-2}.$$

Now, from the equation of the graph, $y = mx + c$.

where $y = \text{Current I (in mA)}$, $x = \text{Solar intensity (in Wm}^{-2}\text{)}$ and $m = \text{The slope of the graph (} 2.972 \times 10^{-6} \text{A/Wm}^{-2}\text{)}$.

The equation of the graph is now: $y = mx$ (that is $I = mS$), $y = 2.972 \times 10^{-6} \text{A/Wm}^{-2} x$

That is, $1.2972 \times 10^{-6} \text{A W/m}^{-2}$

This means that, for every value of current, the solar intensity would be 2.972×10^{-6} times the value of solar intensity (irradiance). It can also be said that, $S = \frac{I}{m}$ that is, the solar irradiance value (in Wm^{-2}) is the ratio of the current value on the constructed solarimeter (in mA) to the slope of the graph (2.972A/Wm^{-2}). The instrument was tested and found to function effectively between the currents 0 and 2.2mA and this corresponds to the range between 0 and 580Wm^{-2} solar irradiance which is close to the acceptable standard of $800 - 1000 \text{Wm}^{-2}$. The instrument is easy to construct and the materials used for this assembling are relatively cheap. It also meets the requirement of portability, affordability, and sensitivity to rapid atmospheric changes.

CONCLUSION AND RECOMMENDATION

Conclusion

The solar measuring instrument was constructed based on the principles explained earlier on and was used to measure the current and hence the solar irradiance. The instrument does not depend on electricity which makes it readily available at all times.

Recommendation

- Where higher readings are needed, they should be taken during periods of high solar intensity to obtain a maximum value of irradiance.
- Other components should be added for memory to be able to go back to previous records of readings taken by the instrument.

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SPATIAL ASSESSMENT OF POPULATION DISTRIBUTION AND NAVIGATION MAP OF ESA-OKE, OBOKUN LOCAL GOVERNMENT AREA, OSUN STATE.

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Abstract

The use of remote sensing data and geographic information system techniques especially with high spatial resolution satellite imagery has great capabilities for mapping and map revision. These techniques have been used at various times and at different stages to study characteristics of earth features, monitoring of natural and physical phenomena, and also to produce street maps and population density maps of different places. In this study, the satellite image of 2022 was used to produce a street map and population density map of Esa-Oke in Osun State. The methodology adopted for the research was data capturing of high-resolution remote sensing images and census data. The data acquired were processed using ArcGIS 10.2. Analyses carried out revealed the total number of roads to be 109 while the total distance of the road network is around 70km. Major roads account to be about 5% while minor road account to be 95%. The population density map revealed the type of distribution that occurs in the study area to be a clustered pattern. From the study, it was recommended, among other things, that government should create more bypasses and open up new roads, especially in the areas that are yet to be built up to ease traffic and avoid environmental hazards in the clustered areas of the town.

Keywords: Esa-Oke, Spatial resolution, Satellite Imagery, and Population density.

Introduction

This study was focused on the production of a spatial index map for navigation and population distribution within Esa-Oke, Osun State using Remote sensing and GIS method to show the navigation and population density within the study area.

Satellites have played a vital role in the development of many technologies such as world mapping, Global Positioning Systems (GPS), etc. However, their applications are not limited to imaging devices only. To be honest, they are whole a lot more than just imaging devices. Remote Sensing is one of the many innovations that were possible, thanks to these satellites roaming around the earth.

According to Burrough (2016), GIS is a tool for collecting, storing, retrieving at will, transforming, and displaying spatial data from the real world for a particular set of purposes. In short, GIS can be used to add value to spatial data Sharma (2016). This is by allowing data to be organized and viewed effectively, by integrating them with other data, by analysis, and by the creation of new data that can be operated on in turn to create useful information that can help decision-making. The uniqueness of GIS is in its ability to integrate data from a variety of sources. A GIS can thus be described as a form of spatial decision support system.

Street guides are a graphic portrayal of a town or city showing the positions and names of all the streets; major/minor highways and roads, railroads, tracks, and other points of interest, and the general road network. It is a form of map that details roads and transport links. They are produced to show current road information, especially to visitors and researchers Ogunleye et al (2007) Street guides are not only important for aiding navigation within the city but are also useful in planning enumeration areas by demographers and are equally useful to tourists, sales fireman, police, security agents, tax collectors, postal service and also serve as a base for land use classification mapping and town planning.

Migration of people from one region to another cause an increase in population density. Urbanization

is the main cause of change in hydrologic and hydraulic processes, loss of existing drainage capacity, and flooding in urban areas. It increases the total runoff volume and peak discharge of storm runoff events (Dewan and Yamaguchi, 2019). The land use change is influenced by humans trying to meet various needs such as residential, industrial, agricultural, mining, and other infrastructural facilities and is a major concern associated with the economic and sustainable growth of an area. Correct use of every part available without further deterioration (Fawat et al., 2017). Land use and land cover change and its implication on hydrological processes have been prominent research topics in recent times.

Remote sensing is used in the study of population distribution, navigation, and analysis because of its ability to cover large areas in a single image scene (Singh, A., 1984). Over the past years, data from earth-sensing satellites has become indispensable in mapping the earth's features, natural resources management, and environmental change studies (Fischer 2019).

The essence of this is to encourage and monitor development in a way that will not damage the environment for the incoming generation. These policies should include taking an appropriate inventory of the available resources, planning for their present and future use, and classifying the land uses.

Recent advances in sensor technology, as well as mobile systems, are revolutionizing the way by which geospatial information is collected, processed, and utilized. The unprecedented wealth of sensor data and image-based geospatial information produce large volumes of data and result in large imagery-based data repositories. This requires the development of new technologies that will be capable of searching, querying, retrieving, and mining to fully utilize the rich data repositories.

The spatial dimensions of population distribution and navigation need to be sufficiently equipped to take informed decisions on land resources. Therefore, a wide range of scientists and practitioners, including earth systems scientists, land and water manager as well as urban planners seek information on the location, distribution, type, and magnitude of land use and land cover change (Weng 2002, Singh and Kumar 2012). The natural vegetation of the reserves has been destroyed and converted at a rapid rate from excessive logging, conversion to forest plantation and farming

Mapping showing population density provides invaluable information for managing land resources and projecting future trends of land productivity (Al-Bakri et al., 2013).

Population density maps are an important requirement for a range of environmental applications, including land use planning, landscape monitoring, natural resources management, and habitat assessment (Brooks et al., 2000, Chen Wang, 2010). These changes have impacts on the ecological stability of the forest regions and, thus identifying and investigating the status of a resource such as the forest cover which is a crucial part of resources management and monitoring from local or global perspectives (Marcal et al., 2015).

According to UN Statistics (2018), natural population increase is supplementary by more than ten thousand inhabitants migrating to cities every week. Esa-Oke is an example of such population growth, most of the population density is concentrated in the city or the town

Exemplarily, we want to focus on Esa-Oke town, the population distribution, and navigation in the study area to highlight the type of distribution that occur in the area and opportunities for sustainable development.

Central population density poses serious threats to the integrity of the ecosystem and biodiversity especially in drought-sensitive landscapes, natural disasters (flooding), and diseases. Based on the above background, this study assessed the drivers of population distribution in the study area to provide a basis for future landscape management and town planning to combat the transformational crisis and ensure ecosystem sustainability.

Statement of Problem

Due to the locational position of Esa-Oke, no updated map shows the population density and navigation map of the study area. Thus, there is a need for a spatial index, street guide, and population distribution map of Esa-Oke to show the population density, and navigation and to provide a basis for future landscape management and town planning to combat the transformational crisis and ensure

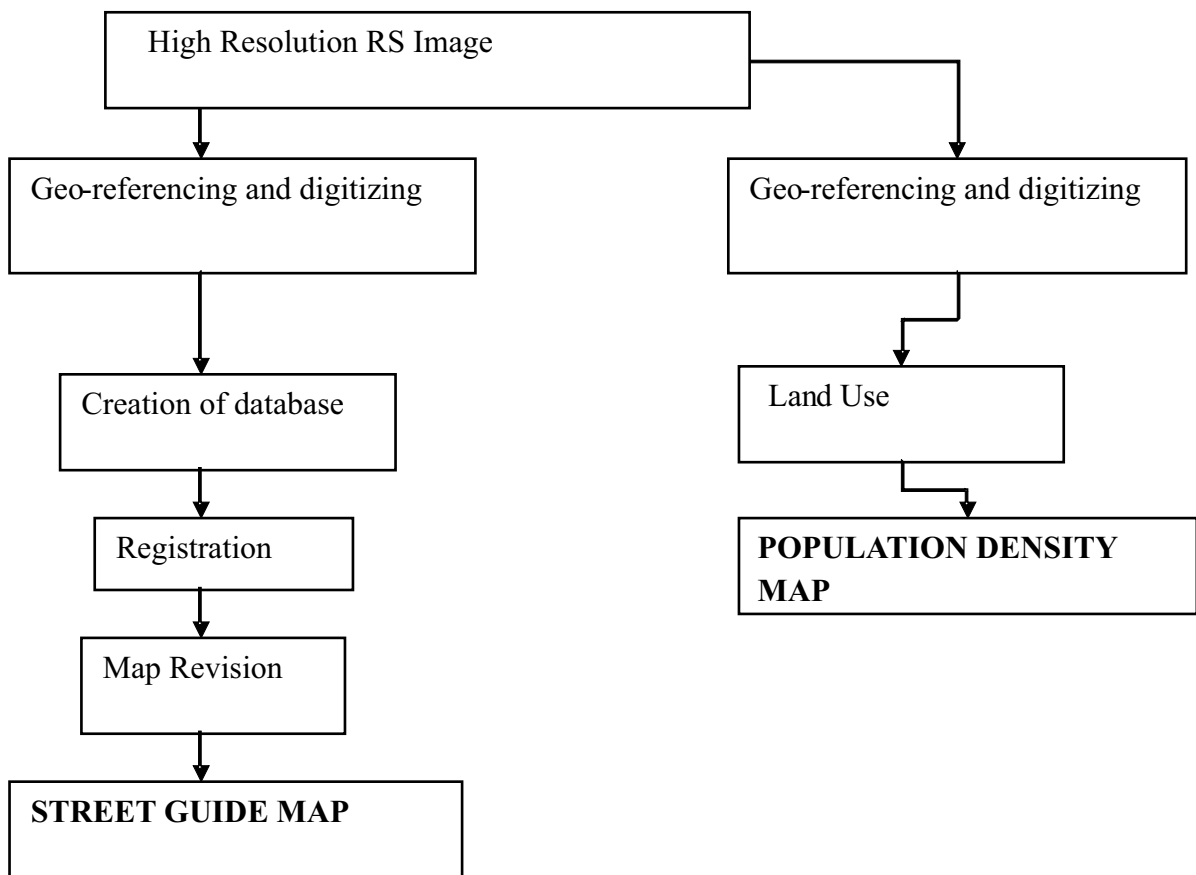


Fig 2: Cartographic Model

Data Acquisition

This is the first step in the execution of the mapping project after the preliminary stage of planning. It is a very important aspect of GIS as the type of data to be obtained and the accuracy of the data determines the output of the whole process. In this work, this was taken into consideration. The data collected consist of three types:

Spatial Data: The spatial data are the high-resolution image, land use data, and building parcel data. Land use data involve the built-up area as a basis for population distribution while Attribute data involves a direct visit to the site to interview people around to get information that is needed for the execution of the project. The data are street names, Number of people residing in the built up.



Fig 3: High-resolution image of the study area: source Google Earth

Data Processing: This is the procedure involved in the acquisition of data required to achieve this project which is:

Boundary Determination: The boundary of the study area was determined using SAS Planet software. The SAS planet was launched and the satellite imagery of the study area was downloaded for two imageries.



Fig 4: Boundary determination using SAS Planet software

A mosaic is produced, this is the merging of two or more images together. After the mosaic process, a couple of images in the same year are merged, a geometric correction is applied and re-projection into a common UTM zone 31. The imagery of the study area was added to the Arc map and the imagery was merged to form one single image.

Geo-referencing is the process of taking a digital image; it could be an air photo, a scanned geological map, or a picture of a topographic map and adding geographic information to the image so that GIS or mapping software can place the image in its appropriate real-world location. These imageries were all brought to the UTM projection systems.

Digitizing is the process of converting geographic data either from a hardcopy or a scanned image into vector data by tracing the features. Digitizing of the study area was done on the Arc map using catalog tools by converting the boundary to shape files.

Clipped: This tool allows you to extract a portion of a raster dataset based on a template extent. The clip output includes any pixel that intersects the template extent. The portion of the study area is clipped out from the mosaic image merged.

Raster Population Data: No doubt built-up area represents where population density is of higher value. Raster data creation was conducted as a basis for determining the structure of population distribution. Raster data was developed by 100m*100m area per unit grid.

The initial stage before determining the distribution of the population was estimating the number of people per house building that had been digitized associated with vast proportion throughout the building in the area.

$$\text{ParcelPop}_{ab} = \frac{\text{SubPop}_b * \text{PFLArea}_a}{\text{SubPFLArea}_b}$$

Where:

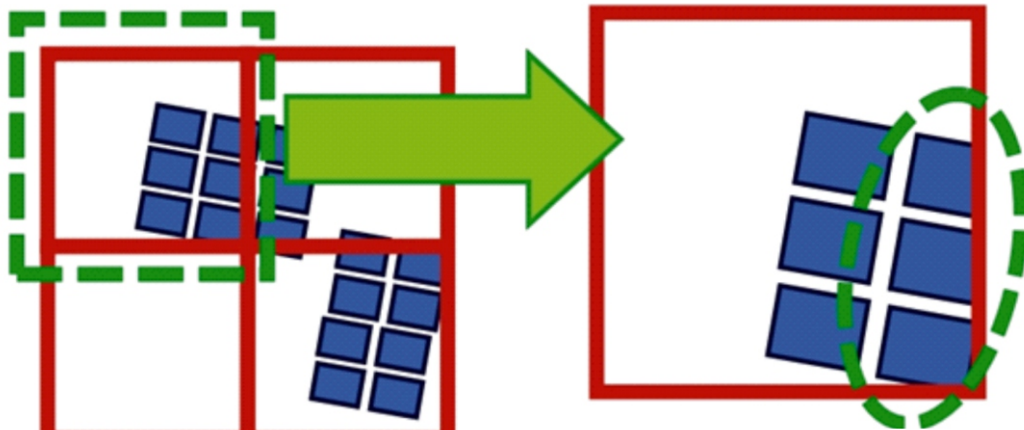
ParcelPop_{ab} = Population in building_a, Esa-Oke_b

SubPop_b = Population in Esa-Oke_b

PFLArea_a = building area_a

SubPFLArea_b = building area in Esa-Oke

By overlapping the building parcel map and grid map the population density in each grid was created. This process was done by the sum of the population within the building in the grid. The population is then converted into density by dividing the amount by the width of one grid.



$$\text{CellPop}_a = \sum_{b=a}^n \text{ParcelPop}_b \times \%P \text{ In Cell}$$

CellPop_{ab} = Population in grid_a

ParcelPop_{ab} = Population in building parcel_b was cut by grid_a

$\%P \text{ In Cell}_{ab}$ = Parcel_b percentage in grid_a

The next step is to change the vector data densities of each grid into raster data to create surface models using the population of the polygon to raster tools in ArcGIS.

$$\text{Population Density} = \frac{\text{Total Population}}{\text{Total land mass}}$$

Street Guide Data: The street guide data was gotten from the open street and questionnaire given to the people of Esa-Oke to get the information needed which is then used to create an attribute table and for query purposes.



Equipment (Hardware & Software)

The various equipment employed for the acquisition and processing of data and the subsequent information presentation can be arranged under three categories. These are the hardware, system selection, and software categories.

The hardware equipment is listed below:

Hardware

System Product: HP Laptop computer

Model: HP15 Notebook

Rating: Window 8.1 Enterprise

Processor: Intel(R) Core (TM)2 Duo CPU P8700 @2.53GHZ

Installed Memory (RAM): 4.00 GB

System Type: 64-bit Operating System.

Software

1. ArcGIS 10.2 for producing a plan
2. Notepad for the running of the script
3. Microsoft Excel for editing
4. Microsoft Word 2013 for report writing

Creating Shapefiles (Feature class)

At this point layers (shape files) were created that were used in vectorizing the analog map. All the shape files used were created using a Personal Geo-database. Create a folder in the desired location. Launch the Arc Catalogue from the ArcGIS 10.2. This includes the acquisition of the X, Y coordinates of points. The features on the satellite imagery were digitized. The satellite imagery of high resolution was used for the digitizing to generate X and Y coordinates.

Data Manipulation

Data manipulation is the process whereby the data acquired and recorded from field observation were properly edited and arranged. During this project, the data acquired and recorded from the field observation were properly edited and arranged on Microsoft Excel 2013.

Database Creation

According to (Kuforiji, 1998) which has designed a generic data structure, procuring necessary hardware and software, the overall system model had to be designed to facilitate ease of data exchange or networking. The information needs met by a well-designed (spatial) database in GIS include – reliable information storage and retrieval at will, up-to-date and well define functions of updating information as well as the provision of analytical functions which allow spatial query and reality modeling or simulations. After the design phase, the database was created and populated. Below are the processes involved in database creation for the map revision of part of the study area:

1. Creating a database;
2. Adding tables to the database;
3. Updating table and database links;
4. Removing the table from the database;
5. Creating persistent relationships;
6. Building referential integrity;
7. Creating stored procedures; and
8. Viewing and setting database properties.

Database Design

The database is the heart of any GIS. The first step in database design is to carry out user requirement studies i.e. ascertain the application and identify the required attributes (Ajibade, 1991). The process of designing such a database is referred to as data modeling. It is the process by which real-world entities and their interrelationships are analyzed and modeled in such a way that maximum benefits

are derived while utilizing a minimum amount of data (Kuforiji, 1998). A spatial database forms the core or heart of any GIS operation in that it allows the system to meet up with the information needs of the people (purpose) for which a GIS project is carried out. The information as well met by a well-designed (Spatial) database in GIS includes – reliable information as well as the provision of analytical functions which allow (spatial) query and reality modeling or simulations. In implementing the database design for the project, two main phases were adopted namely; the design phase and the construction (creation) or implementation phase. The design phase (data modeling) is known to consist of or taken through four stages that are:

1. View of Reality
2. Conceptual Design
3. Logical Design
4. Physical Design

Spatial Analysis

This is the unique capability of GIS that differentiates it from other information systems. The principal objective of spatial data analysis is to transform and combine data from diverse sources into useful information, to improve and understand or to satisfy the requirement of the objective of the decision maker.

This chapter, therefore, deals with spatial analysis, queries, and product generation using ArcGIS 10.2 version software and the analysis and query results show the software's capability of producing specific user information.

The analysis functions of GIS for this project include

1. Population density map
2. Street guide map
3. Cluster of the central service area
4. Queries

A digital database was created for the street guide map of the study area, which facilitated spatial analysis that resulted in the digital map of the study area in 2D. The analyses performed in this project are Population, street guide, and other spatial queries. What differentiates GIS from any other information system is its ability to carry out spatial queries or analyses on the database. Meanwhile, ArcGIS 10.2 version was used for the spatial analysis. The analysis is performed using the ArcGIS 10.2 software where; population density analysis, spatial queries, and street guide

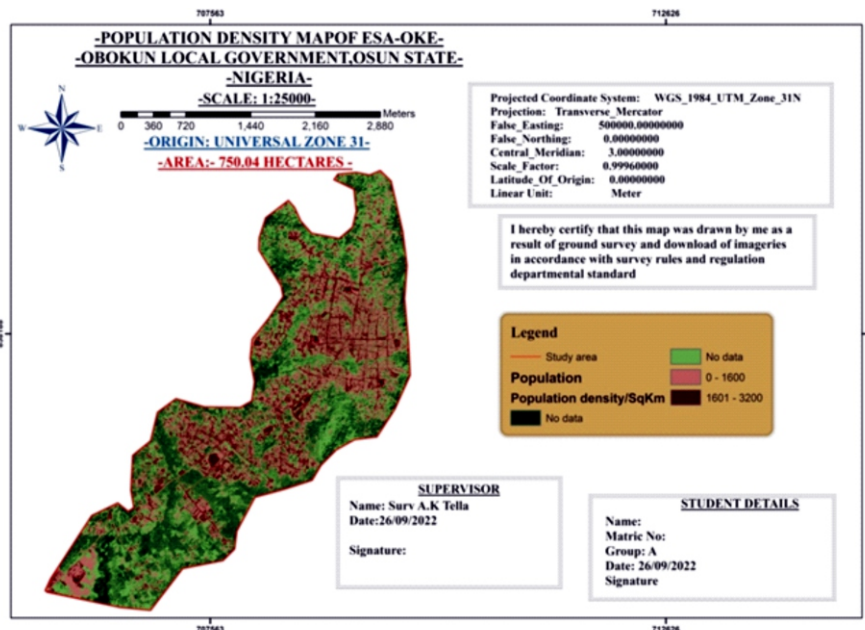


Fig 5: Population Density Map of the Study area

Analysis of Result

Population Density Map

The result of the map shows the brown colour has over 1601 - 3200 people per km² and is densely populated. The pink colour is between 0 - 1600 people per km². The light green and deep green are places that are for vegetation or rock so no data was gotten from it. The brown colour represented the densely populated area where the economic activities of the town are carried out. Most of the infrastructures are concentrated in that portion example the establishment of Osun State College of Technology, Bola Ige Mechatronics Institute. The pink colour represents places that are densely populated after the red colour, they are majorly residential areas. The light green and deep green represent places that are few or no settlements in the area.

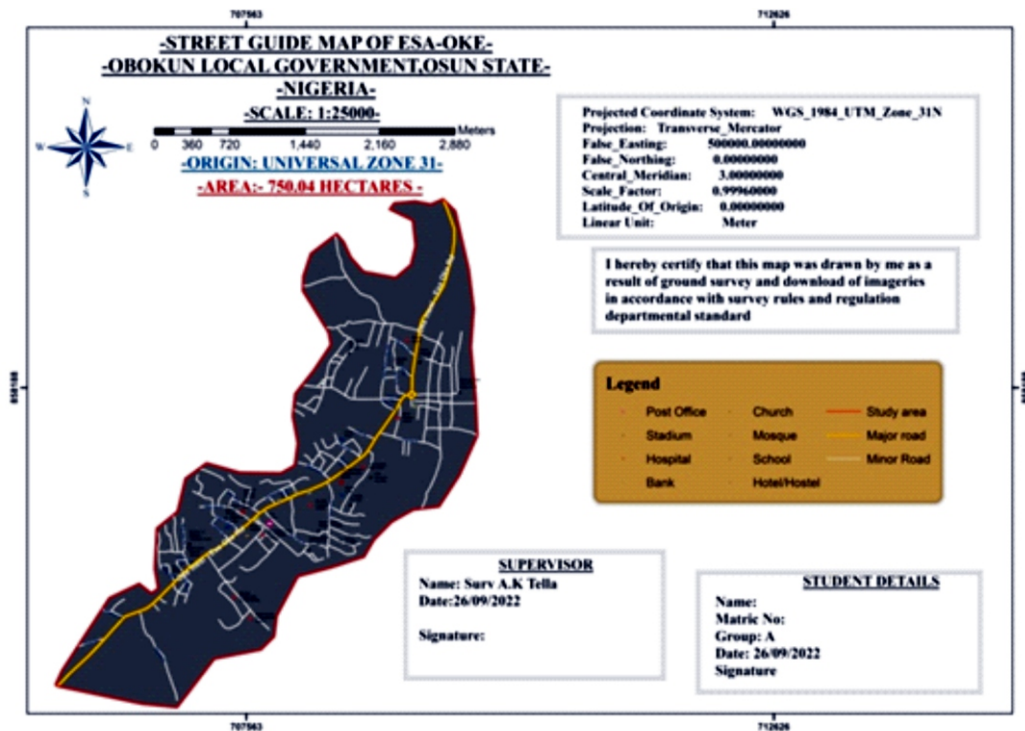


Fig 6: Street Guide Map of the Study Area

Street Guide Map

Based on the study area and the result produced, different road types were identified. The minor road accounted for 90% of the total roads while the major road accounted for 10% of the total road. The total distance of the road network in the study area is roughly 70,000m while the total number of roads is 109. The study area has only one roundabout where the town's major market is situated. The only transport link for people residing where there is no road is to go through the major road.

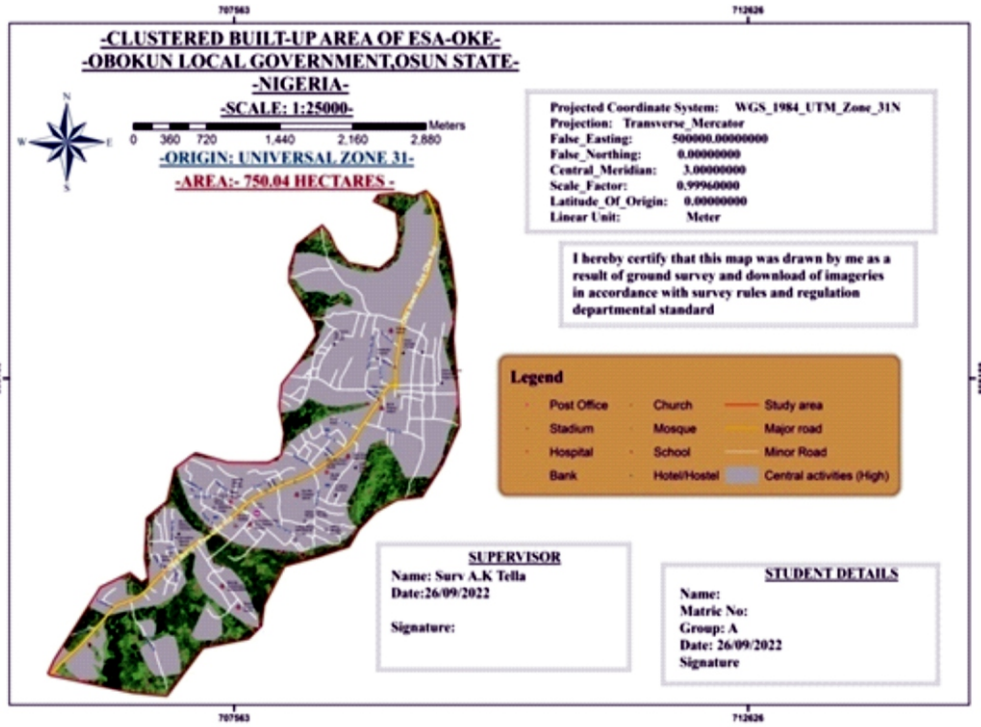


Fig.7 Clusterbuilt-up area of the study area

Analysis type: Query

Process: Query analysis using ArcGIS 10.2

Result: Displayed query analysis of minor roads greater than 500m. Fig 8

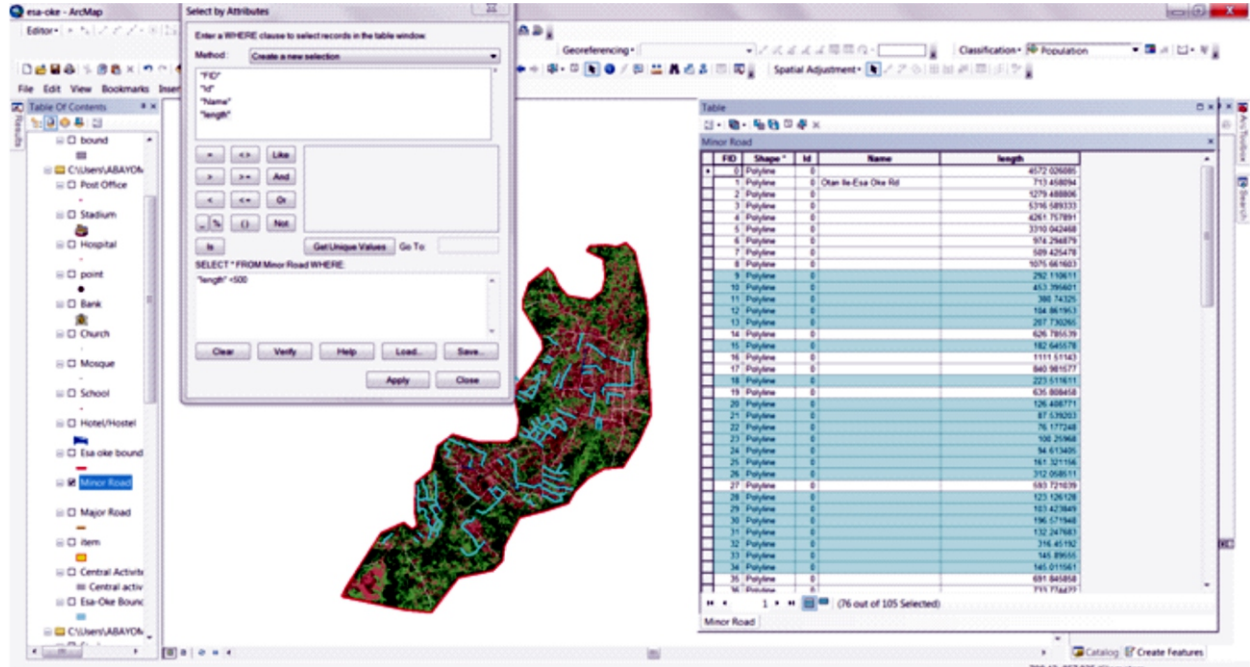


Fig 8: Query Analysis of the Study Area Road Analysis

The analysis of the result shows that out of 105 minor roads in the study area only 76 of them are less than 500m in length.

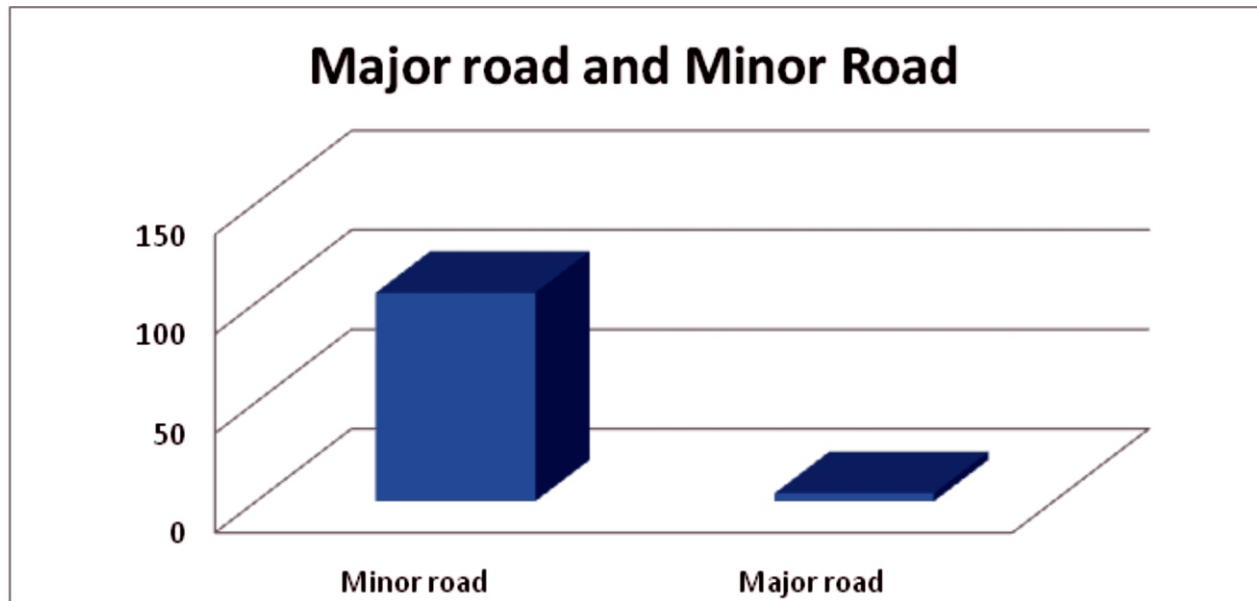


Fig 9: Road Analysis of the Study Area

The analysis of the result shows that there are 105 minor roads and 4 Major roads. The minor road is mostly concentrated in the economic area.

Conclusion

The survey operations carried out provides a framework for future developmental processes in the study area. Furthermore, for the ever-changing trends in technology and the need for spatial information in digital format is a basic necessity. The use of digital equipment and GIS application have become a veritable tool that must be used by all and sundry, high accuracy of spatial information systems must be provided for spatial decision-making. This will in turn aid physical and economic development, hence sustainability of the landscape of the area and the environment at large.

Many factors were identified as being responsible for a centralized population in the economic activities area. Some of these include the establishment of Osun State College of Technology, Bola Ige Mechatronics Institute, and Adonis College of Nursing.

Recommendation

Proper naming of the streets should be encouraged by erecting a signpost for proper identification, Social amenities such as good water, and electricity supply should be evenly distributed in the town to avoid congestion in a particular area. Government should create more bypasses and open up new roads.

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CORPORATE SOCIAL RESPONSIBILITY AND PERFORMANCE OF DEPOSIT MONEY BANKS IN NIGERIA

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Abstract

In today's world, businesses are expected to do more than just make profits. They are also expected to give back to the communities they serve and have a positive impact on society as a whole. This is where corporate social responsibility (CSR) comes into play. In Nigeria deposit money banks have been taking steps towards being socially responsible by investing in various initiatives such as education, healthcare, and environmental sustainability. But what effect does this have on their financial performance? Does CSR actually payoff for corporations? In this blog post, we will explore the impact of corporate social responsibility on the performance of deposit money banks in Nigeria and examine whether or not these efforts lead to greater success for these institutions. The study employed primary data obtained through questionnaire administration while secondary data were obtained from the financial statements of fourteen selected deposit money banks in Nigeria. Ordered logit and panel least square method of multiple regression analysis were used to achieve the objectives of the study. The Hausman test result shows that the random effect model supersedes fixed effect model. The findings of random effect model showed that corporate social responsibility is a significant determinant of employee performance and profitability with coefficient values of 0.043 and 0.059 at 5%. Thus, the study concludes that corporate social responsibility has significant impact on performance of deposit money banks in Nigeria.

Keywords: Corporate Social Responsibility (CSR); Corporations; Social Services and Financial Performance.

1. INTRODUCTION

Corporate Social Responsibility (CSR) has become an increasingly crucial aspect of corporate strategy in recent times. Companies that exhibit a strong commitment to CSR have been known to influence the social and environmental landscape positively, promote their brand image, and impact financial performance positively. Deposit Money Banks (DMBs) are not excluded from this phenomenon as they play a critical role in the economy development of Nigeria. It has become an important issue incorporating a great proliferation of theories, approaches and terminologies, such as social issues management, sustainable development, sustainable entrepreneurship, and business ethics with the aim of addressing issues confronting various organizational performances (Camilleri, 2017). It is the obligation of the firm's decision makers to make decisions and act in ways that recognize the relationship between the business and society. Business organizations do not exist in a vacuum but in a society made up of the employees, customers, government, neighboring environment and other stakeholders which go a long way in influencing the performance.

The primary drivers for CSR reporting came from a range of social factors, in which CSR was defined as an obligation to pursue appropriate policies, to make appropriate decisions, and to follow those lines of action which are desirable in terms of the objectives and values of the society (Elias, 2004). However, from managerial context, Richard and Okoye (2013) asserted that socially responsible business decisions could be justified by a long, complicated process of reasoning as offering an opportunity to bring the company long-run economic gain, thus repaying it for its responsible outlook.

Hence, society has come to expect businesses, with their successful operations to solve a major part of these problems by development of effective social responsibility objective and strategies. However, many organizations in Nigeria are driven by the need to make extra profits at the detriment of all the stakeholders (Akinyomi & Olutoye, 2015). Some do not adequately respond to the needs of host communities, employees' welfare (cheap labour often preferred), environmental protection and community development (Osemene, 2012). However, the expectation of social services from corporate firms has become very high in Nigeria and the negligence of the expectations by these companies has resulted to a very turbulent environment for companies operating in Nigeria. Nigerian banking sector has been bedeviled with internal (workers and investors) and external (depositors and general public) dissatisfaction, culminating to an image problem (Ngerebo & Yellowe, 2012).

There are instances when corporations exhibit socially irresponsible corporate behaviour, such as performance deceiving customers, swindling investors, putting consumers at risk, poisoning the environment and cheating the government (Alozie & Ndu Chigozie, 2018). Hence, this study examined the impact of corporate social responsibility on performance of deposit money banks in Nigeria. The next section is literature review. This is followed by methodology and discussions of findings. The last section covers the conclusion and recommendations of the study.

2. LITERATURE REVIEW

The literature review is a vital part of any research study involving reviewing and analyzing existing literature such as academic articles, books and reports to identify gaps in the current knowledge. In this section, we will discuss various studies conducted on corporate social responsibility (CSR) and its impact on the financial performance of Deposit Money Banks (DBMs) in Nigeria.

2.1.1 Conceptual Issues: Corporate Social Responsibility

There is no universally accepted definition of corporate social responsibility, it is usually described in terms of a company considering, managing and balancing the economic, social and environmental impacts of its activities (*Parliamentary Joint Committee (PJC)*, 2006). Corporate social responsibility is the way in which a company manages and improves its social and environmental impact to generate value for both its shareholders and its stakeholders by innovating its strategy, organization and operations. Organization for Economic Co-operation and Development (OECD), (2003) noted that corporate responsibility *involves* the search for an effective "*fit*" between *businesses* and the *societies in which they operate*. The function of business in society is to yield adequate returns to owners of capital by identifying and developing promising investment opportunities and, in the process, to provide jobs and produce goods and services that consumers want to buy. However, corporate responsibility goes beyond this core function. Businesses are expected to obey the various laws which are applicable to them and often have to respond to societal expectations that are not written down as formal law.

Amnesty International Business Group (UK) (2002) asserted that companies need to recognize that their ability to continue to provide goods and services and to create financial wealth will depend on their acceptability to an international society which increasingly regards protection of human rights as a condition of the corporate license to operate Garriga and Mele (2004) also grouped theories of CSR into four: instrumental, political, integral and ethical theories. Corporate Social Responsibility is the overall relationship of the organization with all of its stakeholders that include customers, employees, communities, owners/investors, government, suppliers and competitors (Khoury, Rostani, & Turnbull, 1999). Dahlsrud (2008) identified five dimensions of corporate social responsibility as; environmental, social, economic, stakeholder, and voluntary.

2.1.2 Performance of Deposit Money Banks

The performance of deposit money banks in Nigeria is a crucial aspect that cannot be overlooked when assessing the impact of corporate social responsibility. Deposit Money Banks are financial institutions that accept deposits from customers and provide them with loans, while also offering other services such as credit cards, overdrafts and trade financing. One way to measure the performance of deposit money banks is through their profitability. Profitability metrics include Return on Equity (ROE), Return on Assets (ROA), Net Interest Margin (NIM), and Non-Performing Loan Ratios (NPL). These indicators help investors understand how well a bank is using its resources to generate profits.

According to Toutou and Xiaodong (2011), financial performance is a general measure of how well a bank generates revenues from its capital. It also shows a bank's overall financial health over a period of time, and it helps to compare different banks across the banking industry at the same time. The bank's financial performance generally can be recognized as its stability and profitability. The stability refers to its risk factors and profitability refers to its financial return. According to Felix and Glaudine (2008), there are different financial indicators for measuring the profitability of banks, which are Return on Asset (ROA), Return on Equity (ROE), Earnings per Share (EPS), and Tobin Q. Return on Asset measures the efficiency with which the company is managing its investment in asset and using them to generate profit. It is the ratio of net income to the total asset. Return on equity measures how well a bank used reinvested earnings to generate additional earnings, equal to fiscal year' after tax. The return on equity is the most important of all financial ratios to investors in bank (Harelimana, 2017). Earnings per share are seen as one of the important factors affecting the dividend policy of a firm. It is calculated by dividing the profit of the companies by the number of ordinary shares outstanding.

Another important factor in evaluating the performance of Deposit Money Banks is their level of risk management which includes assessing whether they have adequate capital reserves to cover any unexpected losses or market volatility. Banks with strong risk management practices are better equipped to navigate economic downturns and remain profitable over the long term. Customer satisfaction is an essential component of a bank's overall performance. A high level of customer satisfaction indicates that a bank has built trust among its clients by providing quality services and meeting their needs effectively. It is a vital for deposit money banks in Nigeria to maintain strong financial health while also fulfilling their corporate social responsibility obligations towards society at large.

2.2 Theoretical Review

Utilitarian theory was propounded by Smart in 1973. The theory posits that corporations serve as part of economic systems with a mechanical function that is profit maximization. The need for economics of responsibility in the business ethics of the corporation, according to this theory led to the emergence of CSR ideas. The old idea of laissez faire business gives way to determinism, individualism to public control and personal responsibility to social responsibility. Utilitarian theory is seen as the instrument of wealth creation, and its social activities are the only means to achieve economic results. Friedman (1970) asserted that corporation needs to invest in the local community, in which it can be able to provide resources and amenities for the community. Piercy (2008) further divides the utilitarian theories into two: the social costs of the corporation and the functionalism idea. The social cost theory has a basis for CSR in which the socio-economic system in the community is said to be influenced by the corporate non-economic forces. The utilitarian theory therefore suggests that the corporation must accept social duties and rights to participate in Social Corporation. The functionalist theory specifically advocates that the corporation is seen as part of the economic system whose main goal is to make profit. The firm is seen as an investment which should generate profits. Therefore one may conclude that CSR is coined as a defense tactic of the industrial system

against external attacks because there is a need to provide a balance between profitability and social objectives for the economic systems equilibrium.

2.3 Empirical Review

Maldonado-Guzman, Pinzon-Castro and Lopez-Torres (2016) analyzed the existing relationship between CSR and business performance of 397 Mexican SMEs. Using Confirmatory Factor Analysis (CFA), the results obtained showed the existence of a positive and significant relationship between CSR and business performance. Mensah (2017) examined the effect of corporate social responsibility practices on organizational commitment of employees of rural and community banks in Ghana. A self-reported questionnaire was used to collect the data from 145 employees of 50 Rural and Community Banks (RCBs) across Ghana. Using descriptive statistics, the study found a strong positive relationship between engagement in corporate social responsibility practices and employee commitment. Engagement in corporate social responsibility practices explained 54.1% of the total variation on employee commitment. However, this relationship is insignificant when educational level and years of working with the bank is controlled for. Gender however does not confound this relationship.

Esteban-Sanchez, Cuesta-Gonzalez and Paredes-Gazquez (2017) examined the effect of corporate social responsibility practices on financial performance of 154 financial entities in 22 developed countries, most of them notably affected by financial crisis, from 2005 to 2010. The study employed static data panel models. The results show that banks with better employee relationships and corporate governance had better CFP. Nevertheless, the crisis negatively moderated this effect in the latter, suggesting failures in corporate governance mechanisms. Contrary to what was expected, the product responsibility dimension did not positively influence financial performance. The study found evidence that, during the crisis, better relations with the community could be valued positively by investors, which, in turn, increases financial performance.

Muhammad (2017) examined the impact of corporate social responsibility practices on financial performance of listed deposit money banks in Nigeria for a period of 2006 to 2013 (8years). Nine out of seventeen Banks were selected as sample of the study. The study uses secondary data from fact book and financial statements of Nigerian Stock Exchange (NSE) while total expenditure on corporate social responsibility practices serves as the independent variable, the dependent variables of financial performance were proxied by Return on Assets (ROA), Earnings per share (EPS) and Liquidity (LQT). The result reveals that CSR has a significant positive impact on ROA and EPS. CSR was also found to have a negative impact on LQT.

Alozie and Ndu (2018) evaluated corporate social responsibility practices practice and corporate performance of selected deposit money banks in Nigeria. Using data from the annual reports of five topmost DMBs in Nigeria (FBN, Zenith Bank, GT bank, UBA and Access bank), and the panel data regression technique for data analysis, it was found that there is positive and significant association between CSR and MS; and that there is no significant association between CSR and Liquidity.

Qun, Abdullah and Alvi (2018) evaluated the relationship between employee perception of corporate social responsibility practices (CSR) and employee's outcome in Pakistan for SMEs. The quantitative method was used to collect data from 300 SME's. While regression analysis was performed for mediation analysis. The results showed that organizational justice partially mediated between employee's perception of corporate social responsibility practices and employee's outcomes. Agyemang and Ansong (2018) examined the influence of corporate social responsibility practices on financial performance of small and medium-sized enterprises (SMEs) in Ghana by using access to capital and firm reputation as mediating variables. The study collected primary data from 423 SMEs within the Accra Metropolis. Partial least squares estimation technique was used to

analyze the data. The study revealed a mechanism through which corporate social responsibility practices results in financial performance of firms.

2.4 Corporate Social Responsibility and Financial Performance of Banks

Corporate Social Responsibility is becoming an increasingly important aspect of business operations for banks in Nigeria. CSR refers to the voluntary actions taken by corporations to positively impact society and environment. Many deposit money banks in Nigeria have recognized the importance of corporate social responsibility and are investing heavily in social services. One way that corporate social responsibility can impact financial performance is through enhanced reputation and brand image. When banks invest in projects that benefit society, it portrays them as responsible institutions, thus enhancing their reputations among customers. This can translate into increased customer loyalty, which may lead to higher revenues. Moreover CSR efforts can also help reduce costs associated with reputation damage or legal issues resulting from non-compliance with environmental regulations or unethical practices. These savings can contribute positively to a bank financial performance.

Additionally, Corporate Social Responsibility initiatives creates opportunities for new markets and revenue streams, banks that actively participate in community development programs often gain access to new markets previously untapped while promoting economic growth within the local communities they serve. There is growing evidence suggesting a positive correlation between corporate social responsibility activities and financial performance of deposit money banks in Nigeria. As such it has become imperative for these institutions to prioritize their participation not only for societal benefits but also as a means of boosting profitability over time.

2.5 Research Gap

Most studies (such as Omoro, Kinyua, & Okiro, 2014; Iqbal, Ahmad, Hamad, Bashir, & Sattar, 2014; Muhammad, 2017) focused on CSR and financial performance. However, there is need to examine the impact of corporate social responsibility on the operational performance of deposit money banks in Nigeria. Hence, this study focused on CSR and operational performance of deposit money banks in Nigeria. The study covers non-financial performance such as customer service delivery while dividend per share were uniquely used to measure financial performance.

More so, the previous studies classified corporate social responsibility as a unique variable. However, this study classified CSR as Educational Related Corporate Social Responsibility, Community Development focused Corporate Social Responsibility and Philanthropy Related Corporate Social Responsibility. All these were done with the aim of investigating the impact of CSR on performance of deposit money banks in Nigeria, banking sector being an important sector contributing to the nation's economy.

3. METHODOLOGY

This study examined corporate social responsibility and performance of deposit money banks in Nigeria. Primary and secondary data were employed. The primary data were obtained through copies of questionnaire administered on officials of deposit money banks in Lagos state. Lagos state was chosen because it is the biggest commercial center in Nigeria and also has the highest number of banks' branches in the country. One hundred and twenty five copies of questionnaire were distributed and used for the analysis of the study. The secondary data was obtained from audited annual reports, financial statements, CSR reports and website of fourteen quoted deposit money banks operating in Nigeria covering ten years (2012-2022). The choice of 2012 year was because Nigerian deposit money banks commenced the adoption of International Financial Reporting Standards while as at the time of this study, 2023 financial reports of Nigerian deposit money banks are yet to be published.

The fourteen (14) banks selected were: Access Bank, Diamond Bank, Ecobank, Fidelity Bank, First Bank PLC, First City Monument Bank (FCMB), Guaranty Trust Bank (GTB), Stanbic IBTC Bank, Sterling Bank, United Bank of Africa (UBA), Unity Bank, Union Bank, Wema Bank and Zenith Bank. The choice of these selected banks was because they are deposit money banks quoted on Nigerian Stock Exchange and also these banks represents 64 percent of the total population. Ordered logit regression technique was used to examine the impact of CSR on non-financial performance of deposit money banks in Nigeria. The method used in this study was unique because the dependent variable had more than two response categories and the responses are ordered. While, balanced panel data analysis was used to analyze the secondary data related to the impact of CSR on financial performance of deposit money banks in Nigeria.

The model used established a relationship between CSR and non-financial performance of deposit money banks in Nigeria. Thus, our model is presented as follows:

$$\text{CSD} = f(\text{PHRCSR}, \text{EDRCSR}, \text{CDFCSR}) \dots \dots \dots (1)$$
$$\text{CSD} = \beta_0 + \beta_1 \text{PHRCSR} + \beta_2 \text{EDRCSR} + \beta_3 \text{CDFCSR} + \mu \dots \dots \dots (2)$$

Where:
 β_0 = Constant
CSD = Customer Service Delivery
CSR = Corporate Social Responsibility
PHRCSR = Philanthropy Related Corporate Social Responsibility,
EDRCSR = Educational Related Corporate Social Responsibility and
CDFCSR = Community Development focused Corporate Social Responsibility.
 μ = Error term

The study went ahead to analyze the effects of corporate social responsibility on the financial performance of deposit money banks using dividend per share as a proxy for banks' performance. The use of DIV here is germane because it represents what each shareholder earns per every single share held in a firm. Thus, using dividend per share (DIV) as the dependent variable, the DIV is written as being determined by educational related corporate social responsibility, community development focused corporate social responsibility and philanthropy related corporate social responsibility in a functional form as:

$$\text{DIV} = f(\text{PHRCSR}, \text{EDRCSR}, \text{CDRCSR}) \dots \dots \dots (3)$$
$$\text{DIV}_{it} = \beta_0 + \beta_1 \text{PHRCSR}_{it} + \beta_2 \text{EDRCSR}_{it} + \beta_3 \text{CDFCSR}_{it} + \mu_{it} \dots \dots \dots (4)$$

Where:
 β_0 = Constant
DIV = Dividend per Share

4. RESULTS AND DISCUSSION OF FINDINGS

The analysis and finding session of this study aimed to examine the impact of corporate social responsibility (CSR) on the performance of deposit money banks in Nigeria. The result shows that there is a positive relationship between corporate social responsibility initiatives and financial performance. It was found that banks with strong CSR strategies had higher profitability ratios compared to their counterparts who did not prioritize social responsibility.

Table 4.1: Correlation Coefficients

Variables	EDRCSR	CDFCSR	PHRCSR	DIV	Variance inflation factor(VIF)
EDRCSR	1				1.64
CDFCSR	0.28	1			1.54
PHRCSR	0.2651	0.1557	1		1.78
DIV	0.132	-0.0308	0.0226	1	1.13

Source: Authors' computations, 2023.

The study examined the existence of multicollinearity among the variables used for the panel regressions. The existence of multicollinearity is a problem that invalidates the estimates of regression estimators. To assess this, a pair-wise correlation was conducted. This shows the nature of relationship between each pair of the variables used. The result of the correlation is presented in Table 4.1. It shows that CDFCSR and DIV have negative correlation coefficients (negative relationship) while all other variables are positively correlated. However, the correlation coefficient is less than 0.5 for all the variables.

Moreover, the Variance Inflation Factor (VIF) test was employed to also test the presence of multicollinearity. The rule of thumb is that, when the VIF value is greater than 5 there is the problem of multicollinearity otherwise there is no problem of multicollinearity. The result of the VIF shows that the values of the VIF, 1.64, 1.54, 1.78 and 1.13 for EDRCSR, CDFCSR, PHRCSR and DIV respectively are less than 5. Therefore, there is no problem of multicollinearity in the model. This implies that there is no strong interdependence among the variables. Hence, multicollinearity does not exist among them. Since there is no multicollinearity, the fixed effect and random effect regressions are employed without dropping any of the variables.

Table 4.2: Result of Ordered Logit Regression for CSD

Independent variables	Dependent variable: Customer Service Delivery (CSD)	
	Coefficient of ordered logit (1)	Marginal effect (2)
CDFCSR	0.83 (1.34)	0.013 (0.014)
EDRCSR	6.48*** (1.41)	0.10 (0.096)
PHRCSR	-1.37*** (0.48)	-0.021 (0.019)
Constant cut 1	9.54*** (2.22)	
Constant cut 2	15.5*** (4.04)	
Constant cut 3	22.3*** (6.24)	
Constant cut 4	27.2*** (7.58)	
Observations	125	125
Log likelihood	154.41577	
Wald statistics	23.54	
P-value of Wald statistics	0.0000	

Source: Authors' computations using STATA 12, 2023.

Standard errors in parentheses; Where ***, ** and * denotes 1%, 5% and 10% level of significance respectively. Ordered logit regression was used to investigate the effects of corporate social responsibility on customer service delivery of Nigerian deposit money banks (DMBs). The result is displayed in table 4.2 above. The estimates of the coefficient of the regression and the marginal effects are presented in column 1 and column 2 of the table respectively. The coefficients are used to examine the nature of relationship and significance of the independent variables while the marginal effect is used to evaluate the extent (magnitude or size) of impact of the independent variables on the dependent variable. The dependent variable is Customer Service Delivery (CSD) while community

development related corporate social responsibility (CDFCSR), education related corporate social responsibility (EDRCSR) and philanthropy related corporate social responsibility (PHRCSR) are the independent variables. The result indicates that EDRCSR and CDFCSR are positively related to CSD. This implies that there is more likelihood that the probability of efficient CSD will increase with increase in EDRCSR and CDFCSR of the banks. On the other hand, there is inverse relationship between PHRCSR and CSD. It means rise in PHRCSR will reduce the probability of high CSD of the banks in Nigeria.

However, the result indicates that EDRCSR and PHRCSR are statistically significant at 1% Level of significance. This is because half of the values of the coefficients of these variables are greater than the standard errors of the coefficients. This means CSR has significant impact on CSD of Nigerian banks. The values of the marginal effect of the logit regression (in column 2) indicate that respondents strongly agree that the probability of having high CSD increases by 0.10 with the increase in EDRCSR while the probability of quality CSD fall by 0.021 with rise in PHRCSR. So, CSR has huge impact on CSD of Nigerian DMBs. In the table all the constant cut values are statistically significant, therefore we cannot collapse any of the categories. This means all the response categories are relevant and thus cannot be collapsed. The Wald test statistics is 23.54 with P-value 0.0000 this means that the model has a good fit.

Table 4.3: Hausman Test

MODEL	Hausman test	P-value
FIXDIV	0.30	0.9593
RANDOMDIV		

Source: Authors' Computation, (2023)

Hausman Test

When both fixed and random effects models have good fit, Hausman test is used to compare and choose a better model between the two. The null hypothesis for the Hausman test is that a random effect model is better than the fixed effect model, or a random effect model is consistent. If the null hypothesis is rejected, use the fixed effect model; otherwise, go for the random effect model.

In the case of the Hausman test results presented in table 4.3 above, the chi-square statistics of the Hausman test for FIXDIV and RANDOMDIV is 0.30 with P-value 0.9593. Since the P-value is greater than 5% level of significance, the null hypothesis is not rejected and the result of the random effect model supersedes empirical inferences regarding the relationship and impact of the independent variables for DIV.

Table 4.4: Result of Fixed Effect and Random Effect Models for DIV

Independent Variable	Dependent Variable: Dividend Per Share (DIV)	
	Fixed effect model (1)	Random effect model (2)
LogEDRCSR	0.46** (0.21)	0.49** (0.20)
LogCDRCSR	0.19 (0.24)	0.18 (0.23)
LogPHRCSR	-1.01*** (0.34)	-0.97*** (0.33)
Constant	9.88 (7.37)	8.94 (6.85)
Observations	112	112

Source: Authors' computations using STATA 12, 2023.

Standard errors in parentheses***, ** and * denotes 1%, 5% and 10% level of significance Respectively.

The model estimated in this study to evaluate the effect of corporate social responsibility on dividend per share of deposit money banks in Nigeria is the one presented in table 4.4. The results of random effect model are presented in column 2. In the model, the dependent variable is Dividend Pay Share (DIV). The Educational Related Corporate Social Responsibility (EDRCSR), Community Development focused Corporate Social Responsibility (CDRCSR) and Philanthropy Related Corporate Social Responsibility (PHRCSR) still remain the independent variables. The independent variables were logged to harmonize the unit of measurements. This is because DIV is in ratios while all the independent variables are measured in millions of naira. The results of the random effect model illustrate that EDRCSR and CDRCSR are positively related to the DIV. That is, DIV of DMBs in Nigeria increased with increase in their corporate social responsibility on education and community development. PHRCSR is inversely related to DIV. So, rise in philanthropic corporate social responsibility tends to reduce the DIV of the deposit money banks.

Moreover, the coefficient of logEDRCSR and logPHRCSR are indicated to be statistically, significant at 5% and 1% respectively in random effect model. This implies that, corporate social responsibility on education and philanthropy are significant determinants of DIV of the deposit money banks in Nigeria. In other words, corporate social responsibility has significant effect on dividend per share of deposit money banks in Nigeria.

Averagely, DIV increased by 0.0046 (0.46/100) and 0.0049 (0.49/100) units in the random effect model due to a percent increase in the expenditure on education related corporate social responsibility of DMBs in Nigeria. However, the results of random effect model indicate that 0.0097(0.97/100) and 0.0101 (1.101/100) units decreases in DIV result from a percent increase in PHRCSR. This implies a spectacular impact of corporate social responsibility on DIV of deposit money banks in Nigeria. The coefficients are divided by 100 and the interpretation is in percentage change to unit change because the independent variables are logged. Meanwhile, the results imply a spectacular impact of corporate social responsibility on DIV of DMBs in Nigeria.

Table 4.5: Fitness of the Models

	Goodness of fit	MODEL	Fit-Statistics	P-value
FIXDIV	5.10		0.0044	
RANDOMDIV	15.90		0.0012	

Source: Authors' Computation, (2023)

Goodness of fit

In order to examine the goodness of fit of the panel regression models employed in this study, F- test was used for the fixed effect model. The results of the tests are presented in table 4.5. FIXDIV and RANDOMDIV represent the fixed and random effect models in which dividend per share is the dependent variable respectively. The fit- statistics for FIXDIV and RANDOMDIV are 5.10 and 15.90 with P-values 0.0044 and 0.0012 respectively. When the P-Value of the statistics is less than the conventional level of significance (1%, 5% and 10%), the model is said to have a good fit, otherwise the fit is bad. The fit statistics of all the models in table 4.5 have P-Values which are much less than 5% level of significance. So, all the models have good fit and their estimates are valid for empirical inferences.

4.2 Discussion of Findings

The results of this study revealed that there is a positive relationship between corporate social responsibility variables (such as education related corporate social responsibility, community development focused corporate social responsibility) and customer service delivery in Nigerian DMBs while philanthropy related corporate social responsibility have a negative relationship with performance of DMBs which is consistent with the study of Alozie and Ndu (2018). Therefore, the null hypothesis which states that corporate social responsibility does not significantly affect banks' customers' service delivery in Nigeria should not be accepted.

Moreover, the research reveals that CSR activities contribute positively to brand reputation, customer retention, employee satisfaction and risk management practices. This benefit indicates that focusing on social services can create value for all stakeholders involved. These findings provide evidence supporting the argument that corporations should integrate social responsibility into their business operations as it has tangible benefits for both society and financial performance.

Finally, the study revealed that corporate social responsibility (such as education related social responsibility and philanthropy corporate social responsibility) have significant impact on dividend per share of Nigerian deposit money banks which is consistent with the study of Adeyanju (2012). These findings conform to Utilitarian theory which is seen as the instrument of wealth creation, and its social activities are the only means to achieve economic results.

5. CONCLUSION AND RECOMMENDATIONS

To sum it all up, Corporate Social Responsibility has become a critical component of the operations of deposit money banks in Nigeria, it is no longer just an activity to fulfill regulatory compliance but rather, a way to gain competitive advantage and improve financial and nonfinancial performance. The findings of this study also confirm that CSR initiatives have a significant impact on the profitability, growth, customer loyalty and reputation of deposit money banks in Nigeria. Furthermore, we found out through our analysis that corporate social responsibility positively affects employee productivity, community development and environmental sustainability which are key factors for business success. The study also reveals that corporate social responsibility impacts on customer service delivery of deposits money banks in Nigeria. Corporate social responsibility has significant impact on the dividend per share in Nigerian deposits money banks. Finally, it can be concluded that effective implementation of Corporate Social Responsibility practices will lead to improve performance not only for deposit money banks but any corporation operating within the Nigerian Market.

Based on the conclusion above, the study recommends that for deposit money banks to achieve enhanced and sustained customer service delivery, involvement in educational related corporate social responsibility should be maintained because educational related corporate social responsibility has been identified as determinant of customer service delivery. In terms of economic performance, the management of deposit money banks should intensify their involvement in community development focused corporate social responsibility so as to improve their profitability. Corporations are encouraged to integrate social services into their operational strategies as part of their core values so as to achieve long term benefits such as increase revenue generation due to brand recognition from satisfied customers who value both quality service delivery and community involvement.



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CITIES OF THE FUTURE; THE GENESIS, GROWTH, DYSTOPIA AND UTOPIA REFLECTIONS

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Abstract

Cities were birthed without preparation, growing without pruning, and degenerating without remedy. Rapid and irreversible urbanization has changed the faces and destinies of cities, calling philosophers and scholars alike into action. The scenario has raised two voices; dystopian and utopian. Dystopia sees today's cities as bad, agonizing, and can only offer dreadful quality of life while utopia envisages a 'perfect city' as a sustainable solution. Hence, a smart city is a way forward; smart technology, smart people, smart governance, smart economy, smart environment, smart infrastructure, and smart living. No matter how cities are viewed, however, they still offer tremendous opportunities for human capital development, and economic and administrative hubs for better and prosperous life.

Keywords: Dystopia, Utopia, Smart City, Future City, and Information Technology

1. Introduction

Primitive men lived not in cities; they wander and gather to meet their daily needs. They later graduated to cultivation and domestication of crops which resulted in sedentary life. This sedentary lifestyle that marks the beginning of settlements is known as **Neolithic Revolution** (Childe, 1892-1957). In no time, the mortality rate in these settlements increased and **Neolithic Demographic Transition** ensued (Johnson, 1966, and Smailes (1970).

Ever since settlements have passed through developmental stages. According to Lewis Mumford's book published in (1962) "*The Cities History*", they have developed from *Eopolis*; when the economy is based on agriculture to *Polis*; when some crude mechanization and specialization are coming-up, *Metropolis* when cities or towns are assuming administrative responsibilities or serves as capitals of states or regions and to *Megalopolis*; when towns or cities show signs of decline and deterioration as a result of inefficient infrastructure and services and to drastic deterioration of cities known as *Tyranopolis*; and *Necropolis*, the worst stage when towns/cities force people out because of threat to life and economic breakdown.

The notion that cities and towns have achieved better economic, political, and social mileage compared to the rural areas has drawn many people into them resulting in the progressive increase in the number of people living in towns and cities to enjoy "*privileged*" social and economic services and benefits. Cities, 'the magnets of hope' are seriously pulling able-bodied rural dwellers without being ready to accommodate them (Oyenyi et al, 2015; UN-Habitat (2023). The presence of these migrants creates new problems or aggravates existing ones (Mabogunje, 1976). The consequences of this, among others, include inadequate housing, urban poverty, food shortage, insecure tenure, increased crime rate, overcrowding, high mortality rate, poor service delivery, inequality and development of informal settlements, traffic problems and transportation inefficiencies, poor basic amenities and urban decay, overcrowding or inadequate living space, housing, and unemployment problems, inadequate safe water and sewerage management problems, high cost of living, noise and air pollution, overstressed and inefficient infrastructural facilities.



1.2 Dystopia and Utopia Reflections

The word Dystopia has a Greek root meaning “bad place”. It is an imaginary place of extremely bad condition, from deprivation, oppression, or terror. It is a hypothetical place/society, or situation in which conditions and the quality of life are dreadful. It is a miserable and dysfunctional state. A state or society that has a very poor standard of living, is simply the opposite of utopia. Critical factors of a dystopian state include the nature of governmental control, environmental destruction, and the effects of man's quest for survival.

The picture that conjures up in our minds, when we talk about current cities, especially in developing countries is that of a dirty, unhygienic, clustered, impoverished, crowded, gloomy, dingy, dark dismal, filth, blighted, and squalor. Unfortunately, human residence continues to shift from rural to urban centers that are already huge and deteriorated (Davis 2004; Borja 2007; Nelson, 2010 and Oyeniyi et al, 2015).

A United Nations report on Migration in 2022 stated that by 2030, the global population would have grown to over 8.5 billion people and 60% of this number would live in cities and one in every three people will live in a city with over half a million inhabitants. By implication, the large cities will keep getting larger and the problems will continue. For instance, The Cable News online on July 4, 2016, reported that Akinwumi Ambode, the then governor of Lagos state, Nigeria, said 86 immigrants who have no plan to return enter Lagos every minute, 123,000 every day –the highest in any city in the world (The Guardian).

Living in these cities for both the rich and the poor is agonizing, dehumanizing, stressful, and unsafe because of social inequality, unemployment and underemployment, poor infrastructure, and dysfunctional security system among others. Residents are increasingly frustrated with the pathetic economic situation and the worsening urban poverty, malfunctioning health, educational, and transportation systems, lack of safe water provision, epileptic power supply, inadequate housing, environmental pollution, and frustration with the enormous potential and opportunity for human development that urban centers offer.

The problems of cities have not just started, they all started at the time of the Neoclassical Revolution when settling down in one place, near animals encouraged the spread of zoonotic and waterborne diseases or since man's disobedience in the Biblical Garden of Eden and has continued in different dimensions. Man has also made efforts without ceasing to find lasting solutions to the ever-growing problems.

Two voices of thinkers and philosophers are loaded, the dystopian and utopia schools of thought. Plato was the first utopian scholar who philosophized and envisaged the ideal city-state in his book, “*The Republic*” published in 380 BC. He laid down concrete parameters as to the activities of every class within society should handle. Thomas Campanella agreed with Plato in his 1602 publication “*The City of Sun*”. He proposed the idea of a city-state that is a harmonious city of genuine communitarianism and governed by beneficent elites in a distant or secluded land. Francies Bacon published his “*New Atlantis*” much later (1626) in which he pictures his ideal state in which technology and scientific experiments will propel the progress of an enlightened future state. Just like Pluto and Becon, he opined that the ideal state/city should be secluded.

Thomas More who lived between (1477-1535) popularized the idea of 'utopia', a word used to describe a perfect imaginary world. More's book envisaged a self-contained society that is situated on an island. He suggested that people should share a common culture and way of life. Thomas More's “*Utopia*” published in (1516) advocated constant inventiveness and; the progressive virtual conception of what an ideal future city should be like. Samuel Butler envisaged how society might be better run with the aid of products of technology in the work titled *Erewhon published in(1872)*. Utopian ideology is aiming for or models a state in which everything is perfect; having a perfect and



ideal condition of cities as well as social organization. Utopia scholars are futuristic; projecting, depicting, and improving the organization of city and societal life.

Utopia is a social-environmental concept of an ideal society but has been viewed in various contexts in literature; it has been seen as the biblical *Garden of Eden*; an aesthetically pleasing place where the knowledge of good and evil ruled. It has been replicated in *Heaven*; a supernatural place where God, the angel, and the soul of man live in harmony. It was described as *Lost Horizon*; a mystical harmonious valley, *The Peace Blossom Spring*; a beautiful and secluded place not affected by the rest of the world, and *A Brave New World* among others. Relevant examples of utopia are ecological utopia; where everything will work in harmony, where waste, pollution, and other anthropogenic hazards are unknown. Scientific and technological utopia attempts to combine the products of science and technology to achieve a better and ideal future city.

The Economist Intelligence Unit (EIU) Global Livability Index Report of 2023 analyzed 173 cities of the world into 5 categories using stability, healthcare, education, culture, environment, and infrastructure as yardsticks. Tripoli, Libya, Lagos, Nigeria, Karachi, Pakistan, Dhaka, Senegal, Bareilly, Karachi and Port Moresby of Papua New Guinea, Dhaka of Bangladesh are the globally acclaimed worst live-able cities in descending order, while the most live-able cities are Vienna, Austria, Copenhagen, Denmark. Melbourne, Australia, Sydney, Australia, Vancouver, Canada, Zurich, Switzerland, Calgary, Canada.

We are in the century of utopia but for cities to be abreast of much anticipated enviable future, they must correctly secure political will, harness human and social capital as well as information technology. Sustainable cities of the future should be able to react to the challenges of today's cities, develop, maintain, and sustain efficient infrastructure, run on hi-tech innovation, big data connectivity and virtual information dissemination and Internet of Things (IoT), use ecologically efficient energy, resistant to environmental challenges and secure, attractive and healthy built environment. Hence, the need for a paradigm shift from dystopia to utopia; the ideal future city.

1.3 A Paradigm Shift in City Management

Smart cities; the obvious city of the future is expected to run on technology, the Internet of Things (IoT), and big data. By “Smart”, we mean that the city is more sustainable, liveable, and efficient. A smart city is a city where urban planning is conceived with the ultimate goal of connecting everything using state-of-the-art technologies; artificial intelligence, machine, and deep learning among other technologies. This connectivity which creates a vast amount of data is then used to improve city services and infrastructures as well as improve citizens' environment and quality of life.

Smart cities integrate various technologies that can deliver sustainable socio-economic development of an urban area, develop and rely on smart city application that sustains and improves the lives of urban residents Donepudi, 2015, UN-HABITAT Report 2022. According to Voda and Radu (2018), the use of technology in smart cities should be able to improve the quality of life of the people, stimulate growth in the economy and improve urban management.

1.4 Smart City Dimensions

The smart city development context has various dimensions. The dimension includes people, community, and technology. A smart city can only be smart when it highlights people, communities, and technology but not technology only. (Pozdniakora, 2016).

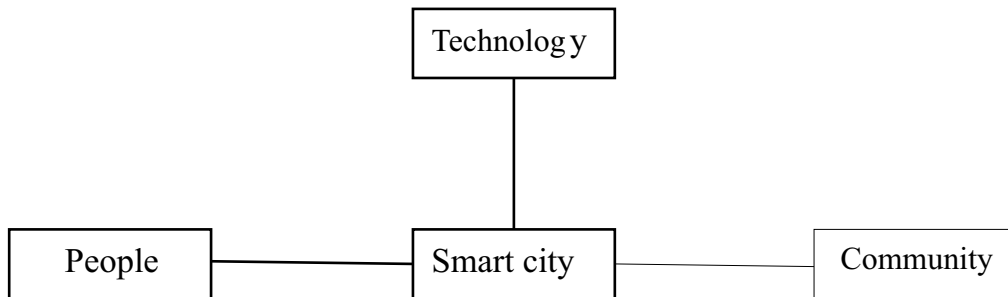


Fig. 1: Smart City Dimension

The presence of technology allows the smart city to have more creativity, improve governance and promote quality of life. The people's dimension/ segment includes a human city, a knowledgeable city as well as human and social infrastructures necessary for the development of smart cities (Pozdniakora, 2016). To have a coherent smart city the learning, cultural and business aspects of smart people are necessary. They play an essential role in upgrading competitiveness of an urban areas context by helping to develop an information economy workforce. Smart people are also to lead a life founded on better education and a skilled workforce (Arroub et al, 2016). Finally, smart communities aim at integrating the necessary number of city dwellers into information technology to improve their quality of life.

2. Conceptual Framework

At its core, a smart city framework leverages the existing legal, economic, and technical environment and impacts the social and management aspects sustainably. Setting a smart city vision and effectively moving towards it with a system-based approach is imperative to ensure optimum resource efficiency and security along with preserving socially inclusive growth.

Drawing from the factors considered above, we conceptualize an integrative framework that explains the relationship between these factors in a more coherent fashion. We have named it as SMELTS framework (Social, Management Economy, Legal, Technology, and Sustainability). Each of these factors enables both public and private sectors to plan and implement smart city initiatives more commendably. These elements provide a basis for matching how different cities are envisaging their smart initiatives, employing shared services, and the related challenges. This framework also analyses the actual impacts of different factors on the success of smart city initiatives. The framework indicates that each factor is both affecting and getting affected by each other factor. It also indicates that some factors may be more influential than others depending on the context.

The framework can be bifurcated into two levels. The level consists of the factors which have a greater impact on smart city initiatives. This also consists of technology which is the foundation of smart cities. The outer level factors are the ones that might get influenced by the inner level before impacting the smart city initiatives. This includes governance and the socio-balance of the community apart from sustainability which should be the basis of any development.

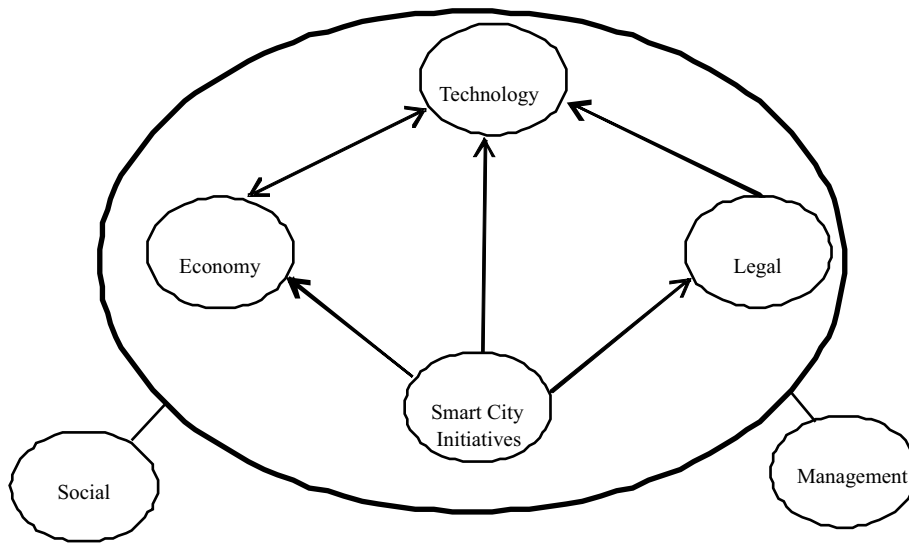


Fig. 2: Framework for smart initiatives

Models and Pillars of Smart City Initiatives

To make smart cities real, various leading stakeholders such as government, businesses, and professionals are to work on effective smart city models. Although most developed cities around the world have made significant progress in the development of smart cities, small cities face numerous challenges as they work on implementing the new and disrupting smart city concept. According to Arroub et al (2016), the Smart city model should be based on a comprehensive examination of current success stories of smart city implementation. Additionally, smart city implementation should consider the implementation of various smart city paradigms which consist of aspects such as smart economy, smart mobility and transport, smart environment, smart living, smart governance, smart people, and smart economy.

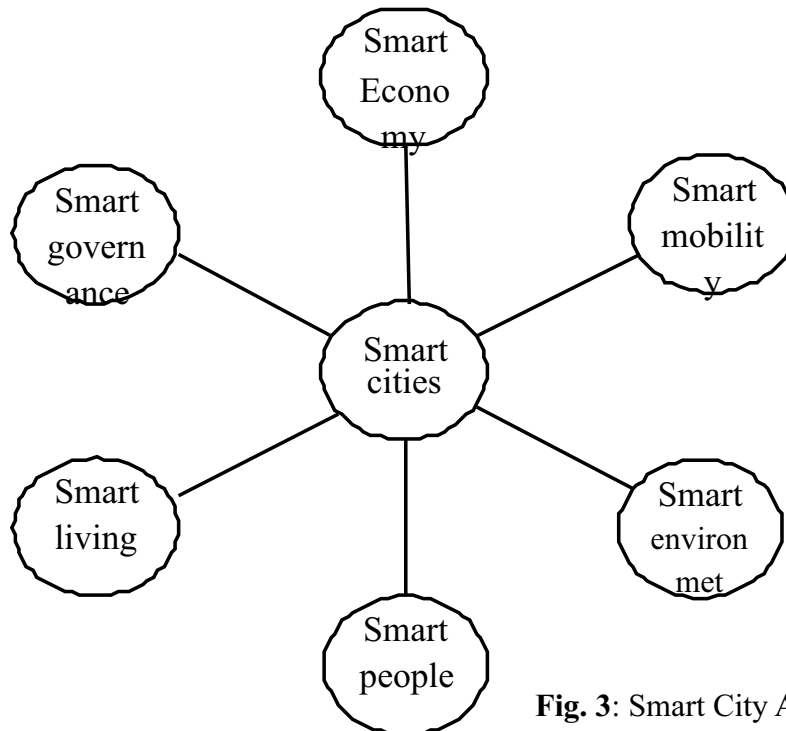


Fig. 3: Smart City Aspect



Smart Governance: Smart cities involve multiple stakeholders handling different projects to improve the management of smart cities' projects; the level of governance should be of high quality. Traditionally, the management of urban center projects was done manually. Today, information technology help improve the management of smart city projects through enhanced communication networks, improved communication system, innovative policies, and better business models (Mohanty et al. 2016). Additionally, with smart governance, stakeholders can collaborate and operate on projects, have improved leadership models, and solve issues efficiently.

Smart Economy: The most important thing in a smart economy is the presence of smart companies that can produce innovative ideas on resource optimization and improvement of the price-quality ratio (Arroub et al 2016). The idea should be able to improve productivity and reduce the cost of production. Additionally, smart companies should be able to achieve high levels of competitiveness through higher profits, good quality products, and efficient cost of production.

Smart Environment: Due to the increased population in urban centers, cities must work on achieving a smart environment. A smart environment involves the usage of green and natural energy resources with less pollution to the environment (Mohanry et al, 2016). Waterway sewers and green spaces should be managed more smartly.

Smart living: Smart cities should support the smart living of the people. People should be able to develop intelligent ways to live through information technology. In smart cities the interconnection of devices using information technology makes a lot of daily tasks carried out by people easier, safer, and cheaper (Mohanty et al, 2016). For example, a smart building may consist of numerous interconnected devices that allow managers to gather data, analyze the data, and make appropriate decisions aimed at managing the building effectively.

Smart mobility: Transport management is essential in all urban places. Cities experience various transport challenges such as congestion and poor transport network. Smart cities should be able to support various systems such as transport management systems and traffic control systems which have evolved over the years to support effective and smarter mobility in cities (Arroub, 2016).

Smart people: Urban centers can not achieve smartness without people being smart. The people must be educated, learned, and knowledgeable. In most cases, when we talk about smart cities, the people's dimension is forgotten. However, it is important to ensure that the smart people concept is implemented to achieve efficient cities.

Opportunities in the Smart/Digital Cities

The future of the city will continue to be dynamic. Innovations will continue the transformation of the city and challenges of integration of various components of the city as a system will always throw up new challenges. Smart cities provide numerous opportunities for city dwellers.

This is attainable as a result of the efforts of many stakeholders working together in a partnership of different shapes and forms. Some of these opportunities include automobile and transportation, where the future cities' structure, landscape, and efficiency will be defined by innovation in self-driven cars, electric cars, metro line mass transit, etc. Information communication technologies which are the center of smart cities will have innovations in the areas of digital technologies, GPS trackers, smartphones, licensed plate trackers, etc. Digital technologies will help future cities to produce more healthcare, more education, more entertainment, and more of all the other material goods and services.

One of those notable opportunities is a sustainable transportation system which is achieved through the smartification of the traffic system. Future cities smart cities can rely on smart transportation



management systems that can reduce congestion on roads, provide citizens with an improved travel experience and reduce the time taken to respond to incidents, (Donepudi, 2015). A good transport management system for future cities should be able to support various features that include the ability to sense and gather data through road sensors, social media, and the use of cameras. The data collected can be analyzed in real-time, allowing faster-making decisions.

The green environment is another area that smart cities of the future can achieve, there is increased awareness of the bad effects of environmental pollution and the need to use renewable energy such as solar and wind power. Additionally, smart cities can rely on technologies such as artificial intelligence to make energy generation consumption and management smarter. Efficient energy management can be achieved through the creation of smart grids that can route energy to consumers in smart, effective, and efficient manners.

Challenges of Smart Cities

Both current and future cities are exposed to various challenges, and the ability and mechanism to ameliorate these challenges triggered the emergence of smart cities. However, the main areas that if not well addressed can limit the successful implementation of smart cities include economic, social, demographic, and environmental factors. These aspects must be highlighted when implementing smart cities. Furthermore, it is important to note areas such as transport and health which are the main obstacle to achieving totally smart cities.

One critical area in which smart cities are throwing up a great challenge is the increasing automation and use of robotics to replace manual work which can lead to the disappearance of many traditional jobs. This is creating functional unemployment; this will require that many people acquire new and emerging skills to stay relevant and employable.

The greatest challenge created by smart cities will be in the area of social cohesion and inclusiveness. Cities create avenues where everybody is less concerned about the next person. Worst still, smart cities will create a more divided world and bring to the fore the social segregation that clearly shows the differences between the haves and have-nots.

1. Conclusion

With the ever-increasing population levels and sudden population explosion in the cities occasioned by urban challenges such as pollution, scarcity of resources, traffic congestion, and many more. There have been new different schools of thought on the emergence, growth, and state of future cities; some view cities as a place of opportunities, development, and progress while the other school of thought view cities as a place of crisis underdevelopment, and a place that is not worthy of living. Notwithstanding the views of the school of thought, it's time to leverage technology and establish a smarter system that can optimize the use of limited resources. Many cities have already started. For the cities of the future to be live-able, efficient, and smarter, it is essential to act fast as the need to provide sustainable cities through the smart cities initiative is non-negotiable.

Smart cities will solve the problems associated with large populations in cities with smart cities resources and this will be managed efficiently. New urbanism perspectives in urban governance and planning of cities will be efficient while transport systems, waste management, and health care services will be effective. However, to achieve such benefits cities will need to adopt emerging technologies such as artificial intelligence, the Internet of Things (IoT), deep learning, and machine learning. With such technologies, smart cities will be able to deliver sustainable socio-economic development.



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ASSESSMENT OF THE EFFECTS OF MONITORING AND EVALUATION PRACTICES ON CONSTRUCTION PROJECTS' QUALITY IN OSUN STATE
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ABSTRACT

Monitoring and Evaluation of construction projects is a vital component of project management. The paper examined the effect of monitoring and evaluation practices on construction project delivery (quality) in Osun State. Questionnaires were designed to meet the research objectives and to test its hypotheses and were administered to construction professionals working with the state. The questionnaires were analyzed using descriptive and inferential statistics methods and deductions derived from the analysis. The results showed that there is a fairly strong positive relationship between monitoring and evaluation practices and project quality ($R=0.411$). The hypotheses were tested and the test revealed that monitoring and evaluation Practices have no significant impact on the project. The study revealed that a unit increase in X1, X2, X3, and X4 causes Y (Project delivery defined by quality, to increase by -0.042, 0.108, -0.007, and 0.009 respectively. The study concluded that M & E practices have no significant impact on construction project quality in the study area. The study recommended that monitoring and evaluation practices should still be incorporated and effectively implemented in the construction process because of other variables of Construction Projects delivery. The study further recommended that construction stakeholders' feedback should be well captured and analyzed for implementation of effective monitoring and evaluation

Keywords: *Monitoring, Evaluation, Monitoring and Evaluation practices, Construction, Projects*

Introduction

Project abandonment and building collapse have become a major phenomenon in Nigeria and a major cause is a lack of effective monitoring and evaluation practices or a total absence of it. The study is assessing the effect of Monitoring and evaluation practices on Construction projects' quality; which is a sub-variable of Construction projects' delivery. Previous researchers have focused on the main dependent variable of 'Construction projects delivery'.

Monitoring and evaluation (M&E) is described as a process that assists project managers in improving performance and achieving results. According to United Nations Development Programme (2012), the goal of Monitoring and Evaluation is to improve current and future management of outputs, outcomes, and impact. Williams (2000) asserts that monitoring provides management and the main stakeholders of a development intervention with indications of the extent of progress and achievement of expected results and progress with respect to the use of allocated funds. Monitoring provides essential inputs for evaluation and therefore constitutes part of the overall evaluation procedure. Evaluation is an organized and objective assessment of an ongoing or concluded policy, program/project, its design, execution, and results. Ballard (2010), noted that monitoring and evaluation is a process that helps program implementers make informed decisions regarding program operations, service delivery, and program effectiveness, using objective evidence. Monitoring and evaluation (M&E) should be an integral part of any construction project development process, unfortunately in most cases, it is brought into the development planning process as a contingent element. Dialo and Thuillter (2010) pointed out that project monitoring and evaluation are even more critical than planning in the achievement of project success. The

construction industry plays a very significant role in the socio-economic development of any nation. In most countries, construction activity constitutes 6-9% of the gross domestic product (GDP) and more than half of the fixed capital formation as infrastructure and public utilities required for economic development (Chitkara, 2009; Alade, Lawal, Omonori and Olowokere, 2016). In Nigeria, the construction industry is one of the main targets of the government budget, in terms of government development programs. According to the National Bureau of Statistics (2022), Construction contributed 10.16% to nominal GDP in the fourth quarter of 2022, higher than the 9.99% contribution a year earlier, and higher than the 9.50% contributed to the fourth quarter of 2021.

The client's need from the contractor is value for money, the best quality work (product) with minimum or considerable cost at a required duration (timely delivery), which can be seen as the common criteria for a successful construction project. The traditional performance indicators in the construction industry are completion time, cost, and quality control. The perception of failure and success of projects is usually based on personal indices and the experience of the project manager and it is not uncommon that two project managers would assess the performance of the same project but using the same data differently. The disparity of judgment is mainly due to the lack of clear and consistent monitoring and evaluation procedures and methodology. There are many occasions when the project is under budget and progressing as scheduled, yet it is considered a failure by upper management because of low quality and safety performance records. Charles and Humam (2015) opined that in developing countries, a lack of monitoring and evaluation capacity continues to cause non-sustainable outcomes of the projects.

The study aimed to assess the effect of monitoring and evaluation practices on construction projects' quality to enhance the quality performance of construction projects in the study area. The specific objectives of the study were to:

- i. assess the roles of monitoring and evaluation practices in construction projects delivery in the study area; and
- ii. examine the effect of monitoring and evaluation practices on construction projects' quality in the study area.

Study Hypothesis: H01: planning process, technical expertise, stakeholder involvement, and management participation have no significant impact on construction project delivery (quality).

Literature Review

Construction Projects' Monitoring and Evaluation Practices

Project Management Body of Knowledge (2001) explains that monitoring and control of construction project work is “the process of tracking, reviewing, and regulating the progress to meet the performance objectives defined in the project management plan”. It further explains that monitoring includes status reporting, progress measurement, and forecasting.

According to Dyason (2010), Monitoring is the collection along with analysis of information regarding a given program or intervention; and evaluation is an assessment whose focus is to answer questions relating to a program or an intervention.

Evaluation is more about the results/outcomes and impact of the project. It is usually a periodic assessment of changes in the predetermined results that relate to the program or the interventions of a project (Goyder, 2009). It helps the project manager to arrive at decisions on the project's destiny and to determine if the project has attained the set goals and objectives.

Monitoring and Evaluation practices ensure that the project/program results at the levels of impact, outcome, output, process along with input can be quantified to offer a framework for accountability and assisting in making informed decisions at program and policy levels. Though monitoring and evaluation practices implementation have substantial cost, time as well as human resource

implications, they are very vital for successful projects and should not be overlooked at the beginning of the process (Khan, 2013).

Those involved in the process understand the importance of evaluation (Chaplowe, & Cousins, 2015). The project implementers must recognize the methods and the thinking that is based on monitoring and evaluation techniques used (Ober, 2012). Project monitoring and evaluation should bring a way of considering goals achievement. Shenhar (2011) noted that community engagement and strengthening of local capacities are applied throughout the programme cycle. That meant the community should be involved directly in the identification of their own needs, defining the objectives of the programme, implementing the activities and monitoring and evaluating the programme. Human resources management is very critical in project management. Particularly, they are essential for effective monitoring and evaluation.

The technical capacity and organizational know-how in carrying out evaluations, the value and participation of its human resources in the process of decision-making as well as their motivation in executing the decision arrived at can significantly affect the evaluation (Vanessa, 2016). Estimation of Financial resources done during planning for implementation of monitoring and evaluation (Dyason, 2010). The key aspect of planning for monitoring and evaluation is to approximate the costs, staffing, and other resources that are required for monitoring and evaluation work. Monitoring and evaluation specialists need to weigh in on monitoring and evaluation budget needs during the project design phase so that funds are distributed to the implementation of key monitoring and evaluation tasks (Ahsan and Gunawan, 2010).

Project success (delivery) is measured by product and project quality, timeliness, budget compliance, and degree of customer satisfaction. Ling, Low, Wang, and Lim (2009) as cited by Charles and Humam (2015) also assessed Scope management, Time management, Cost management, Quality management, Risk management, Human resource management, Procurement management, and Integration management concerning project success where he established that there were significant associations.

Construction Projects delivery is a process of using specific project management techniques to oversee the planning, design, and of course, the construction of a project from start to finish to hand over the construction project to time, cost, quality, and user satisfaction. Monitoring and evaluation are regarded as core tools when it comes to enhancing project management quality, considering that in the short run and the medium term, the management of complex projects will entail corresponding strategies from the financial viewpoint, that are required to adhere to the criteria of effectiveness, sustainability along with durability. The activity of monitoring supports both the project managers and staff in understanding whether the projects are progressing as predetermined (Houston, 2008). Therefore, monitoring offers the background for minimizing time along with cost overruns, while at the same time ensuring that the required standards of quality are attained in the implementation of the project. On the same note, evaluation is a tool for assisting project planners and developers in assessing the extent to which the projects have attained the objectives that are outlined in the documents related to the project (Crawford and Bryce, 2013).

In a construction project, quality management has been widely used by world-class companies to ensure successful project delivery (Aichouni et al., 2014). The interactions and interrelationships between key participants (e.g. the client, the architect, and the contractor) largely determine the overall performance of the construction project. Rwelamila and Wisemant (1995), Arditi and Gunaydin (1997). Turk (2006) and Saeed and Hasan (2012) pointed out that quality in the construction industry can be defined as meeting the requirements of the designer, constructor, and regulatory agencies as well as the owner. According to Luai, Lana, and Christine H, (2016),



Construction specific factors of standards, drawings, and specifications must be established before detailing in the form of a contract and before performing the tasks.

A study that was conducted by Singh, Chandurkar, & Dutt, (2017) highlighted that monitoring and evaluation was the major driving factor in development projects. The objective of this study was to determine the effect of monitoring and evaluation on development projects. However, the recommendation that was given in this study was that the management should provide full support and should fully engage themselves in the monitoring and evaluation process as this will help them in coming up with sound and well-informed decisions.

Mackay & World Bank. (2007) conducted a study in Washington, which indicated that planning for monitoring and evaluation was critical in enhancing better project performance on government projects.

Barasa (2014) conducted a study on '*Strategic Plan, Logical Framework, Budget, Stakeholder's Analysis & Construction Project Delivery in Kenya*' using Survey, Correlation, and Multivariate Regression Analysis. The findings showed that Monitoring & Evaluation tools influence project delivery. Stakeholder analysis had the most significant influence on project delivery followed by Strategic Plan, Budget, and Logical framework. The results showed a significant correlation between monitoring and evaluation tools and project completion.

The study carried out by Sialala (2016) revealed that quality Integration of M&E leads to good results and provided a way to assess the crucial link between implementers and beneficiaries.

Other studies had recognized four skills for effective project managers, they include mental, human, stakeholder, and technical skills, along with their 16 other skill competencies. The study was to determine whether project technical skills influence project performance. Data were collected from 107 project team members using a questionnaire assessment method. The study results showed that project team leads technical skills impact project performance. Project excellent performance is impacted by several skill components, which include visioning, sensitivity intelligence, interactive skill, dynamic leadership, interpersonal influence, integrity, quality management, and document and agreement administration. Project Managers may use the outcome as a parameter to assign project managers with the 'right' skill profile or to concentrate their human resource development on skills that are significant for project success. A study done by Vittal (2008) indicates technology awareness is important in project monitoring and controlling due to greater challenges in today's technology-enabled project, this is especially where technological tools are used in project management practices,

This study helped to analyze fundamental connections between technical expertise and project performance. Subsequently, understand the indulgent function of expertise to the project team in cultivating enhanced project performance. The findings of this study were that project teams are equipped with the right technical skills linked to project performance. The study demonstrated that it is difficult to disassociate the use of technology with project performance and the absence of such relation-induced project performance, being a technical expert in monitoring and evaluating a project can play a main role in supporting the project team in handling projects effectively and efficiently.

Methodology

The target population is Architects, Quantity Surveyors, Builders, and Engineers in the State Ministry of Works and contracting firms. The research design used for this study is a survey design. The instrument of data collection for the study was the questionnaire which was structured in such a manner that allowed the respondents to easily fill in their responses without difficulties as well as a personal oral interview. The study was carried out in Osun State in which the projects in the State to

which monitoring and evaluation practices were applied comprised construction of new roads, rehabilitation of existing roads, construction of various new public buildings as well as renovation of some existing ones. The population of this study is made up of 106 construction professionals engaged in the service of the State and 555 construction professionals in construction companies and organizations, making a total of 661.

The procedure that was adopted for selecting respondents for this research was purposive sampling. The sample size for this study was determined using Yamane's (1967) formula.

$n = N / (1 + N(e)^2)$ n = the sample size; N = size of the population, e = level of precision (or limit of tolerable error) i.e. 0.05 or 95% confidence level. With a population of 661 respondents: $n = 661 / (1 + 661(0.05)^2) = 661 / 2.6525 = 249.20 = 250$ respondents

To assign the sample size of 250 to the two categories of respondents, Bourley's proportional allocation formula was used $nb = n(n)/N$

Where: nb = Bourley's Proportional Allocation Formula, n =Population allocated to respondent groups, n = Total sample size, N =Population of the study 40 respondents was selected for construction professionals in the ministry of works while 210 respondents was selected from the contracting firms and organizations. Regression analysis which is a statistical model was used in this study to establish the relationship between Monitoring and Evaluation practices and project time.

The study used the following regression model:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e,$$

Where: Y = Project Cost α = Constant term, β = Beta

Coefficients, X_1 = Planning process, X_2 = Management participation X_3 = Technical expertise

X_4 = stakeholders' involvement e = Error term.

Results and Discussion

234 of the 250 distributed questionnaires were returned representing 93.6% of the total questionnaires distributed.

Demographic Characteristics of Respondents

Demographic features	Categories	Frequency	Percentage
Profession	Architects	18	7.7
	Quantity Surveyors	50	21.4
	Civil/Structural Engineers	56	23.9
	Builders	36	15.4
	Electrical/Mech. Engineers	42	17.9
	Others	32	13.7
	Total	234	100
Years of experience	< 5years	28	12.0
	5-10years	84	35.9
	11-15years	64	27.4
	16-20years	14	6.0
	Over 20 years	44	18.8
	Total	234	100

Source: Researcher's Field Survey, 2022

The table also shows that 23.9% of the respondents were Civil/Structural Engineers, 21.4% were Quantity Surveyors, 15.4% were Builders, and 17.9% were Electrical/Mechanical Engineers while



7.7% of the respondents were Architects. This shows a balanced distribution of Professionals in the construction industry. 35.9% of the respondents had spent between 5 to 10 years in the construction industry, 27.4% had spent between 11 to 15 years, and 18.8% had spent well over 20 years while only 12% had spent less than 5 years in the construction industry. This shows that the respondents had requisite experience in the construction industry.

Descriptive Statistics

	Mean	Std. Deviation	N
Project Time	.8649	.34658	37
Planning Process	5.2432	.43496	37
Management Participation	7.5405	.50523	37
Technical Expertise	7.5946	.49774	37
Stakeholders Involvement	4.7568	.64141	37

The table presents the descriptive statistics results. Mean is the average value of the series which is obtained by dividing the total value of the series by the number of observations. The above table showed that the mean score for the independent variables: Planning Process, Management Participation, Technical Expertise, and Stakeholders' Involvement are 5.2432, 7.5405, 7.5946, and 4.7568 respectively.

Standard deviation is a measure of spread or dispersion in the series. From the table, the standard deviation for the planning process, management participation, technical expertise, and stakeholders' involvement are 0.435, 0.505, 0.498, and 0.641 respectively.

Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.274 ^a	.075	-.041	.23387

- a. Predictors: (Constant), Stakeholders' Involvement, Management Participation, Technical Expertise, Planning Process
- b. Dependent Variable: project quality

Table 15 shows that there is a weak positive relationship between monitoring and evaluation practices and project quality with an R-value of 0.274

The table further shows M &E Practices accounted for 7.5% of the variation in the dependent variable: Project quality (R²=0.075). Other factors that may affect the dependent variable are outside the scope of this research work.

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.142	4	.035	.648	.633 ^a
	Residual	1.750	32	.055		
	Total	1.892	36			

a. Predict *ors: (Constant), Stakeholders' Involvement, Management Participation, Technical Expertise, Planning Process

b. Dependent Variable: project_quality

From the ANOVA table, P (sig.)-value = 0.633 which is greater than 0.05,

Decision: Accept Ho

Coefficients

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients		
1	(Constant)	.356	1.205		.296	.769
	Planning Process	-.042	.106	-.079	-.395	.696
	Management Participation	.108	.080	.238	1.359	.184
	Technical Expertise	-.007	.084	-.014	-.079	.937
	Stakeholders Involvement	.009	.070	.025	.128	.899

a. Dependent Variable: project_quality

From the table of coefficients above, the Regression model for project quality is

$$Y = 0.356 - 0.042X_1 + 0.108X_2 - 0.007X_3 + 0.009X_4$$

The regression model shows that a unit increase in X_1 , X_2 , X_3 , and X_4 causes Y (Project delivery defined by project quality) to increase by -0.042, 0.108, -0.007, and 0.009 respectively.

Hypotheses

H_0 : planning process, technical expertise, stakeholder involvement, and management participation have no significant impact on construction project quality.

Level of significance (α) = 5% (i. e. 0.05), since P-value = 0.633

Accept H_0 , therefore, M & E Practices (planning process, technical expertise, stakeholder involvement, and management participation) have no significant impact on construction project quality.

The result is a deviation from the discoveries of previous researchers and this might be a result of the study area as well as other variables that are beyond this study. Also, this might be because project quality is a sub-variable of the main variable: project delivery or success.



Conclusion and Recommendation

The study examined the effect of monitoring and evaluation practices on construction project delivery (quality) in Osun state. The study revealed that M&E practices ensure the successful and timely delivery of construction projects and enhance compliance/ adherence to specifications.

Furthermore, the study revealed that the effect of monitoring and evaluation practices (Planning process, management participation, technical expertise, and stakeholders' involvement) is high on construction project delivery defined by quality.

The study also revealed that there is a fairly strong positive relationship between monitoring and evaluation practices and project quality ($R=0.411$).

The test of hypothesis also revealed that monitoring and evaluation Practices (planning process, technical expertise, stakeholder involvement, and management participation) have no significant impact on project quality.

Given the findings and conclusion of the research, the following are suggested recommendations deduced from the study:

- i. Monitoring and Evaluation practices should still be incorporated and effectively implemented in the construction process because of other variables of Construction Projects delivery.
- ii. Construction stakeholders' feedback should be well captured and analyzed for the implementation of effective monitoring and evaluation.

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-9-

AN ASSESSMENT OF RESIDENTS' RECREATIONAL BEHAVIORS AND PREFERENCES IN OSOGBO METROPOLITAN AREA OF OSUN STATE.

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Abstract

The study appraised the level of involvement and preferences of residents in recreational activities in the Oshogbo metropolis. The data for the study were sourced from both primary and secondary sources. The survey research design was adopted whereby structured questionnaires were used to elicit information from 411 randomly selected residents of the study area, this represents 0.095% of the sample frame of 449, 099. The secondary data were sourced from the internet, journals, textbooks, magazines, and the Ministry of Youth, sport, and social development. Descriptive statistical tools were used in the analysis of the data. Results of the investigation reveal that recreational activities occupy about 65% of the respondents' leisure time and only 35% of the sample residents usually engaged in non-recreational activities. The result revealed the five most preferred activities of recreation by a majority (79%) of the sampled population which include; watching soccer, playing soccer, taking beer/other drinks, visiting places of interest, and trekking/walking. However, the results also indicate that the preferred recreational activities also vary with the age, gender, educational attainment, and income level of the residents. For effective planning therefore, the study recommends that the allocation of resources for recreational facilities in the metropolitan areas should reflect the different social classes; age, gender, education, and income levels.

Keywords: Recreation, recreational behaviors, recreational preferences.

Introduction

Recreation is described as the activity that people choose to engage in when at leisure, and it may be multifaceted, comprising physical, cognitive, emotional, and social components (Broad Hurst 2001). Recreation involves activities that people do for enjoyment, usually to refresh the body and mind. Recreation, therefore, includes kind of activities like visiting areas such as parks, wilderness areas, lakes, rivers, and forests as well as engaging in different exercises such as trekking, fishing, hunting, and camping. Participating in recreational activities is of great importance for maintaining the mental and physical health of individuals, families, and communities (Neuvonen et al 2007). As indicated in various studies, engaging in recreational activities two or three times a week or for half an hour, a day is beneficial for human health (Pouta and Sievanam, 2001, Oja, 2000). Every human being needs leisure time which could be utilized in a certain recreational activity for rejuvenation, positive recreation is neither a luxury nor unproductive activities but a fundamental human need required to stay healthy. However, attitude can be one of the most difficult barriers to recreation participation (Bedni 2000; Smith et al, 2005). (Obina et al, 2009) equally contend that attitude to recreation is one of the recreation challenges in the rural and urban areas in Nigeria.

Kachoub (2010) report that attitude is an intrinsic component that reveals one's thought and beliefs in a language, culture, people, or activity which consequently helps to predict the behavior of the individuals.

Crow and Crow (1999) described the attitude as the effective by-product of an individual's experience, having bases in their inner urge, acquired habits, and the environmental influence by which he is surrounded. Henry (1991) explains attitudes as serving as an index of how he thinks about people, objects, and issues in our environment. They provide clues to future behavior, predicting how

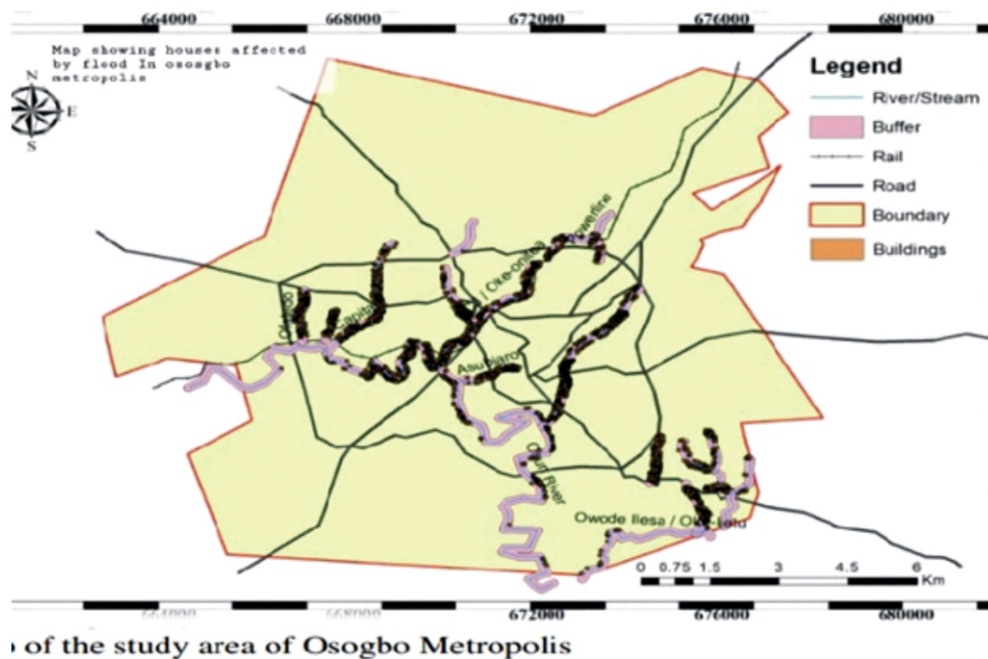
we will act when we encounter the object of our belief. However, many people feel limited in participating in recreational activities due to various constraints. Lack of knowledge, overcrowding, distance to recreational areas, family problems, and lack of money and companionship were indicated as the most significant recreational constraints in many studies (Coyle and Kinney, 1990; Kay and Jackson, 1991). Gender has been found as an important constraint in many studies, especially for females who are participating in recreational activities less frequently than males (Johnson et al; 2001; Henderson and Bilaesehki (1991). Health problems and aging are other constraints on the participation of people in recreational activities. Distance to recreational areas is another factor affecting the participation of people in recreational activities (Neuvononet et al 2007). Recreational areas are visited more frequently if they are located near urban areas (Grahn and Stigsdotter; Roovers et al, 2002).

The Study Area

Osogbo is the capital of Osun state, it is located on latitude $7^{\circ}42'10''$ and $7^{\circ}51'10''$ N, and longitude $4^{\circ}28'43''$ and $4^{\circ}40'12''$ E. It has an area of approximately 2875 km^2 . It is some 88km by road from northeast of Ibadan. It is about 195km or approximately three hours drive from Lagos. Osogbo shares boundaries with Ikirun, Ilesha, Ede, Egbedore, and Iragbiji and it is easily accessible from any part of the state because of its central nature.

The projected population for Osogbo in 2023 was put at 771,515 (World Population Review, 2023). Most of the population are members of the Yoruba ethnic group. Osogbo has a tropical climate with rainfall and an average annual temperature of 25.5° Celsius (77.8° Fahrenheit) and 1361 millimeters (55.6 inches) of precipitation. The height is about 500m above sea level (Falade, 2000) and it is drained by the Osun River and its tributaries such as Gbonmi, Ogbaagba, and Omu. Osogbo is located in the tropical hinterland of Nigeria.

The Osun Osogbo sacred groove, a forested area with shrines and sanctuaries, harboring Osun State and other deities was designated as a UNESCO World Heritage site in 2015. Osogbo is the trade center for a farming region; yam, cassava, grain, and tobacco are grown. About 27% of the population is engaged in farming as their primary occupation, 8% are traders and 30% are clerks, teachers, etc.



Map of the Study Area of Osogbo Metropolis



Literature Review and Conceptual Framework

Recreation is from two Latin words “RE” meaning to do again and 'CREARE' meaning to create. Recreation is a reviewing experience, a different and refreshing change from daily routine and workday experience (Fadamiro, 2003). Leisure according to Nixon (2003) is from the Latin word, “Licere” meaning to be allowed or licensed. Recreation is the expenditure of time with the intent to gain some refreshment. It is a break from monitoring and a diversion from a daily routine. It is a positive change from the stereotypical lifestyle and involves active participation in some entertaining activities (Oak, 2010). Recreation activities involve an element of enjoyment and happiness obtained from engaging in something one likes. Different recreational activities serve as a source of immense pleasure and provide relaxation to one's mind and body. Boniface and Cooper (1987) and Roberts (2001) agreed that recreations are the varieties of activities we choose to undertake during leisure. Recreation, therefore, is a pursuit taken up during leisure time other than those to which people have high commitments. Recreation also is a means of escaping from work, boredom, and a body renewed in preparation for routine and necessary work. Leisure according to Boniface and Cooper (1987) is a measure of time, after personal household chores have been completed. Akogun (2006) reported that leisure and recreation are classified as tourism activities which involve other sectors of the economy; Transportation, education, industry, urban development, forestry, telecommunications, etc. at national, state, and local socio-economic policies and socio-politics tradition. While caught in the rut of hectic jobs and routine chores, everyone needs sometimes to revitalize their mind and body to indulge in recreational activities. Opportunities to combine work, rest, and play should not be taken for granted because as Swann (2004) explains, recreation is an essential component of emotional, physical, and cultural well-being required for a balanced lifestyle and a complete person.

Recreation gives us more opportunities to spend time with our dear ones and ourselves. They allowed us to meet new people, make new friends, and socialize. Some of the recreational activities help us in developing leadership qualities and interpersonal skills. Aside from work to meet the basic needs of man (i.e. hunger, warmth, and safety), leisure and recreation are regarded as one of the basic human needs as sources of pleasure, relaxation, and excitement (Fadamiro,2003).

The California state parks (2005) authorize the values of recreation this way; physical activity reduces obesity and diminishes the risk of chronic diseases like heart disease and diabetes. There are over 2 million people in California with diabetes mellitus. Physical activity also boosts immune systems, increase life expectancy, reduces depression, relieves stress, improves the quality of life, reduces crime, unites families, supports youths, etc. Okunrotifa (1995) observed that recreation could be seen as an antidote to work. That is, it reduces the pressure on the individual that participates in it after the day's tedious work. Recreation provides the capacity to escape from boredom. Recreation may be the main reason for participation in tourism, and tourism may represent a particular form of recreation. Industrial recreation for employees cut down drastically the main hours lost in going to health clinics (Okafor, 1986). Recreation, therefore, increases the efficiency of work. This is the reason why many developed countries have set aside specific periods in between working hours for compulsory recreation for workers.

Understanding the recreational behaviors and preferences of residents is of great importance for cities to have a sustainable recreation plan. It is only then that city managers and decision-makers will make sure that the number of recreational facilities and other characteristics is adequate to meet the various recreational needs of residents, (Zandersen and Tol, 2008; Jensen 2008). Surveying the residents is still the best way to understand their recreational behavior and preference (Zandersen and Tol, 2008). The survey is conducted in cities and countries by researchers and government agencies to collect data about locations or most preferred recreational areas, frequency of participation, type of recreational activities to engage in, problems of existing recreational areas, and recommendations for

further development. The survey also includes some questions on gender, age, occupation, educational level, and income to make further analysis among different groups of participants to determine recreational constraints within the community. These are important factors that shape the way they behave, Malalchlan (2009) emphasizes that attitude towards a product is a function of the sum of perceived attributes weighted as to the importance possessed by that product. That is an individual attitude towards any product is a function of that perception about production in terms of product attributes and the importance of these attributes, people prefer the products towards which they express a more favorable attitude.

Research Methods

Data for the study were generated from both primary and secondary sources. The primary data was used to solicit information from the sampled population in the study area through the use of structured questionnaires. Using the projected 2006 population of Oshogbo and Olorunda Local Government that makes up Oshogbo Metropolis of 449,099 sample frame, 430 questionnaires representing a sample size of 0.095% were administered in 10 randomly selected wards of 26 (INEC) wards in the two Local Government of Oshogbo Metropolis.

Table 1: Political Wards in Oshogbo

Local Government Areas	Political Wards
Oshogbo	Alagbaa Afonja, Ekerin, Otun Balogun 1, Are Ago, Ataoja 1, Ekefa, Otun Balogun 2, Ataoja 2, Atoaja 3, and Jagun 1, Otun Jagun 1, Ataoja 4, Bakekere Jagun 2.
Olorunda	AgoWande, Akogun, Atelewo, Ayetoro, Balogun, Ilie, Obaoke, Oba Ile, Owode1, Owode 2, Owope.

Source; Authors fieldwork 2023.

Table 2: Selected Political Wards

S/N	Political Wards	Local Government Location
1	Alagbaa	Oshogbo
2	Otun Balogun 1	Oshogbo
3	Ataoja 1	Oshogbo
4	Are Ago	Oshogbo
5	Jagun 1	Oshogbo
6	Agowande	Olorunda
7	Atelewo/Ayetoro	Olorunda
8	Oba-Oke	Olorunda
9	Owode1	Olorunda
10	Owope	Olorunda

Source; Authors fieldwork 2023.

A systematic random sampling method was adopted in the administration of the questionnaires which was based on the principle that the first house is selected, one in every 5th house is selected, and others follow in sequential pattern. Household heads were interviewed. (411) questionnaires representing 96% of the questionnaires were retrieved and analyzed. The secondary data was used to obtain information from the journal, textbooks, Ministry of Sports, youth, and social development. A simple tabulation method was used to analyze the collected data.

Results and Discussion

This study discusses the recreational behaviors and preferences of the residents of the Oshogbo metropolis. Indices such as the most preferred recreational activities, and preferences based on gender, age, education, and income status; were used to determine the degree of people's participation in the recreational activities and their preferences in the study area. 430 questionnaires were distributed for the analysis and 411 came out successfully.

Table 3: Respondents' Activities during Spare Time

Activity	Frequency	Percentage%
Visiting Friends and Relatives	75	6
Outdoor Recreation	152	37
Indoor Recreation	115	28
None	199	29
Total	411	100

Source; Authors fieldwork 2023.

As presented in Table 3, it was discovered that 65% of the sampled residents indicate that they indulge in various forms of recreational activities such as indoor recreation (28%). Outdoor recreation (37%) while 29% of the sampled residents indulge in non-recreational activities. 6% however use their spare time to visit friends and relatives. This result, therefore, provides a remarkable understanding of the extent to which recreational activities occupy the resident spare time in the study area.

Table 4: Outdoor Recreational Activities Preference

Activity	Frequency	Percentage%
Taking drinks at the relaxation Centre	86	21
Watching soccer at the viewing Centre	111	27
Playing Tennis	33	8
Basket/Volleyball	37	9
leisure walking	25	6
Hunting Games	8	2
Visiting Historical Site	21	5
Taking Photograph	8	2
Bicycle Riding	8	2
Swimming	16	4
Playing Soccer	14	14
Total	411	100

Source; Authors fieldwork 2023.

Table 4 indicates that watching a soccer game at viewing Centers, taking drinks at a relaxation Centre and playing soccer games are the most preferred recreational activities in the study area with 27%, 21%, and 14% respectively. Playing basket/volleyball, playing tennis and leisure walk however follow with 9%, 8%, and 6% respectively. Others such as visiting historical sites (5%) swimming (4%), taking photographs (2%), and riding bicycles (2%) however account for the least outdoor recreational activities engaged in by the residents of the study area.

Table 5: Most Preferred Recreational Activities in Terms of Age

RECREATIONAL ACTIVITIES	AGE CATEGORY	
	Below40yrs %	Above 40yrs %
Watching soccer/Other sports	19.7	21.5
Playing Soccer/Other sports	15.5	13.4
taking beer/Other drinks	23.8	19.8
Bicycle Riding	12.8	10.2
Visiting Historical Site	14.2	11.2
Taking leisure walks	7.2	9.4
Playing Basket/Volleyball	2.2	2.9
Taking Photograph	0.9	1.7
Others such as swimming etc.	3.7	9.9
Total	100	100

Source; Authors fieldwork 2023.

Table 5 above shows that the most preferred activities by the greater percentage of participants below 40 years of age are taking beer/other drinks with friends in public and relaxation centers (23%) and watching soccer and other sports (19.7%). Also, watching soccer matches and other games in public places is the most preferred by participants that are 40 years and above. Playing soccer and visiting museums are still important recreational activities for the two age groups. Again, from the responses, interest in playing soccer seems to decrease with age as the level of participation drops from 15.5% among the younger participant below 40 years to 13.4% among the older participants of 40 years and older population.

Table 6: Most Preferred Recreational Activities in Terms of Gender.

RECREATIONAL ACTIVITIES	GENDER	
	Male	Female
Watching soccer/Other sports	31.0	10.6
Playing Soccer/Other sports	21.1	11.1
taking beer/Other drinks	33.2	6.6
Bicycle Riding	2.7	9.5
Visiting Historical places	2.2	23.8
Taking leisure walks	6.5	16.9
Playing Basket/Volleyball	0.8	3.9
Taking Photograph	0.6	4.7
Others such as swimming etc.	1.9	12.9
Total	411	100

Source; Authors fieldwork 2023.

Table 6 indicates differences in the most preferred activity between male and female respondents, the larger percentage of the male respondents (33.2%) mostly prefer taking beer/other drinks with friends in relaxation centers or pubs during leisure time, while the most preferred activity to the greater percent of the sampled female population (23.8%) preferred visiting places of historical interest.

Table 7: Most Preferred Recreational Activities in Terms of Educational Qualification.

RECREATIONAL ACTIVITIES	EDUCATIONAL QUALIFICATIONS	
	graduate	non-graduate
Watching soccer/Other sports	20.2	18.3
Playing Soccer/Other sports	17.3	14.5
taking beer/Other drinks	12.2	22.7
Bicycle Riding	2.8	8.3
Visiting Historical places	12.3	11.4
Taking leisure walks	21.4	8.6
Playing Basket/Volleyball	5.7	6.1
Taking Photograph	6.5	3.0
Others such as swimming etc.	1.3	6.9
Total	411	100

Source; Authors fieldwork 2023.

Table 7 shows that variation also exists based on participants' level of education. To the larger percent (20.2%) of participants with at least a University degree or its equivalent, watching soccer/other sports in the viewing center is the most preferred outdoor recreational activity. The second and third larger percent (17.3% and 12.5%) of the group still preferred playing soccer and taking beer/other drinks at relaxation centers, pubs, and hotels. These figures, however, change with the group of participants who had lower educational qualifications. To the larger percentage of this (22.9%), taking beer/other drinks at public places and pubs is the most preferred activity followed by watching soccer and other sports and games.

Table 8: Most Preferred Recreational Activities in Terms of Income

RECREATIONAL ACTIVITIES	INCOME	
	Less Than#100,000	Above #100,000
Watching soccer/Other sports	24.7	23.3
Playing Soccer/Other sports	14.7	10.4
taking beer/Other drinks	18.4	12.8
Bicycle Riding	8.4	9.0
Visiting Historical places	10.5	14.7
Taking leisure walking	13.0	23.7
Playing Basket/Volleyball	3.6	1.9
Taking Photograph	2.1	1.4
Others such as swimming etc.	4.6	2.8
Total	411	100

Source; Authors fieldwork 2023.

The study according to Table 8 also reveals the influence of income on recreational activity preference. The most preferred types of recreational activities seem to change with participants' monthly incomes. It shows that though watching a soccer game in viewing centers, playing soccer and other games, and taking beer and other drinks at pubs are the three most important preferred activities by families earning below #100,000 monthly and those earning #100,000 and above, the level of interest in these activities significantly declines with increase in monthly income. On the other hand, visiting places of historical importance with 10.5% and 14.7% and taking leisure walk with 13.0% and 23.7% seem to increase with participants' family income.



Conclusion and Recommendation

The conclusion is hereby drawn with attention to the findings in the research to address the salient discoveries made to ameliorate the recreational deficiencies of the residents in the study area; for effective recreation planning, allocation of resources for the provision of recreational facilities in the city should not be with due consideration of the preferences of the larger percentage of the categories but should also reflect that of the minorities in the same age, gender, educational level, and monthly income categories. This will act as a guide toward the adequacy of the facilities for the needs of all groups, thereby averting abandonment or underutilization of facilities due to high pressure on them. The following measures are recommended in recreational activities to enhance the quality of life.

Sustainable Advocacy Program; There should be a sustained advocacy campaign through the collaborative effort of the government, non-government organizations, and community-based organizations using symposia workshop radio, television, and news media to enlighten and correct poor attitudes toward active recreation.

Insurance schemes and paid recreation policy; to encourage residents' participation in physical activities the government and corporate organization should float insurance covers for them to eliminate the fear of sustaining injuries, the fear of which hinders many from taking part in the active form of recreation. Provision of residents' choice of recreational facilities; desired recreational facilities should be provided for the youths to encourage them to participate actively in recreation and enhance their skills in competitive recreational activities.

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APPLICATION OF PLEA BARGAINS IN CRIMINAL TRIAL NIGERIA: THE GOOD, THE BAD AND THE UGLY

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Abstract

Plea bargain, also known as plea agreement or plea deal, is an agreement in criminal law proceedings, whereby the prosecutor provides a concession to the defendant in exchange for a plea of guilt. In this procedure, the defendant pleads guilty to a less serious charge in return for the dismissal of other charges or for a more lenient sentence. Despite the positive aspects of plea-bargaining, there are numerous problems that are associated with its implementation. This paper examines the impact of plea bargaining on the criminal justice system in Nigeria. It begins by exploring the concept of plea bargaining, followed by an analysis of the history and implementation of plea bargaining in Nigeria. It then moves to an assessment of the positive and negative aspects of plea-bargaining in Nigeria, to provide an insight into its effects. The paper adopts a doctrinal research approach using primary sources of information gathering to discuss the concept of Plea Bargaining and its effects on the administration of criminal justice in Nigeria. The paper concludes with a discussion of the implications of the practice and the need for further research into the effects of plea bargaining in Nigeria.

Keywords: Criminal Justice, Plea-bargain, Prosecution, Defendant, Sentence.

Introduction

Plea bargaining has long been an integral part of the criminal justice system in Nigeria. It is a mechanism whereby a defendant admits guilt and receives a lesser sentence than they would if they had been convicted at full trial. Plea bargains can also be used to expedite the process of criminal proceedings and reduce the costs associated with a trial. However, this form of negotiation can also have significant negative consequences.

One of the primary concerns of plea bargaining is the potential for false confessions and wrongful convictions. This is because plea bargains are often made with little or no evidence that the defendant is guilty, leading to confessions that may not be reliable. Moreover, plea bargains can lead to sentences that are disproportionately harsh compared to what the defendant would have received at a full trial. This can lead to violations of the defendant's human rights, including the right to a fair trial. Also, plea bargains can lead to corruption and injustice in the criminal justice system. This is because it has been alleged that in some cases police officers were the ones pressurizing the defendants to plead guilty to crimes that they may not have committed. In some instances, prosecutors are alleged to be demanding large sums of money to reduce or eliminate a sentence. Additionally, plea bargains can be used to facilitate corruption and nepotism within the criminal justice system.

Definition and Meaning of Plea Bargaining.

'Plea' means when a defendant gives a formal answer to a criminal charge, which may be a plea of guilty or not guilty. Plea is regarded as the commencement of criminal proceedings. It is so fundamental that without it, there is no trial.



Plea bargaining is an agreement in a criminal trial in which the prosecutor and the accused person arrange to settle the case against the accused in exchange for concessions. It is seen as a negotiated agreement between the prosecutor and the defendant whereby the defendant pleads guilty to a lesser offense or to one of the multiple charges to get a lenient sentence or a dismissal of the other charge. Plea is personal and no one can plead on behalf of another. It is an agreement between the parties for the exchange of promises or performances.

Supporters of plea bargain claim that it speeds court proceedings and guarantees a conviction, whereas opponents believe that it prevents justice from being served. Plea-bargain provides a win-win situation for both the state and the accused. It is a win for the state in such a way that the conviction upon a plea bargain adds in number to the successful conviction by the state and on the other hand, a win for the suspect because he receives a reduced charge and sentence. Although some have argued that the practice of plea bargain violates the fundamental human rights of the accused by the inducement of confession of guilt and a trial waiver for the promise of a reduced sentence

Brief Historical Background of Plea Bargain

Plea bargain has a very long history. In modern times, plea bargaining has become the primary procedure through which we dispose of the vast proportion of cases of serious crime. Plea bargaining became a dominant method of resolving criminal cases at the end of the nineteenth century and beginning of the twentieth century- at a time when the bondsman, the ward politician, the newspaper reporter, the jailer, and the fixer exerted an everyday influence on the administration of criminal justice.

Various crime commissions in the United States in the 1920s demonstrated that plea bargaining had become common and that the use of this route to conviction had increased in the immediately preceding decades.

The United States Supreme Court first upheld a guilty-plea conviction in *Hallinger v. Davis*, decided in 1892. In that case, the court observed as follows:

“The [trial] court refrained from at once accepting [the defendant's] plea of guilty, assigned him counsel, and twice adjourned, for several days, so that he might be fully advised of the truth, force, and effect of his plea of guilty.” Similarly, in its decision in *Brady v. United States* in 1970, the Court concluded that plea bargaining was “inherent in the criminal law and its administration.”

Types of Plea Bargains

There are three main types of plea bargains. Each type involves sentence reductions, but those reductions are achieved in very different ways.

In charge bargaining, the defendant agrees to plead guilty to reduced charges (e.g., aggravated assault rather than attempted murder).

Sentence bargaining involves assurances of lighter or alternative sentences in return for a defendant's pleading guilty. One of the most visible forms of sentence bargaining occurs when defendants plead guilty to murder to avoid the death penalty. Sentence bargains also occur in less-serious cases, such as pleading guilty to a charge in exchange for a sentence of “time served,” which generally means that the defendant will be immediately released.

The third type of plea negotiation is count bargaining, in which defendants who face multiple charges may be allowed to plead guilty to fewer counts. The charges need not be identical: the prosecutor may drop any charge or charges in exchange for a guilty plea on the remaining charges. Because count bargaining applies only to defendants who face multiple charges, it is the least common form of bargaining.

Plea Bargaining and Administration of Justice in Nigeria.

In Nigeria, under the Constitution, an accused person is presumed innocent until proven guilty. This presumption of innocence can only be rebutted by the prosecution and this is achieved when the prosecution can satisfactorily discharge the legal burden on it to prove its case against the accused person beyond reasonable doubt under Section 135(1),(2) and (3) of the Evidence Act, 2011. Section 1(1) of the Constitution declares its supremacy over all authorities and persons throughout the Federal Republic of Nigeria. Equally, Section 1(3) provides that: "If any other law is inconsistent with the provisions of this constitution, this constitution shall prevail, and that other law shall to the extent of the inconsistency be void."

The Criminal Procedure Code (CPC) and the Criminal Procedure Act (CPA) applicable in the Northern and Southern parts of Nigeria respectively regulates the conduct of criminal trials in Nigeria. Lagos state is the first state to adopt the principle of plea bargaining in its criminal procedure law by localizing the provisions of the ACJA, 2015 into its ACJL in 2021. The provisions that bother on plea bargain are contained in Sc. 75 of ACJL, Lagos state.

The Osun ACJL, 2018 provides for Plea Bargaining in Sec 265. It will not be out of place to reproduce a few relevant sections.

- (1) Notwithstanding anything in this Law or any other Law, the Prosecutor may:
 - (a) receive and consider a plea bargain from a defendant charged with an offense either directly from that defendant or on his behalf; or
 - (b) offer a plea bargain to a defendant charged with an offense.
- (2) The prosecution may enter into plea bargaining with the defendant, with the representation of the evidence of the presentation of the evidence of the defense, provided that all of the following conditions are present:
 - (a) the evidence of the prosecution is insufficient to prove the offense charged beyond a reasonable doubt;
 - (b) where the defendant has agreed to return the proceeds of the crime or make the restitution to the victim or his representative; or
 - (c) where the defendant, in a case of conspiracy has fully cooperated with the investigation and prosecution of the crime by providing relevant information for the successful prosecution of other offenders.

Implementation of Plea Bargaining in Nigeria

The prosecution must prove all the ingredients of alleged offenses beyond a reasonable doubt before it can secure a conviction against the defendant, except in instances where an accused person voluntarily confesses to the commission of an offense. Most often than not, the issue of voluntariness of the confessional statement comes to play at trial and where the defendant raises an issue regarding involuntariness of the confessional statement, the court must conduct trial within trial to ascertain the veracity of the defendant's claims. When a defendant and the prosecution enter into a plea bargain, the issue of voluntariness is also a fundamental one.

Another important and germane issue in the concept of plea bargain practice is the tendency for abuse of the process by the authorities especially the Attorney-General who already wields enormous powers in criminal administration. This is because the ACJL of many states vests so much power in the AG as far as Plea Bargain is concerned. Already, there are several calls for the powers of the Attorney-General to be reduced possibly by the splitting of the office and functions into two, viz - the Attorney-General (being an officer of the state) on one hand, and the Minister for Justice (being an appointee of the executive) on the other. This is to reduce the influence and interference by the executive with the discharge of the functions of the office of the Attorney-General both at the federal and state levels.

The following are a few instances where Plea Bargaining procedure has been adopted in criminal trials in Nigeria.



1. Yusuf John Yakubu was a former Assistant Director of the Police Pension Board. He was accused of embezzling about N23 billion from the Police Pension funds that he was meant to oversee. In the process of his trial, a plea bargain arrangement was adopted. The accused later entered a guilty plea on the three-count charge and was sentenced to payment of a fine of N750, 000.00 (N250, 000.00) for each count and forfeiture of his assets acquired with the embezzled funds.

2. The case of former Governor Lucky Igbinedion went through a similar process. Lucky Igbinedion, the former Governor of Edo State was accused of looting about N4.4 billion. He also entered a plea bargain and at the end of the day, he was fined the sum of N3.5 million while he forfeited three landed properties to the Federal Government. In a plea bargain arrangement, The EFCC, the prosecuting agency, reduced the 191-count charge to one - a count charge that reads as follows:

“That you, Lucky Igbinedion (former Governor of Edo State) on or about January 21, 2008, within the Jurisdiction of this honorable court neglected to make a declaration of your interest in account No. 41240113983110 with GTB in the declaration of assets form of the EFCC and you thereby committed an offense punishable under section 27 (3) of the EFCC Act 2004”

The terms of the plea bargain were that the prosecution would reduce the 191-count charge to a one-count charge and in return, Lucky Igbinedion will refund N500m, three properties, and plead guilty to the one-count charge.

In line with the plea bargain, on the 18th December 2008, the court presided over by Justice A. Abdul Kafarati convicted Lucky Igbinedion on the one-count charge and ordered him to refund N500m, forfeit 3 houses, and sentenced him to 6 months imprisonment or pay N3.6m as an option of fine.

3. In the case of The Federal Republic of Nigeria v. Dr (Mrs) Cecilia Ibru, Justice Dan Abutu of the Federal High Court sitting in Lagos, convicted Cecilia Ibru, the former managing director of Oceanic Bank plc, of a three-count charge of authorizing loans beyond her credit limit, rendering false accounts and approving loans without adequate collateral. The court sentenced the accused to six months imprisonment for each count, which ran concurrently and ordered the forfeiture of related assets worth N191.4 billion. In adjudicating this case, the prosecution and accused agreed on a plea bargain by relying on section 17 of the Federal High Court Act which encourages reconciliation among parties to facilitate amicable settlements in civil and criminal cases.

4. Similarly, the former Governor of Bayelsa State, Governor Alamiyeseigha was charged with financial crimes and sentenced to 12 years in prison on a six-count charge. He was sentenced to two years on each count but all sentences ran concurrently and the sentences ran from the day he was arrested and detained in 2005. The above was a result of a plea bargain and because he has almost concluded two years in jail before brokering the bargain, he was released a few days after the judgment.

5. Another case where plea bargaining was adopted in the case of Salisu Buhari who got only one Thousand Naira fine when one of the three offences leveled against him has a prescribed punishment of 14 years and a fine.

Good Sides of Plea Bargaining

There is no doubt that the concept of plea bargain is becoming one of the fastest ways of disposition of criminal matters in Nigeria. In the case of F.R.N V. LUCKY IGBINEDION, the Court of Appeal enumerated some of the advantages of the application of plea-bargaining as follows:

Accused can avoid the time and cost of defending himself at the trial, the risk of harsher punishment, and the publicity the trial will involve. The prosecution saves the time and expense of a lengthy trial, both sides are spared the uncertainty of going to trial, and the court system is saved the burden of conducting trials on every crime charged.

When parties to a criminal matter enter into plea bargain, the practice saves both the accused and the prosecution the cost of prosecuting and defending the case in court. Supreme Court of the USA held that Plea Bargaining should be encouraged if it can properly be administered because if every criminal charge was to be subjected to full trial, the resources of the states and federal Government will be overburdened.



Duration of Trial

The issue of time is a fundamental one in criminal trials in that enormous time is usually consumed especially where so many issues have to be considered in a bid to ensure that there is fair trial. Trials in Nigeria usually take a considerable length of time. This is because parties have the opportunity to appeal rulings and judgments of the courts of first instance. When the outcome of a matter is appealed against at the Supreme Court, it could last as long as 15 to 20 years or even more. In some instances, the accused may still be in prison custody. With the application of plea bargaining, this hardship can be avoided.

Uncertainty in the Outcome of Trial

Only God knows the mind of a judge. It is usually difficult to predict to certainty the outcome of a trial. The prosecutor and the defence are spared of the uncertainty that is associated with trials when plea bargain is adopted. The plea bargain practice also has the advantage of avoiding a situation where an innocent man is convicted of a crime he may not have committed. It is not therefore outside the realm of possibilities that an innocent person is convicted of a crime for any reason, maybe due to the ineptitude of its counsel or the failure of the judge to have a full and perfect grasp of the case.

Reduction in the frequency of conducting trials on every crime charged

Where the state decides to prosecute every offence as alleged, the courts will be greatly overburdened. This may in turn hamper the efficiency of the judiciary in the discharge of its constitutional duties.

Procedure or Guidelines for Plea Bargain

There are no special or hard and fast rules in adopting the plea bargain system. The guidelines are as stipulated by the legal framework of a particular jurisdiction. Even though there are similarities at both the Federal and state levels, there are slight variations in the provisions establishing plea bargains across various states in Nigeria. Moreover, the law of each State determines the commencement and the process or procedure of plea bargain. The agreement on plea bargain in any given criminal case specifically revolves around the “guilty plea” by the Defendant. This is provided for in section 265 (I) (a) & (b) ACJL, Osun State.

Another important factor to consider is that of public interest and public policy. Where the prosecutor is of the view that the offer or acceptance of a plea bargain is in the interest of justice, the public interest, public policy, and the need to prevent abuse of the legal process, he may offer or accept the plea bargain. See section 265 (3) ACJL, Osun State.

It must however be noted that both the prosecutor, the defendant, and his legal practitioner are fully aware and they all execute the agreement together as stipulated under section **265 (4) ACJL, Osun State**. The presiding judge or magistrate shall not participate in discussions about the plea bargain. It is also important to note that where the prosecution and defence reach a plea agreement, the prosecutor shall inform the court that the parties have reached an agreement and the presiding judge or magistrate shall then inquire from the defendant to confirm the terms of the agreement. See 265 (9) ACJL, Osun State.

The presiding judge or magistrate shall ascertain whether the defendant admits the allegation in the charge to which he has pleaded guilty, that the agreement is voluntary, and that it is without undue influence. Where he is satisfied that the defendant is guilty of the offence to which he has pleaded guilty, convict the defendant on his plea of guilty to that offence, and shall award the compensation to the victim in accordance with section 300 of this Law. See section 265 (10) ACJL, Osun State.

However, where the defendant has been convicted under subsection (9) (a), the presiding judge or magistrate shall consider the sentence as agreed upon and where he is satisfied that such sentence is an appropriate sentence, impose the sentence. If the judge or magistrate is of the view that he would have imposed a lesser sentence than the sentence agreed, he would go ahead and impose the lesser sentence, but if the judge or magistrate is of the view that the offence requires a heavier sentence than the sentence agreed upon, he shall inform the defendant of such heavier sentence he considers to appropriate. See section 265 (11) & (12) ACJL, Osun State.

Other Merits of Plea-Bargain

Plea bargain is to take full advantage of a criminal proceeding mechanism that will achieve the best within a short time and at a bearable cost to the authority and the defence. Plea bargain is a method that benefits both the Prosecution and the Defence in that there is no risk of total loss on both sides in any criminal trial where it is employed.

It allows a mutually acceptable result even in cases where the evidence against a given Defendant or the evidence such a defendant will rely on for his/her defence is dicey. Plea bargain allows the Prosecution to increase their rate of convictions and within a reasonable time. It assists the Prosecution, in most cases, to secure conviction where a given Defendant would have been acquitted or discharged on technical grounds. It can be used in favour of a given Defendant in order to secure his cooperation to give more information or testify against another Defendant in the same case or in another criminal proceeding.

It reduces the number of cases that will go on appeal and minimizes the risk of having Rulings or Judgements of a Trial Court being overturned on Appeal. It allows the Court, the Leaned Counsel for the Prosecution and Defence to share the responsibility of sentencing. Plea bargain removes the frightening and upsetting fear of testifying in Court for the Defendants and would-be witnesses of both sides.

Shortcomings Associated with Plea Bargaining

Despite these obvious merits of the plea bargain, it is not devoid of shortcomings. A very fundamental defect of the process is that though the state has the power to prosecute, where there is a crime against a person (the victim), such a victim may not feel that justice has been done in his case where the court accepts the plea bargain of the defendant. Plea bargaining is increasingly becoming the norm in Nigeria in criminal cases involving the influential class. Adoption of Plea bargaining allows them to buy their way through any lesser penalty levied against them unlike the poor who are left to their fate to languish in the prison. Society feels plea bargain procedure allows offenders to escape appropriate sanctions they deserve for the crime committed and that it may result in injustice at times when an innocent Defendant will plea bargain for whatever reasons such as overwhelming fear or as a result of long detention or likelihood of prolonged trial. Critical scrutiny of Plea bargaining suggests that it brings the criminal justice delivery system into ridicule at times when society feels that the outcome of a given plea-bargained case is unacceptable for being outrageously lenient. It looks like the offenders of plea-bargained cases were given veritable leeway to defeat justice which feeling in no smaller measure, over the years has eroded and is still eroding the public confidence in our criminal justice system.

Recent Instances of Abuse of Plea Bargaining

Recently, MT Heroic Idun, a ship was released by the Federal Government of Nigeria on a purported agreement of a Plea bargain. The tanker was released after the owners fulfilled the conditions of the plea bargain entered between them and the Nigerian government.

The tanker which had 26 foreign crew members on board had earlier resisted arrests by the Nigerian Navy Ship (NNS) Gongola, near the Akpo oilfield offshore Nigeria and was later arrested in Equatorial Guinea in August 2022 and brought back to Nigeria for prosecution in November 2022 on three count charges, including attempted oil theft.

The vessel and her 26 foreign crew in January 2023 pleaded guilty and elected voluntarily to enter into a plea bargain agreement with the Federal Republic of Nigeria as well as to make restitution to the federal government, in the interest of justice, the public, and for public policy interest in line with Section 270 (5) (a) of the Administration of Criminal Justice Act 2015.

The agreement on that bargain was that the convicted vessel, the owners of MT Heroic Idun were to pay conviction fines and restitution to the federal government and make an apology to the Federal Republic of Nigeria in print and electronic media as well as Llyod's List, while the federal government agreed not to further criminally prosecute and/or investigate the vessel, her owners, charterers or her crew in the matter of her crime against the state.



Another recent case of misapplication of plea bargaining is where a Federal High Court judge in Delta State, Nigeria, presided over by Honourable Justice Abang expressed dismay over a plea bargain agreement that led to the release of oil thieves who had stolen crude oil worth N200 million.

The trial judge while delivering the judgment on November 24, 2021, described the plea bargain agreement as “sordid, and morbid, very unpleasant and dirty.” He also expressed frustration of being bound by law to accept the plea bargain which he said inhibited him from imposing a heavy punishment on the defendants to emphasize the contribution of oil theft to the nation's economic adversity.

The plea bargain was filed by the federal prosecutor, who reduced the charges initially brought against the thieves. The judge criticized the agreement for allowing criminals to escape with a paltry N2,000 fine each, instead of facing appropriate punishment for their crimes. Additionally, the judge questioned the sale of the recovered crude oil, valued at N200 million, which was sold at a mere N17 million. He expressed frustration at being bound by law to accept the plea bargain, urging the National Assembly to revisit the plea bargain arrangement to curb abuse.

Initially, another judge, Mr. Emeka Nwite, had ordered the crude oil to be sold, and the proceeds kept in an interest-yielding account until the trial's conclusion. However, the oil was sold at a significantly lower price, and the full amount wasn't remitted to the government's account.

Justice Abang questioned the legitimacy of the sale, suggesting it might have been done through a private arrangement, and criticized the lack of transparency in the bidding process. He was also worried about the vessel involved in the theft being released to the defendants upon payment of a fine, instead of being forfeited to the federal government as per the proper law.

He also expressed the frustration of being bound by law to accept the plea bargain which he said inhibited him from imposing a heavy punishment on the defendants to emphasize the contribution of oil theft to the nation's economic adversity

Conclusion

According to Sir Winston Churchill, the quality of a nation's civilization can be measured by the methods it uses in the enforcement of its criminal law. This paper has highlighted that if not properly used, the concept of plea bargaining in the administration of criminal justice in Nigeria can be subjected to various degrees of abuse. It is very important to state that plea-bargaining can be likened to providing a soft landing to the affluent facing criminal charges most especially corruption and financial-related offenses. If not properly applied, plea-bargaining can harden the hearts of perpetrators, because the perpetrator/s especially the highly placed officials and influential class may just think that as long as they are ready to forgo some part of their ill-gotten 'booties' it is business as usual. This is a case of a big thief receiving light punishment while a petty thief receives the maximum punishment for his minor offense.

Plea-bargaining in Nigeria is like promulgating a law meant to shield the 'powerful' elites from the wrath of the law. This work suggests that Plea bargains at the federal and state levels should be properly reviewed and amended to stipulate the monetary limit for the procedure.

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Statutes:

List of Statutes

Osun State Administration of Criminal Justice Law, 2018

Administration of Criminal Justice Act, 2015

Constitution of the Federal Republic of Nigeria (1999) As Amended



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DEVELOPMENT OF STUDENTS' ACADEMIC PERFORMANCE PREDICTION MODEL USING DECISION TREE

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ABSTRACT

Students' academic performance prediction model is a model developed to reduce the students' failure rate in higher institutions of learning. The model is developed to ascertain the students' academic performance by looking at the extent of socio-economic background on the student's performance and the effect of the student's previous academic status (GPA) on his/her future performance. This paper proposed the J48 Decision tree model for predicting the academic performance of third-year Bachelor of Science (B. Sc) students in Computer Science at Ajayi Crowther University, Oyo as they proceed to the final year. The data collected from the department contain the students' Name, Matriculation number, Gender, State of Origin, Current G.P.A. The parameter used as the Key Performance Indicator (KPI) is the Current G.P. The model is created using a Training data set, and the performance is confirmed by the Supplied test set and applied to the student's data to generate the Prediction model. The extracted knowledge from the prediction model is used to identify and profile the student to determine the student's level of success in the final year. The outcome of the work showed that the students have a high tendency to have the same GPA in the final year.

Keywords: Data mining, Educational Data Mining, Key Performance Indicator, Prediction, Decision tree, WEKA, Classification.

1. INTRODUCTION

Education is an important factor that contributes immensely to the growth of society at large. Many educational organizations and school administrations today, leave no stone unturned to improve their student's academic performance, in which the marks obtained by the student in the examination decide his/her future. They want to increase the number of students getting passed yearly to develop the best quality of the education process in their institution, to maintain the brand name of the organization, and to educate students in a better way.

To achieve this target, Data Mining (DM) is considered one of the most suitable techniques for giving additional insights to the Institutions of Higher Learning community to help them make better decisions in educational activities. Data mining is the process used to transform data into useful information by extracting and making use of relatively unknown patterns, trends, and datasets from large amounts of stored raw data in the repository. Though many factors determine a good institution, the academic performance of the student plays a vital role in it (Jai & David, 2014).

Educational Data Mining (EDM) is an emerging trend in data mining, which is concerned with developing techniques for exploring and mining useful educational patterns/datasets from the database of an educational institution and using the extracted data to make decisions and predictions for the enhancement of the educational system as it relates to students' performance and systemic improvement. Researchers in this field focus on discovering useful knowledge either to help educational institutes manage their students better or to help students to manage their education and deliverables better and enhance their performance (Amjad, 2016).

2. LITERATURE REVIEW

Data Mining

According to Mehmed (2011), *Data mining is a process of discovering various models, summaries, and derived values from a given collection of data.* It has been widely used in recent years due to the availability of huge amounts of data in electronic form, and there is a need for turning such data into useful information and knowledge for large applications. These applications are found in fields such as Artificial Intelligence, Machine Learning, Market Analysis, Statistics and Database Systems, Business Management, and Decision Support Systems.

In practice, the two primary goals of data mining tend to be *prediction* and *description* (Mehmed, 2011). *Prediction* involves using some variables or fields in the data set to predict unknown or future values of other variables of interest. *Description*, on the other hand, focuses on finding patterns describing the data that can be interpreted by humans.

Therefore, it is possible to put data-mining activities into one of two categories:

1. Predictive data mining, which *produces the model* of the system described by the given data set, or
2. Descriptive data mining, which *produces new, nontrivial information* based on the available data set.

On the predictive end, the goal of data mining is to produce a model, expressed as an executable code, which can be used to perform classification, prediction, estimation, or other similar tasks. On the descriptive end of the spectrum, the goal is to gain an understanding of the analyzed system by uncovering patterns and relationships in large data sets.

Data mining techniques

Data mining techniques are used to build a model to identify new knowledge information (Osmanbegovic and Mirza, 2012). Several major data mining techniques have been developed and used including association, classification, clustering, prediction and sequential patterns.

Mehmed (2011) postulated that the goals of prediction and description are achieved by using data-mining techniques for the following primary data-mining tasks:

1. *Classification* -Discovery of a predictive learning function that classifies a data item into one of several predefined classes.
2. *Regression* -Discovery of a predictive learning function that maps a data item to a real - value prediction variable.
3. *Clustering* -A common descriptive task in which one seeks to identify a finite set of categories or clusters to describe the data.
4. *Summarization* -An additional descriptive task that involves methods for finding a compact description for a set (or subset) of data.
5. *Dependency Modelling* -Finding a local model that describes significant dependencies between variables or between the values of a feature in a data set or in a part of a data set.
6. *Change and Deviation Detection* -Discovering the most significant changes in the data set.

Data mining process

The general experimental procedure adapted to data–mining problems involves the following steps:

1. State the problem and formulate the hypothesis
2. Collect the data
3. Pre-process the data
4. Estimate the model
5. Interpret the model and draw conclusions

Educational Data Mining

According to Amjad (2016), Educational Data Mining (EDM) is a new trend in the data mining and Knowledge Discovery in Databases (KDD) field which focuses on mining useful patterns and discovering useful knowledge from the educational information systems, such as admissions systems, registration systems, course management systems (module, blackboard, etc...), and any

other systems dealing with students at different levels of education, from schools to colleges and universities.

Researchers in this field focus on discovering useful knowledge either to help educational institutes manage their students better or to help students to manage their education and deliverables better and enhance their performance. It is an emerging discipline, concerned with developing methods for exploring the unique types of data that come from educational settings and using those methods to better understand students and the settings in which they learn (Kumar and Radhika, 2014).

In this paper, the Traditional Class Room Educational System is considered. The performance of the students depends on many factors such as their family background. Also important is the academic background i.e. Secondary School Certificate Examination (SSCE), all previous semesters' results and Cumulative Grade Point Average (CGPA) has to be considered. Those students who are at risk can be found out and some remedial action can be taken to improve their performance. Due to these results, the institution can improve the chance(s) of the students who will pass. Educational data mining can be used to get feedback for the teachers so the teacher can improve the teaching method. Also, the information can be useful for those who are designing the course content.

Key Performance Indicator

Osmanbegovic and Mirza (2012) presented a model to predict student performance. They evaluate student success by passing grades on the exam. Parameters addressed for prediction include students' socio-demographic variables, achieved results from high school, the entrance exam, and attitudes toward studying which can affect success.

Ramesh et al. (2013) presented a valuable study to figure out factors that influenced student success. They focused on parents' occupations and school types. Their obtained results from hypothesis testing reveal that type of school does not influence student performance and parents' occupation plays a major role in predicting grades. The ability to predict students' marks could be useful in a great number of different ways associated with university-level learning.

Even though there are many prediction models available with different approaches to student performance, Sajadin (2011) posited that there is no certainty if there are any predictors that accurately determine whether a student will be an academic genius, a dropout, or an average performer.

Graded Point Average (GPA) is a commonly used indicator of academic performance. Many universities set a minimum GPA that should be maintained. Therefore, GPA remains the most common factor used by academic planners to evaluate progression in an academic environment. Many factors could act as barriers to students attaining and maintaining a high GPA that reflects their overall academic performance, during their tenure in university. These factors could be targeted by the department in developing strategies to improve student learning and improve their academic performance by way of monitoring the progression of their performance (Oyelade et al., 2010).

In this work, the key Performance Indicator used is the Graded Point Average (GPA) of the student, bearing in mind that the student's family background and SSCE result cannot be fully relied upon as key performance indicators to predict his/her future performance.

The Waikato Environment for Knowledge Analysis (WEKA)

According to Frank et al. (2005), WEKA is a data mining system developed by the University of Waikato in New Zealand that implements data mining algorithms. WEKA is a state-of-the-art facility for developing machine learning (ML) techniques and their application to real-world data mining problems. It is a collection of machine learning algorithms for data mining tasks. The algorithms are applied directly to a dataset. WEKA implements algorithms for data pre-processing, classification, regression, clustering, and association rules; it also includes visualization tools.

WEKA would not only afford a toolbox of learning algorithms but also a framework inside which researchers could implement new algorithms without having to be concerned with supporting

infrastructure for data manipulation and scheme evaluation. WEKA is open-source software issued under General Public License (Pallavi, 2015).

The data file normally used by WEKA is in Attribute Relation File Format (.arff), which consists of special tags to indicate different things in the data file foremost: attribute names, attribute types, attribute values, and the data. For working with WEKA we do not need deep knowledge of data mining which is the reason why it is a very popular data mining tool. It also provides the Graphical User Interface of the user and provides many facilities. The GUI Chooser consists of four buttons—one for each of the four major WEKA applications. The buttons can be used to start the following applications:

Explorer: It is the main interface in WEKA. It has a set of panels, each of which can be used to perform a certain task. Once a dataset has been loaded, one of the other panels in the Explorer can be used to perform further analysis.

Experimenter: An environment for performing experiments and conducting statistical tests between learning schemes.

Knowledge Flow: This environment supports essentially the same functions as the Explorer but with a drag – and drop interface. One advantage is that it supports incremental learning.

Simple CLI: Provides a simple Command-Line Interface that allows direct execution of WEKA commands for operating systems that do not provide their command-line interface.

A trial version of the WEKA package can be downloaded from the University of Waikato website at <http://www.cs.waikato.ac.nz/~ml/weka/index.html>.



Figure 1: WEKA tool front view

(Source: Purva and Kamal, 2015)

Execution in WEKA

Execution in WEKA is a step-by-step process (Purva and Kamal, 2015). First is data loading, Data can be loaded from various sources, including files, URLs, and databases. WEKA can read in ".csv" format (Comma Separated Value). Firstly we take Excel datasheet from the real world, the first row contains the attribute names (separated by commas) followed by each data row with attribute values listed in the same order (also separated by commas), and convert it into .csv file format. Then go to the explore button in WEKA and save this .csv file. Once data is loaded into WEKA, the data set is automatically saved into ARFF format (Purva and Kamal, 2015).

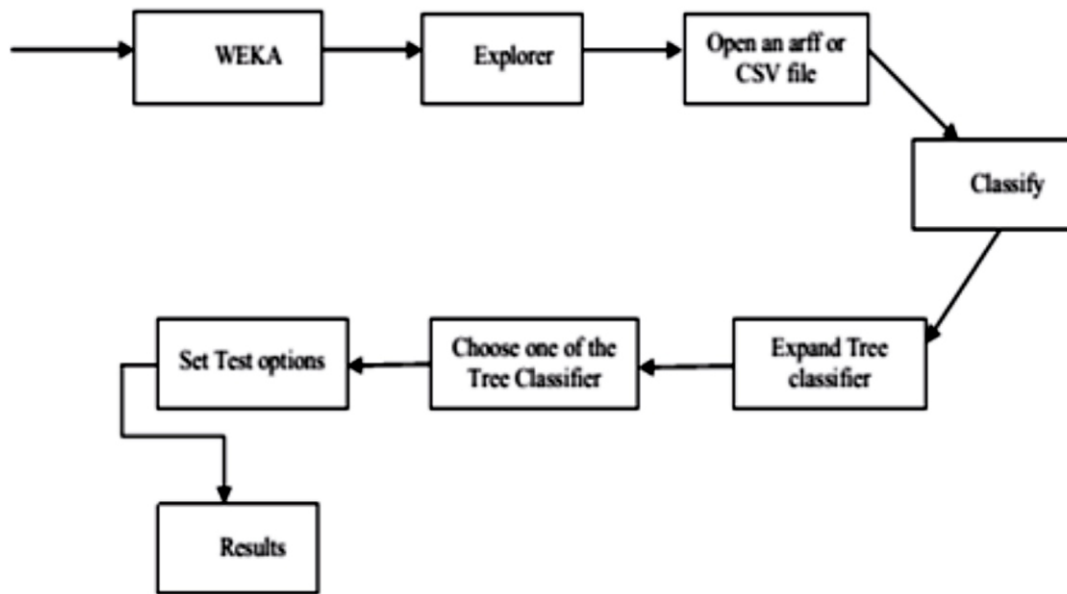


Figure 2: Execution in WEKA tool (Source: Purva and Kamal, 2015)

Decision Tree Classification in WEKA

Classification is a process of finding a model that describes and distinguishes data classes and concepts to predict the class of objects whose class label is unknown. The derived model should be represented in a decision tree or neural network.

The Classification process involves the following steps:

1. Create a training dataset.
2. Identify class attributes and classes.
3. Identify useful attributes for classification (Relevance analysis).
4. Learn a model using training examples in the Training set.
5. Use the model to classify the unknown data samples.

Classification is possibly the most frequently used data mining technique. It is the process of finding a set of models that describe and differentiate data classes and concepts, to be able to use the model to predict the class whose label is unknown. Many algorithms can be used for classification, such as decision trees, neural networks, logistic regression, etc., and various decision tree algorithms are used in classification like ID3, AD Tree, REP, J48, FT Tree, LAD Tree, decision stamp, LMT, random forest, random tree, etc. In this work we are using J48 decision tree algorithm for classification.

1. METHODOLOGY

In this study, the students' Grade Point Average (GPA) is selected as a dependent parameter. The dataset collected of forty-nine (49) instances (students) was used to develop a training model whose precision level and other parameters were considered to ascertain the model's accuracy. The model's status was further confirmed by the User-supplied Test set which was supplied to the system, and the statistic of the result was compared to the Training model to confirm the accuracy of the model, this was done by supplying the model result of the first nine (9) students and comparing the result generated.

To generate the prediction model, a class of unknown results (Predicted GPA) was created and supplied to the model. The prediction level of the result and other performance metrics signifies the accuracy of the prediction for each student as revealed.

Algorithm of the model

The training dataset (I1...In) which is the total number of instances was loaded to WEKA. The GPA (Key Performance Indicator) for each student (GPA1...GPAn) from the dataset with other



information about each student is used to build the model, and data of unknown GPA ($nG1 \dots nGn$) for each student was fed into the model for prediction. The result generated displays the Previous GPA and the Predicted GPA.

Step 1 - Start

Step 2 - Take input which is given by User

$In = \{I1, \dots, In\}$

Step 3 - Dataset preparation

$Dn = \{\{I1, \dots, In\}D\}$

Step 4 - Dataset elaboration

$DI = \{GPA1, \dots, GPA_n, I1, \dots, In, nG1, \dots, nGn\}$

Step 5 - Processing

While ($Dn \neq 0$)

{

If ($nGn == In$)

Check GPA_n ;

}

Step 6 - Result Generation

$R = \{GPA, nG\}$;

Step 7 - Stop

Where,

In = Input given by users

Dn = Dataset

D = Database

DI = Dataset contents

$GPA1 \dots GPA_n$ = Previous GPA for each student

$nG1 \dots nGn$ = New GPA (Predicted) for each student

R = Result generated

Flowchart of the Model

The system flowchart for training the data is shown in the Figure below:

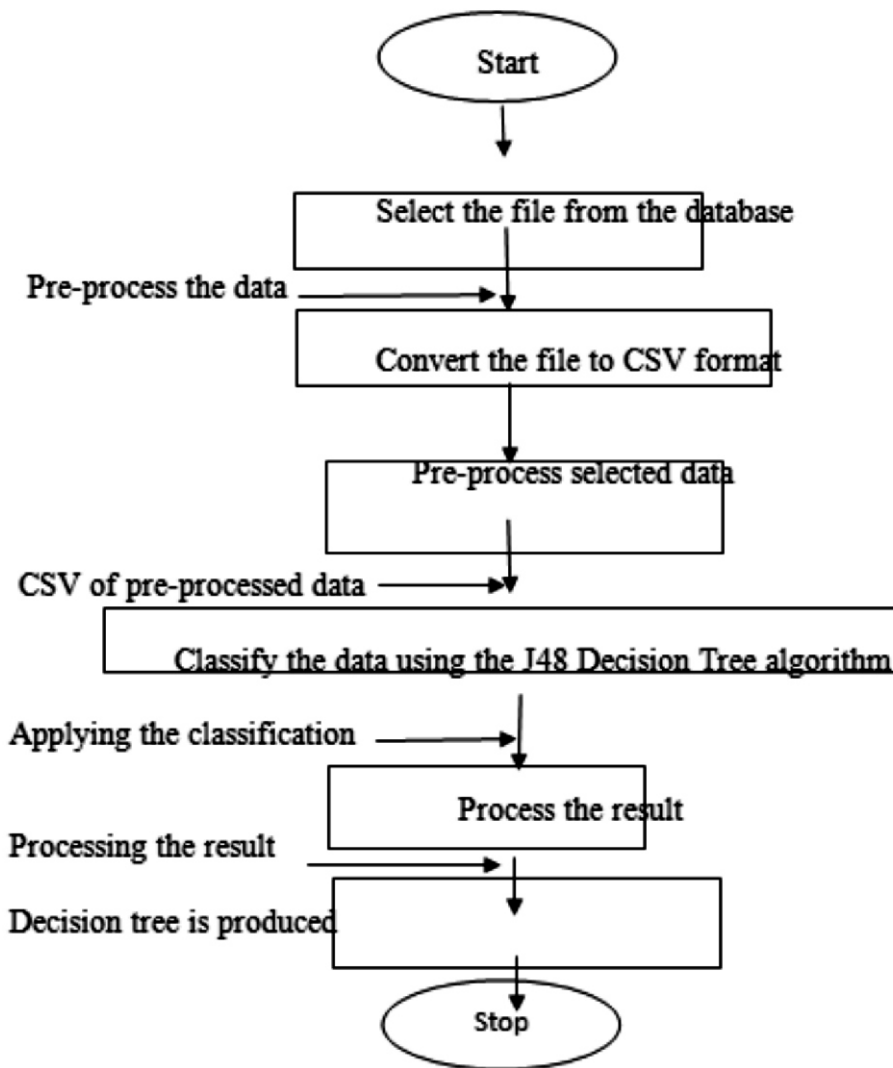
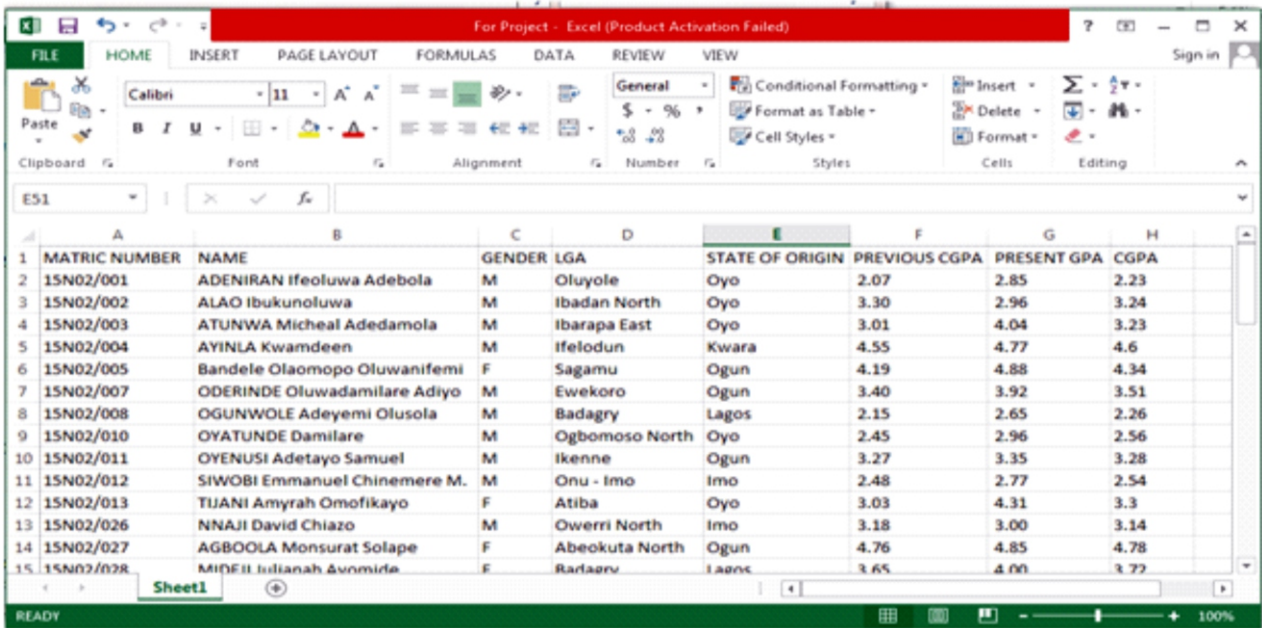


Figure 3: System flowchart for the training of the data

Method of Data Collection

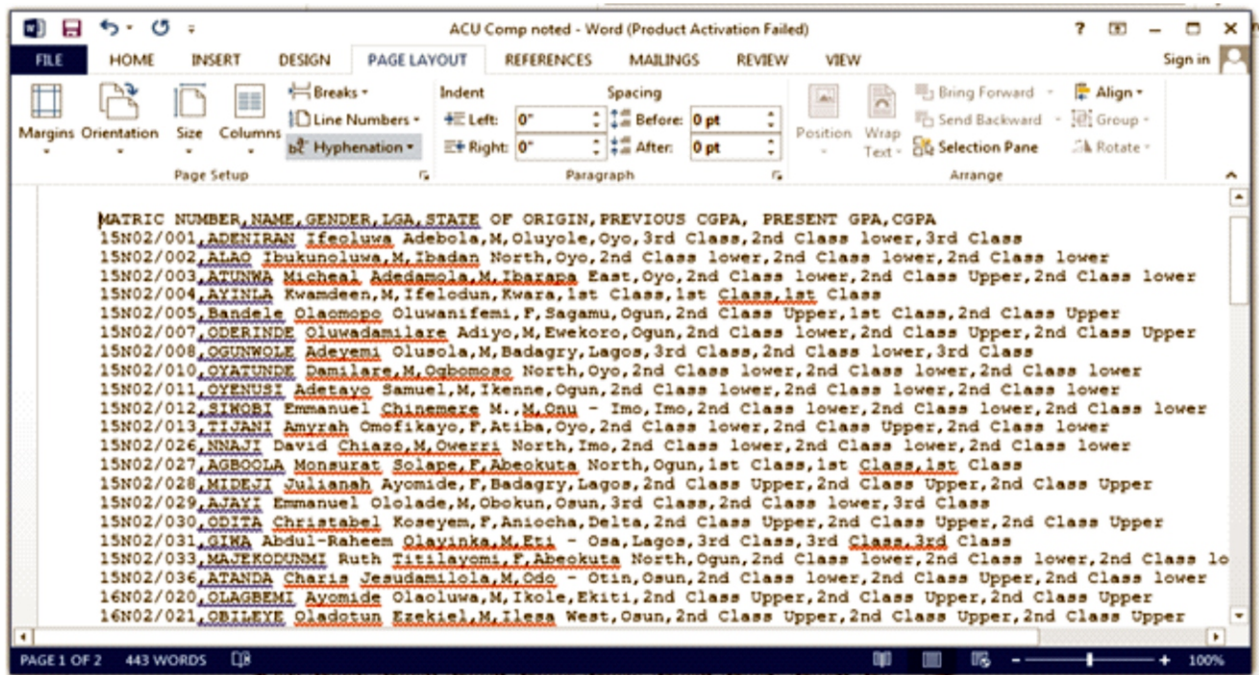
The method used for the collection of data was by getting the student's basic information such as the Matriculation number, Name of the student, Sex of the student, State of origin, and previous academic status of the student. The data collected from the department are in a Word format. The data was copied to the Microsoft Excel (spreadsheet) format:



	A	B	C	D	E	F	G	H
1	MATRIC NUMBER	NAME	GENDER	LGA	STATE OF ORIGIN	PREVIOUS CGPA	PRESENT GPA	CGPA
2	15N02/001	ADENIRAN Ifeoluwa Adebola	M	Oluyole	Oyo	2.07	2.85	2.23
3	15N02/002	ALAO Ibukunoluwa	M	Ibadan North	Oyo	3.30	2.96	3.24
4	15N02/003	ATUNWA Micheal Adedamola	M	Ibarapa East	Oyo	3.01	4.04	3.23
5	15N02/004	AYINLA Kwamdeen	M	Ifelodun	Kwara	4.55	4.77	4.6
6	15N02/005	Bandele Olaomopo Oluwanifemi	F	Sagamu	Ogun	4.19	4.88	4.34
7	15N02/007	ODERINDE Oluwadamilare Adiyi	M	Ewekoro	Ogun	3.40	3.92	3.51
8	15N02/008	OGUNWOLE Adeyemi Olusola	M	Badagry	Lagos	2.15	2.65	2.26
9	15N02/010	OYATUNDE Damilare	M	Ogbomosho North	Oyo	2.45	2.96	2.56
10	15N02/011	OYENUSI Adetayo Samuel	M	Ikenne	Ogun	3.27	3.35	3.28
11	15N02/012	SIWOBI Emmanuel Chinemere M.	M	Onu - Imo	Imo	2.48	2.77	2.54
12	15N02/013	TIJANI Amyrah Omofikayo	F	Atiba	Oyo	3.03	4.31	3.3
13	15N02/026	NNAJI David Chiaz	M	Owerri North	Imo	3.18	3.00	3.14
14	15N02/027	AGBOOLA Monsurat Solape	F	Abeokuta North	Ogun	4.76	4.85	4.78
15	15N02/028	MIDEJI Julianah Ayomide	F	Badagry	Lagos	3.65	4.00	3.72

Figure 4: Microsoft Excel format of the collected data

And saved as “comma separated value” format i.e.csv.



MATRIC NUMBER,NAME,GENDER,LGA,STATE OF ORIGIN,PREVIOUS CGPA,PRESENT GPA,CGPA
 15N02/001,ADENIRAN Ifeoluwa Adebola,M,Oluyole,Oyo,3rd Class,2nd Class lower,3rd Class
 15N02/002,ALAO Ibukunoluwa,M,Ibadan North,Oyo,2nd Class lower,2nd Class lower
 15N02/003,ATUNWA Micheal Adedamola,M,Ibarapa East,Oyo,2nd Class lower,2nd Class upper,2nd Class lower
 15N02/004,AYINLA Kwamdeen,M,Ifelodun,Kwara,1st Class,1st Class
 15N02/005,Bandele Olaomopo Oluwanifemi,F,Sagamu,Ogun,2nd Class upper,1st Class,2nd Class upper
 15N02/007,ODERINDE Oluwadamilare Adiyi,M,Ewekoro,Ogun,2nd Class lower,2nd Class upper,2nd Class upper
 15N02/008,OGUNWOLE Adeyemi Olusola,M,Badagry,Lagos,3rd Class,2nd Class lower,3rd Class
 15N02/010,OYATUNDE Damilare,M,Ogbomosho North,Oyo,2nd Class lower,2nd Class lower,2nd Class lower
 15N02/011,OYENUSI Adetayo Samuel,M,Ikenne,Ogun,2nd Class lower,2nd Class lower,2nd Class lower
 15N02/012,SIWOBI Emmanuel Chinemere M.,M,Onu - Imo,Imo,2nd Class lower,2nd Class lower,2nd Class lower
 15N02/013,TIJANI Amyrah Omofikayo,F,Atiba,Oyo,2nd Class lower,2nd Class upper,2nd Class lower
 15N02/026,NNAJI David Chiaz,M,Owerri North,Imo,2nd Class lower,2nd Class lower,2nd Class lower
 15N02/027,AGBOOLA Monsurat Solape,F,Abeokuta North,Ogun,1st Class,1st Class,1st Class
 15N02/028,MIDEJI Julianah Ayomide,F,Badagry,Lagos,2nd Class upper,2nd Class upper,2nd Class upper
 15N02/029,AJAYI Emmanuel Ololade,M,Obokun,Osun,3rd Class,2nd Class lower,3rd Class
 15N02/030,ODITA Christabel Koseyem,F,Aniocha,Delta,2nd Class upper,2nd Class upper,2nd Class upper
 15N02/031,GINA Abdul-Raheem Olayinka,M,Eti - Osa,Lagos,3rd Class,3rd Class,3rd Class
 15N02/033,MAJEKODUNMI Ruth Titilayomi,F,Abeokuta North,Ogun,2nd Class lower,2nd Class lower,2nd Class lower
 15N02/036,ATANDA Charis Jesudamilola,M,Odo - Otin,Osun,2nd Class lower,2nd Class upper,2nd Class lower
 16N02/020,OLAGBEMI Ayomide Olaoluwa,M,Ikole,Ekiti,2nd Class upper,2nd Class upper,2nd Class upper
 16N02/021,OBILEYE Oladotun Ezekiel,M,Ilesa West,Osun,2nd Class upper,2nd Class upper,2nd Class upper

Figure 5: CSV format of the collected data

The data are loaded in CSV format to the WEKA tool. During the scan of the data, WEKA computes some basic statistics on each attribute. The following statistics are shown in the 'Selected attribute' box on the right panel of the 'Pre-process' window:

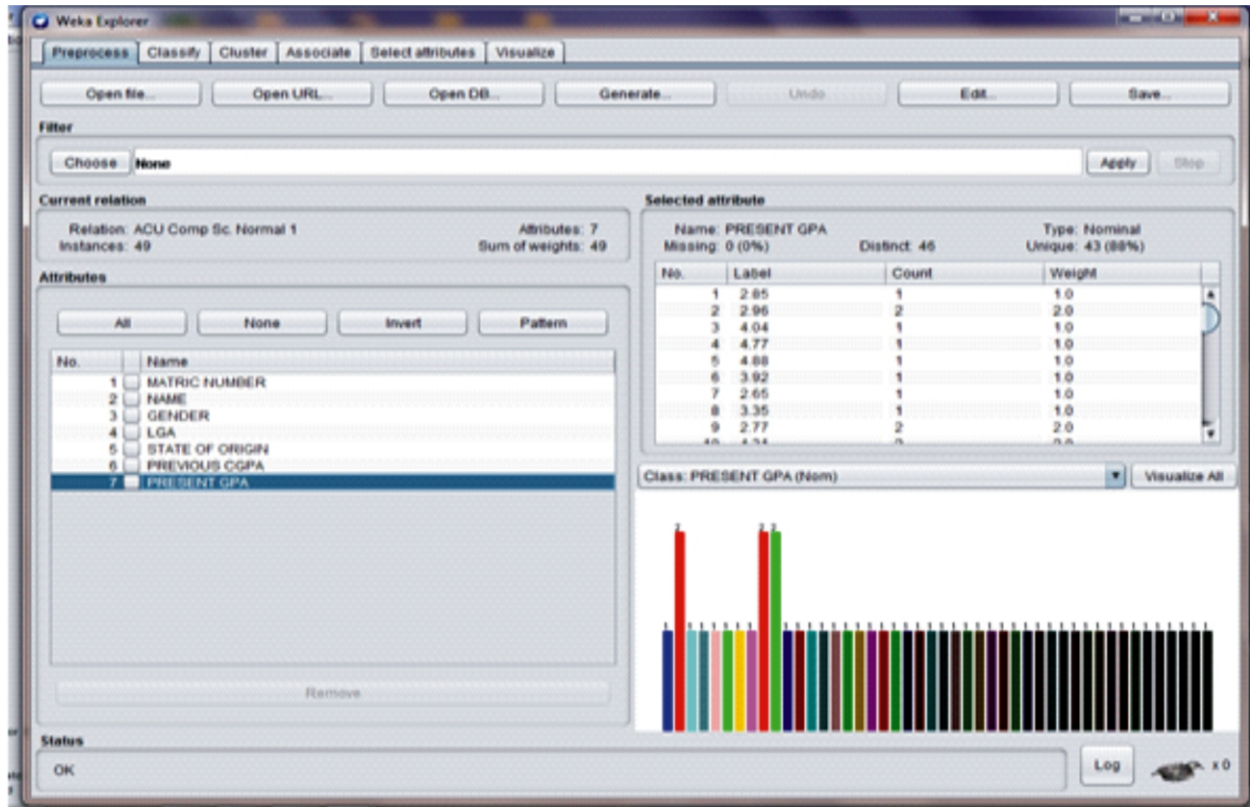


Figure 6: The Pre-process panel showing the attributes and basic statistics

Techniques for Data Analysis

The technique used for data analysis consists of the Training phase, Testing phase, Prediction phase, and Knowledge representation. The data set is divided into two (2) sets, a training set and a testing set. The training set is used to build the model from the J48 decision tree classifier, it evaluates the classifier on how well it predicts the class of the instances it was trained on as the student's Current G.P.A was used as the Key Performance Indicator, and various statistics in the output such as Precision, F-measure, TP, FP are analyzed. A total of forty-nine instances (49 students) were trained. The testing set is used to validate the model by checking the accuracy of the model on how well it predicts the class of a set of instances loaded from a file as a user-supplied test set. The prediction phase consists of the Prediction model created by leaving a blank column in which the prediction level is inserted by the classifier from which the students' performance is predicted based on the level (ranging between 0.5 to 1). The result generated by the model can further be represented in visualized (chart etc.) or tree form for further clarification and easy understanding.

1. RESULTS AND DISCUSSION

This work was developed using the J48 decision tree classifier in WEKA to predict the academic performance of forty-nine (49) students of the Department of Computer Science under seven (7) attributes.

From the experimental results, J48 algorithm predicted the unknown category of CGPA to the accuracy of 93.8776% which is fair enough for the system to rely upon for the prediction of students' academic performance and it also takes relatively little time to execute.

Setting Test Options

Two categories of data set were used in the course of the work, they are:

1. **Training data set** - evaluates the classifier on how well it predicts the class of the instances it was trained on. To produce the model, a training data was used, a data set with known output values was used to build the model. This type of model used the entire dataset as the training set which was used



to create the model and use the same dataset to test the accuracy of the model having identified the unknown attribute.

The summary of the model is as shown below:

```

=== Summary ===
Correctly Classified Instances      46      93.8776 %
Incorrectly Classified Instances    3       6.1224 %
Kappa statistic                    0.9373
Mean absolute error                 0.0027
Root mean squared error             0.0365
Relative absolute error             6.2624 %
Root relative squared error         25.0284 %
Total Number of Instances          49
    
```

The correctly classified instances are 46 at 93.8776% which signifies that the model is efficient enough to be relied upon in contrast to the incorrectly classified instances. The Kappa statistics is 0.9373 or 93.73% which indicates that the classifier is doing better than mere chance.

2. **Supplied test set** - evaluates the classifier on how well it predicts the class of a set of instances loaded from a file. Clicking on the '**Supplied test Set**' button brings up a dialog allowing you to choose the file to test on. The test data was created to control over-fitting after the model is created, it is tested to ensure that the accuracy of the model does not decrease with the test set. This ensures that the model will accurately predict future unknown values. Only nine (9) instances (the first nine students) were selected and used to evaluate the model.

```

=== Summary ===
Correctly Classified Instances      9      100 %
Incorrectly Classified Instances    0       0 %
Kappa statistic                    1
Mean absolute error                 0
Root mean squared error             0
Relative absolute error             0 %
Root relative squared error         0 %
Total Number of Instances          9
Ignored Class Unknown Instances      40
=== Detailed Accuracy By Class ===
    
```

TPRate	FPRate	Precision	Recall	F-Measure	MCC	ROC Area	PRC Area	Class
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	2.85
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	2.96
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	4.04
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	4.77
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	4.88
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	3.92
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	2.65
1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	3.35

A total of nine (9) instances (students) were used to evaluate/test the model. The model has the same information as the Training data set model, thus showing that it is okay and efficient for prediction.

The correctly classified instances are 9 at 100%, the incorrectly classified instances 0 at 0%, Kappa Statistics is 1, and Ignored instances 40 (this is because only nine (9) students were used to test the model out of the forty-nine (49) students of ACU), True positive (TP) is 1, False positive (FP) is 0, Precision Rate, Recall, and F-Measure are 1. It thus reflects that the model is strong and better for prediction.



Prediction Model

After training and testing the model, data of unknown academic performance was then fed into the system for prediction. The prediction output of a given student is either “Pass” or “Fail”. Out of forty-nine (49) datasets supplied into the system forty-six (46) were correctly predicted and only three (3) were incorrectly predicted. The percentage of correctly predicted datasets is 93.8776% which is fair enough to be entirely dependent on.

==== Summary ====

Correctly Classified Instances	46	93.8776 %
Incorrectly Classified Instances	3	6.1224 %
Kappa statistic	0.9373	
Mean absolute error	0.0027	
Root mean squared error	0.0365	
Relative absolute error	6.2624 %	
Root relative squared error	25.0284 %	
Total Number of Instances	49	

The model having correctly classified instances of 46, Kappa statistics of 0.9373, True positive rate of 1, False positive rate of 0, Precision rate and Recall of 1, and F-measure of 0.667-1, shows that most of the students have a high tendency to have the same GP in the coming Semester.

The table below shows and interprets the prediction of the first nine (9) students as predicted by the model:

Student Name	Matric. Number	Current G.P	Predicted G.P	Prediction Level
ADENIRAN IfeoluwaAdebola	15N02/001	2.85	2.85	1
ALAO Ibukunoluwa	15N02/002	2.96	2.96	1
ATUNWA MichealAdedamola	15N02/003	4.04	4.04	1
A YINLA Kwamdeen	15N02/004	4.77	4.77	1
BandeleOlaomopoOluwani femi	15N02/005	4.88	4.88	1
ODERINDE	15N02/007	3.92	3.92	1
Oluwadamilare Adisa	15N02/008	2.65	2.65	1
OGUNWOLE Adeyemi Olusola	15N02/008	2.65	2.65	1
OYATUNDE Damilare	15N02/010	2.96	2.96	1
OYENUSI Adetayo Samuel	15N02/011	3.35	3.35	1

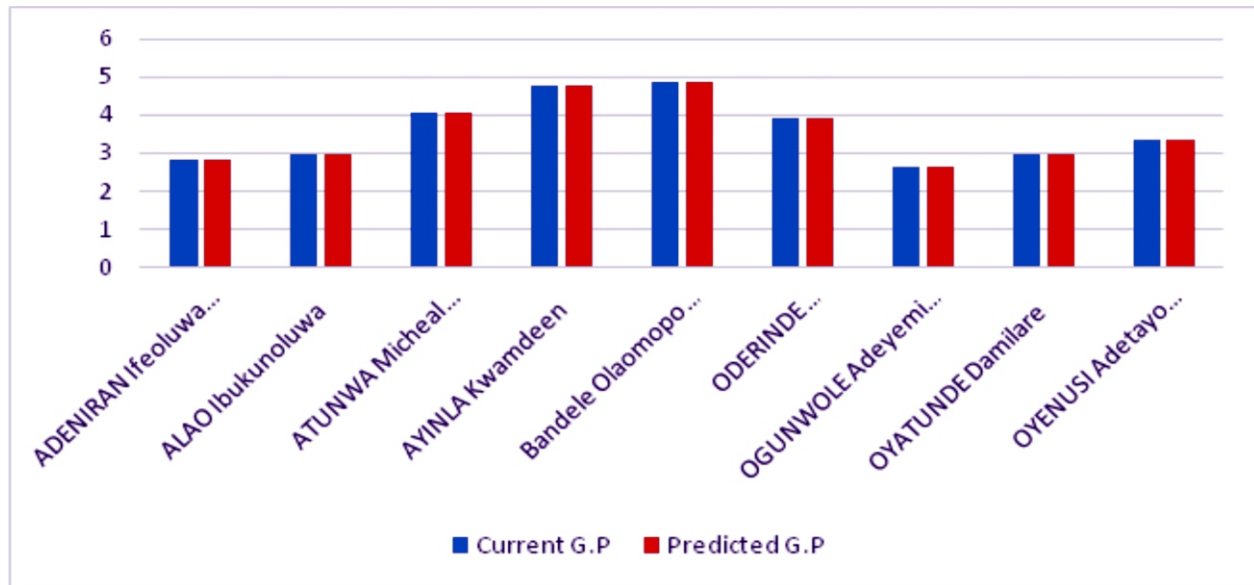


Figure 7: Prediction graph for the first nine students

From the graph, the Current G.P. is represented by the blue bar (left) while the Predicted G.P. is represented by the orange bar (right). The graph shows that the Predicted G.P. and the Current G.P. are at the same level for all the students, thus signifying that the student is liable to have the same G.P. in the coming Semester. For example, Adeniran Ifeoluwa had a GPA of 2.85 is likely to have the same GPA in the coming Semester because the prediction level is 1, the same goes for other students.

Summary

In this paper, the J48 method of classification was used to build a model to predict the student's academic performance based on its accuracy measure and prediction level for small datasets, and in terms of its merits above other decision tree algorithms. As the model was evaluated using the student's record of the Computer Science Department, Ajayi Crowther University, Oyo.

The simplicity of the J48 result output and its easy interpretation and prediction makes it a more convenient tool to predict students' academic performance.

Conclusion

The J48 decision tree presents and achieves a high rate of accuracy. It classifies the data into the correct and incorrect instances as we cover seven (7) attributes under forty-nine (49) instances and the model successfully identifies the students who are likely to fail. These students can be considered for proper counselling to improve their results in the coming Semester.

The system will generally help students to benchmark their grades from their entry point into the final year, thereby helping them to work harder to achieve this. Finally, the developed system would help to significantly reduce the overall failure rate in most academic institutions as students can be well guided and counselled.

Recommendation

From the results and findings of the experiments in this work, we recommend the adoption of the student performance prediction model as Education Data Mining is an emerging data Mining discipline. More similar studies on a different data set for the machine learning approach are needed to confirm the above finding.

Future work could also include applying data mining techniques on an expanded data set with more unique attributes to get more accurate results. Also, a comparative analysis of these results would be carried out based on other experiments results gotten from using other types of decision tree algorithms such as C4.5, CHAID, and CART.



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DEVELOPMENT OF AN ENHANCED SELECTION COMBINER IN AN UNCORRELATED NAKAGAMI 0.5 FADING CHANNEL USING ADAPTIVE POWER CONTROLLED

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Abstract

Wireless communication has found worldwide recognition in providing acceptable signal levels due to its flexibility and ease of usage. However, the system is characterized by severe multipath propagation effects that degrade its performance. Selection Combiner (SC), as one of the techniques being used to address this problem has a poor performance with low Spectral Efficiency (SE) and high Bit Error Rate (BER) due to the fixed transmitting power used in the system. Hence, in this paper, an enhanced SC that adjusts the transmitting power based on Channel State Information (CSI) with a closed-form expression over an uncorrelated Nakagami-0.5 fading channel is proposed. The proposed technique is developed using the conventional SC (CSC) and feedback algorithm. The multiple copies of the transmitting signal over an uncorrelated Nakagami 0.5 fading channel are received using multiple antennae. The resultant signals at varying paths 'L' (2, 3, 4) were scanned by SC to choose a path with the highest Signal Noise Ratio (SNR). The output of SC which is a function of Channel State Information (CSI) acquired was used to determine the channel gain. The transmitting power was then adjusted based on the value of channel gain through the feedback algorithm. A mathematical expression for BER and SE was also derived. The proposed technique was simulated using Matrix Laboratory R2018a and evaluated using SE and BER by comparing with each Optimal Rate Adaptation (ORA) and Channel Inversion Fixed Rate (CIFR) to determine the performance of the system. The results obtained revealed that the proposed technique shows a percentage reduction in BER of 33.33% and 66.67% when compared with ORA and CIFR, respectively. The study showed that the proposed technique gave lower BER values compared to ORA and CIFR and this is due to self-adjustment of the transmitting parameter.

Keywords—Diversity Combiner (DC), Adaptive Power Control (APC), Selection Combiner (SC), Bit Error Rate (BER), Spectral Efficiency (SE), Nakagami 0.5 fading channel

1 Introduction

Wireless communication system which involves the transmission of information across a distance without the use of wire has become an important tool for fast and efficient means of data transmission. The term wireless is used to describe communications in which electromagnetic waves carry signals over part or the entire communication path [1]. Unlike wired communication channel which is static and predictable, the wireless communication channel is dynamic and unpredictable and this makes an exact analysis of the wireless communication system often difficult. In wireless communication, the signal propagates from transmitter to receiver through an unbounded environment known as radio propagation. In the course of propagation, radio waves are mainly affected by three physical phenomena including diffraction, reflection, and scattering resulting in signal fading [2]. Fading is a unique characteristic in wireless communication and it can be described as variation of signal amplitude over time and frequency. Fading is a channel impairment that is characterized as a non-additive signal disturbance in the wireless channel and degrades the

transmitting signal. Fading is either due to multipath propagation, referred to as multipath fading, or as a result of blockage known as shadowing.

Multipath fading occurs when the signal propagates in multiple copies between the transmitter and receiver due to obstructions along the propagation path, while, shadowing is the fluctuation in the power of the received signal due to obstructions along the propagation path. The effect of multipath fading and shadowing is degradation in the quality of the received signal causing poor reception. Thus, fading compensation is typically required to mitigate the effect of fading [1]. Diversity Combiner (DC) is one of the techniques that mitigate the detrimental effect of fading in wireless communication. It is a technique that combines multiple copies of the transmitted signal at the receiver to improve the signal strength of the received signal [8]. DC technique consists of Equal Gain Combiner (EGC), Maximal Ratio Combiner (MRC), and Selection Combiner (SC). The results of the past research on the DC technique reveal that the SC technique is often used in practice due to its low complexity but suffers from poor performance when compared with MRC and EGC [9]. In the SC technique, the SNR of all the diversity branches that are available in the system is evaluated to select the best path. The diversity output path from the combiner has a signal-to-noise ratio that is equal to the maximum SNR of all the diversity branches [10, 11, 12]. The poor performance of SC is due to only one signal branch being used out of the multiple available branches, fixed transmitting power, and the time-varying nature of the channel [1, 8]. As a result of the varying nature of the channel, modern wireless devices are equipped with channel measurement and rate adaptive capabilities that allow the transmitter-receiver pair to measure the fade state using a pre-determined pilot signal and rate control capability that allows the transmitter to adjust the reliable transmission rate over time. Such a control is achieved in various ways such as adjusting the power level, symbol rate, coding scheme, constellation size, and any combination of these approaches. Then, the receiver detects these changes directly from the received data without the need for explicit rate change control information [2]. Therefore, this paper proposed an enhanced SC technique that adjusts the transmitting power based on Channel State Information (CSI) known as Adaptive Power Controlled (APC).

Several works have been carried out on diversity combiners to improve the performance of wireless communication systems. In [12], closed-form expressions for the spectral efficiency of dual branch Selection Combiner (SC) with no diversity under Optimum Rate Adaptation (ORA) and Channel Inversion with Fixed Rate (CIFR) schemes were proposed. Error bounds were derived for truncated infinite series under ORA. The results illustrated that bounds can be used effectively to determine the number of terms needed to achieve a desirable level of accuracy. The results obtained in the paper revealed that the SC with ORA and CIFR gave a lower BER when compare with conventional SC. However, the technique suffers from poor performance in a time-varying channel due to the fixed transmitting power used. The performance analysis of hybrid MRC/EGC Diversity Combining Techniques over the AWGN channel is carried out in [13]. In this paper, there was an L number of MRC each having an M number of input branches and each of the M branches received the signal and the individual antennas were kept sufficiently apart to have negligible correlation among the received branch signals. The output of each of the L Maximum Ratio Combining was used as input to Equal Gain Combiner.

The results obtained from the paper showed that the hybrid technique gave better performance by providing a maximum benefit compared to other techniques. However, the technique is characterized by hardware complexity. Also, [14] presented a paper on the Spectral efficiency of dual diversity selection combining schemes under correlated Nakagami-0.5 fading with unequal average received SNR. The authors derived expressions for the spectral efficiency over correlated Nakagami-0.5 fading channels with unequal average received SNR. The spectral efficiency was

evaluated under different adaptive transmission schemes using a dual-branch SC diversity scheme. The result obtained from the paper revealed the spectral efficiency degradation due to channel correlation and unequal average received SNR between the different combined branches under different adaptive transmission schemes. The authors stated that the truncated channel inversion with fixed rate (TIFR) scheme is a better choice over the ORA scheme under correlated Nakagami-0.5 fading channels with unequal average received SNR. However, the techniques suffer from poor performance in a time-varying channel due to the fixed power used for radio wave propagation. Furthermore, in [15], fading mitigation techniques in wireless mobile communication were carried out to solve the problem of multipath fading using a Rake receiver. The rake receiver combined the time-shifted versions of the original signal by providing a separate correlation receiver for each of the multipath signals. The design of a rake receiver can be visualized as a series of time-delayed correlator taps fed from a common antenna. The system has a better performance but it requires a dedicated receiver for each path which led to total dependence of the entire transmission process on a single receiver. As such, the failure of the dedicated receiver would imply total system shutdown.

Therefore, previous works on diversity combiner showed that the SC technique is often used in practice due to its low complexity but suffers from poor performance when compared with other diversity combining techniques in a time-varying channel due to only one path and fixed transmitting power used. Therefore, in this paper SC with adaptive power control based on the CSI to improve the existing SC with adaptive transmission techniques such as ORA and CIFR is proposed. Signal propagation in wireless communication follows different fading distributions such as Weibull, Nakagami- m , and Rician fading distributions. Uncorrelated Nakagami- m distribution in which that signal propagated does not encounter overlapping is adopted in this paper due to its capability to model both the indoor and outdoor mobile radio environment [13, 14, 15]. The proposed technique will be compared with the commonly used adaptive SC technique, that is, Optimal Rate Adaptation (ORA) and Channel Inversion with Fixed Rate (CIFR) to measure the performance. The contribution of this paper is as follows

- 1). Proposes an adaptive SC technique that adjusts its transmitting power based on the channel gain at an instant thereby enhancing the performance of the existing SC.
- 2). Derivation of Bit Error Rate (BER) expression for the proposed adaptive SC technique over uncorrelated Nakagami 0.5 fading distribution.

The remaining part of this paper is organized as follows; section 2 designed the proposed adaptive SC, while, the simulation results that analyzed the performance of the proposed SC technique are presented in section 3. The conclusion of the paper is presented in section 4.

2. METHODOLOGY

2.1 Designed of the Proposed Adaptive SC Technique

The transmitting signal generated randomly is propagated through a Nakagami- m fading channel from the transmitting antenna and Selection Combining (SC) scans through the multiple copies of the signals to choose the branch with the highest SNR ($\max R(t)$) as shown in Fig 2. The selected signal passes through Channel State Information (CSI) to obtain the channel gain thereby determining the SNR of the received signal. The output of CSI serves as input to the decision device to check the value of the SNR. If the channel gain is high, therefore, the decision device instructs the transmitter through a feedback path to increase or reduce transmitting power based on the value of SNR of the received signal.

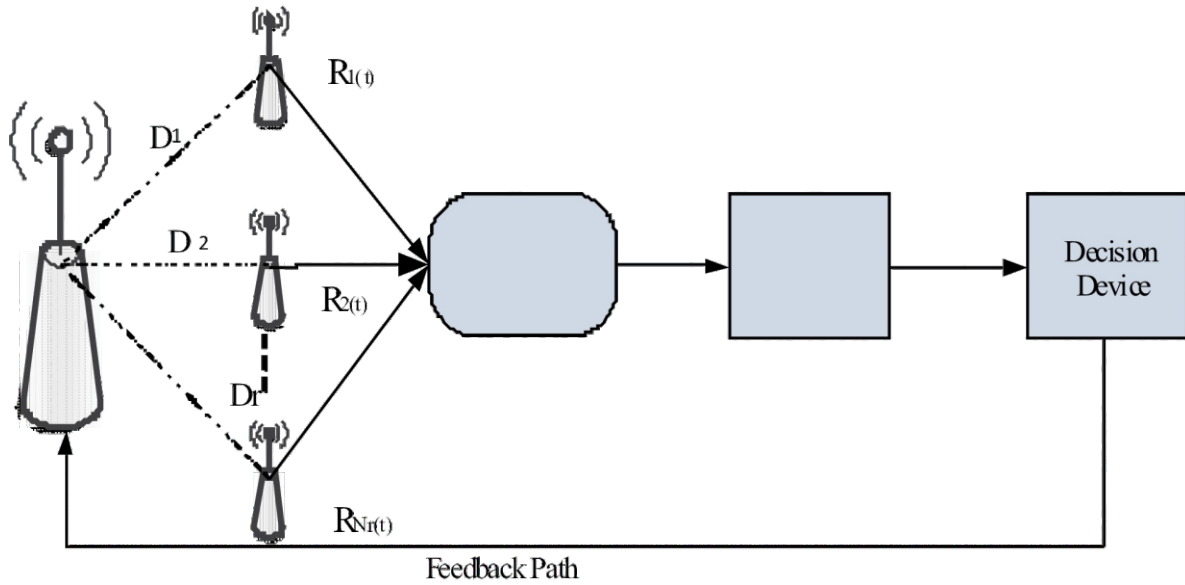


Fig. 1: Block diagram of an Adaptive Power Control System

The instantaneous Signal-to-Noise ratio (SNR) of the received signal is the product of channel gain 'H' at a particular time and the constant P_t/NB . Therefore, the instantaneous SNR of the received signal 'γ' is given by [22] as

$$\gamma = \frac{P_t H}{NB} \quad (1)$$

Where: P_t is the transmit power

B is the channel bandwidth

H is the channel gain

N is the noise spectral density which is equal to $10^{-9} W/Hz$

The Probability Density Function (PDF) of the received signal over the Nakagami-m fading channel is given by [23] as

$$P_r(r) = \frac{2}{\Gamma(m)} \left(\frac{m}{2\sigma^2}\right)^m r^{2m-1} \exp\left(\frac{-mr^2}{2\sigma^2}\right) \quad r \geq 0 \quad (2)$$

But Bit Rate 'R' is given by [19] as

$$R = B \log_{10} \left(\frac{1 + (P_x H)}{N} \right) \quad (3)$$

where: B is the Bandwidth of transmitted data

P is the transmit power in watts

H is the channel gain

N is the noise.

From equation 3, channel gain 'H' was obtained as

$$\frac{R}{B} = \log_{10} \left(\frac{1 + (P_x H)}{N} \right) \quad (4)$$

$$10^{\frac{R}{B}} = \frac{1+(PxH)}{N} \quad (5)$$

$$H = \frac{(Nx10^{\frac{R}{B}})^{-1}}{P} \quad (6)$$

Substituting equation 6 into equation 1 gives

$$\gamma = \frac{P_t \frac{(Nx10^{\frac{R}{B}})^{-1}}{P}}{NB} \quad (7)$$

Therefore, a PDF of the received signal for the proposed technique is obtained by substituting equation 7 into equation 2, yield

$$P_r(r) = \frac{2}{\Gamma(m)} \left(\frac{m}{2\sigma^2}\right)^m \left(\frac{P_t \frac{(Nx10^{\frac{R}{B}})^{-1}}{P}}{NB}\right)^{2m-1} \exp\left(\frac{-m \times \frac{P_t \frac{(Nx10^{\frac{R}{B}})^{-1}}{P}}{NB}}{2\sigma^2}\right) \quad (8)$$

By solving equation 8 and substituting $m = 0.5$, equation 8 becomes

$$P_r(r) = \frac{2}{\Gamma(0.5)} \left(\frac{0.5}{2\sigma^2}\right)^{0.5} \exp\left(\frac{-P_t \times (N \times 10^{\frac{R}{B}})^{-2}}{NB}\right) \quad (9)$$

2.2 Derivation of Bit Error Rate for the proposed technique

The performance of the proposed technique is evaluated using BER which is the ratio of the erroneous bit to the transmitted bit and the lower the value of BER, the better the performance of the technique. The expression for Bit Error Rate ($P_b(E)$) is given by [19] as

$$P_b(E) = \int_0^\infty P_b(E/\gamma) P_r(\gamma) d\gamma \quad (10)$$

where: $P_b(E/\gamma)$ is the conditional error probability

E is signal per bit or signal per symbol

γ is the received SNR

$P_r(\gamma)$ is the PDF of the output SNR.

Substituting equation 9 into equation 10 gives

$$P_b(E) = \int_0^\infty P_b(E/\gamma) \frac{2}{\Gamma(0.5)} \left(\frac{0.5}{2\sigma^2}\right)^{0.5} \exp\left(\frac{-P_t \times (N \times 10^{\frac{R}{B}})^{-2}}{NB}\right) d\gamma \quad (11)$$

According to [19], conditional error probability $P_b(E/\gamma)$ is given as

$$P_b(E/\gamma) = 1/2 \exp(a\gamma) \quad (12)$$

where: $a = 0.5$ for non-coherent modulation

For non-coherent modulation, equation 12 becomes

$$P_b(E/\gamma) = 1/2 \exp(0.5\gamma) \quad (13)$$

Substituting equation 13 into 10 gives

$$P_b(E) = \int_0^\infty 1/2 \exp(0.5\gamma) \frac{2}{\Gamma(0.5)} \left(\frac{0.5}{2\sigma^2}\right)^{0.5} \exp\left(\frac{-P_t \times (N \times 10^{\frac{R}{B}})^{-2}}{NB}\right) d\gamma \quad (14)$$

3 RESULTS AND DISCUSSION

Results for BER and SE presented in equations (14) and (17), respectively were obtained and used to evaluate the performance of the proposed technique. The comparison was done using the results obtained by comparing with ORA and CIFR proposed in [12]. The proposed technique is named Adaptive Power (AP) and this was used in presenting the results for ease of comparison.

Fig. 2 presents the Bit Error Rate (BER) versus SNR at propagation path ‘L’ of 2, for the proposed Adaptive Power (AP), Optimal Rate Adaptation (ORA), and Channel Inversion Fixed Rate (CIFR) over the Nakagami fading channel. At SNR of -6, -4, 2, and 4 dB, the BER values of 1.69×10^{-5} , 1.14×10^{-5} , 1.59×10^{-7} and 8.54×10^{-8} were obtained for AP, respectively, as against 1.13×10^{-2} , 1.68×10^{-3} , 1.61×10^{-4} and 8.51×10^{-5} obtained for ORA at the same value of SNR. CIFR showed poor performance when compared with AP and ORA with BER values 1.69×10^{-1} , 4.18×10^{-2} , 4.17×10^{-3} and 2.69×10^{-3} at SNR of -6, -4, 2, and 6 dB, respectively. From Fig. 3, the AP showed better performance with lower BER when compared with ORA and CIFR. The better performance of the proposed AP technique is due to adjusting the transmitting power based on the channel gain at any time.

Fig. 3 depicts the BER values obtained for AP, ORA, and CIFR at L of 3. At SNR of -6, -4, 2, and 4 dB the BER values of 9.84×10^{-8} , 9.67×10^{-9} , 8.82×10^{-11} and 9.35×10^{-12} were obtained, respectively for AP. The BER values obtained for ORA at the same SNR were 9.84×10^{-5} , 9.67×10^{-6} , 8.01×10^{-7} and 9.67×10^{-8} as against 2.79×10^{-2} , 9.84×10^{-3} , 4.37×10^{-4} and 2.53×10^{-4} for CIFR. The results obtained showed that BER decreases as SNR increases and this demonstrates the effect of transmitting power on the transmitting signal. Fig. 4 depicts the BER values obtained versus SNR at L of 4 over the Nakagami 0.5 Fading Channel.

The BER values obtained at SNR of -6, -4, 2, and 6 dB are 4.92×10^{-11} , 4.83×10^{-12} , 4.65×10^{-15} , 4.65×10^{-16} for AP as against 4.92×10^{-7} , 4.83×10^{-8} , 4.34×10^{-10} and 4.65×10^{-11} for ORA. CIFR showed poor performance when compared with APC and ORA with BER values of 4.92×10^{-4} , 1.37×10^{-4} , 4.83×10^{-6} and 1.22×10^{-6} at SNR of -6, -4, 2, and 4 dB, respectively. The results obtained show that, BER values decrease with an increase in the number of paths.

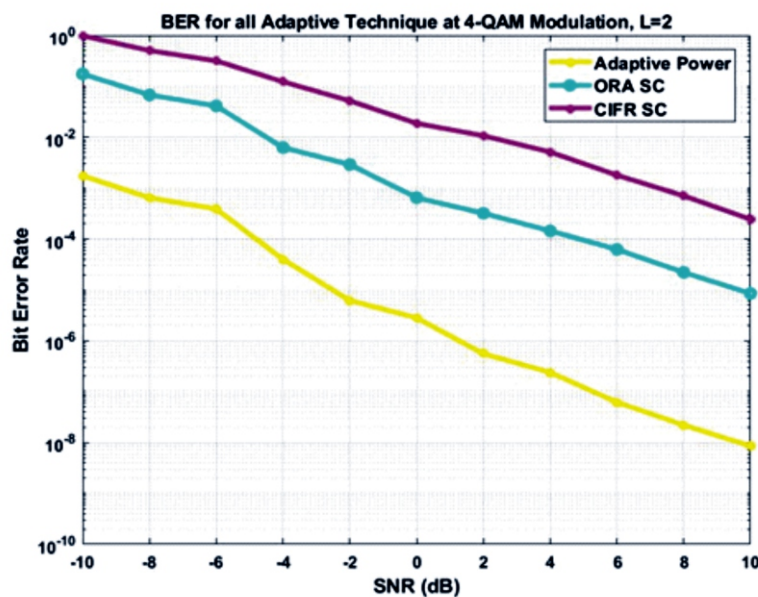


Fig. 2: BER versus SNR for Adaptive Power, ORA, and CIFR at L of 2 over Nakagami 0.5 Fading distribution.

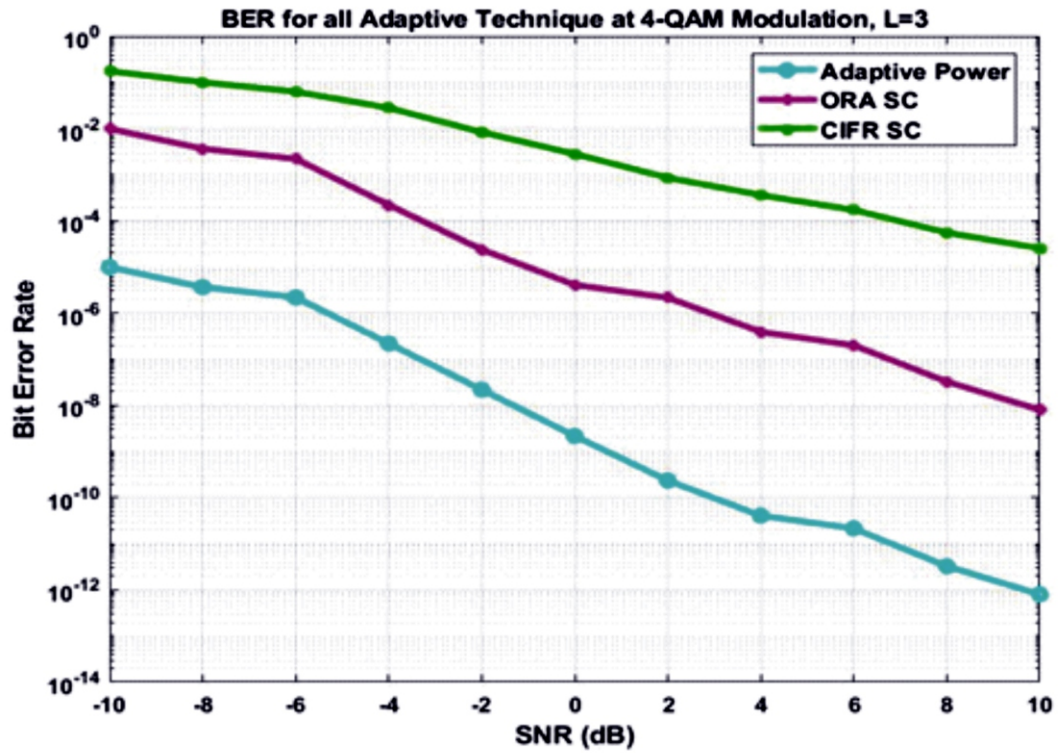


Fig.3: BER versus SNR for Adaptive Power, ORA, and CIFR at L of 3 over Nakagami 0.5 Fading distribution.

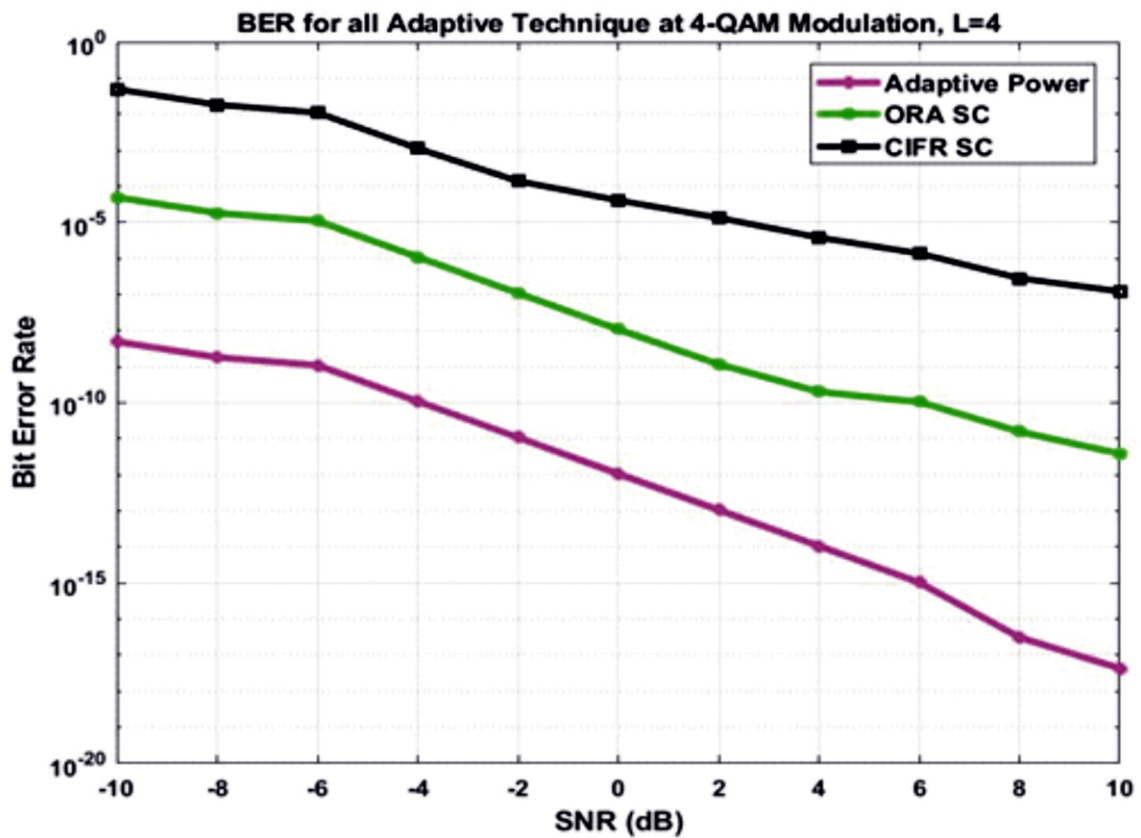


Fig. 4: BER versus SNR for Adaptive Power, ORA and CIFR at L of 4 over Nakagami 0.5 Fading distribution

3 CONCLUSION

This paper enhanced the performance of SC using Adaptive Power Controlled (APC) system over a time-varying Nakagami 0.5 fading distribution. The closed-form expression of the Bit Error Rate (BER) for the proposed technique was derived using the Probability Density Function (PDF) of the received signal. The proposed technique is evaluated using BER as performance metrics by comparing it with each of the ORA and CIFR techniques. BER values for the proposed adaptive SC technique, ORA, and CIFR are obtained at different SNRs using different numbers of paths.

The results obtained revealed that the proposed adaptive SC technique gives better performance with a reduction in BER compared to the other two existing techniques, that is, ORA and CIFR, and this is due to self-adjustment of transmitting power of the proposed technique, which happened to be a function of channel gain at an instant. The percentage reduction in BER is 33.33% and 66.67% when compared with ORA and CIFR, respectively. The better performance of the proposed SC technique is a result of the self-adjustment of the transmitting power based on channel gain at an instant, which allocates an appropriate transmitting power to the transmitting signal based on channel gain at an instant.

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WOMEN FINANCIAL INCLUSION AND SUSTAINABLE DEVELOPMENT IN NIGERIA

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Abstract

This study examined the effect of women financial inclusion on sustainable development in Nigeria for the period 1990-2022. Specifically, the study aimed to investigate the long-run relationship between women financial inclusion and sustainable development in Nigeria. The source of data for the study was secondary. To investigate the objective, Autoregressive Distributed Lag (ARDL) was adopted for the study. The resource of the ARDL revealed that there was a positive long-run relationship between women financial inclusion and sustainable development in Nigeria but not significant. The result further showed that poverty, exchange rate, inflation rate, and women's unemployment rate adversely affected sustainable development. It was discovered that bank credit to women entrepreneurs contributed to sustainable development in Nigeria. The study concluded that women financial inclusion did not enhance sustainable development.

Keywords: Women Financial Inclusion, financial Exclusion, Poverty, Bank Credit, Inflation

1. Introduction

The challenges of inaccessibility of financial services to the majority of women in Nigeria have continued to deprive the country of meaningful development that tricks down to the most vulnerable in society. The effect of this has been increasing poverty rate, unemployment, malnutrition, gender inequality, income inequality, and high level of illiteracy among women in Nigeria. Akomolafe and Folorunsho (2019) argued that the consequences of the inability of a substantial number of women in Nigeria to enjoy sustainable financial services could cause a reduction in life expectant, an increase in the poverty rate, and a decrease in the capacity of women to participate and contribute their quotas to economic activities in Nigeria, thus, failure of the country to attain improve sustainable development among women in Nigeria. To this end, Okorie (2020) pointed out that the quality of women in a society determines greatly the extent a country has achieved its sustainable development goal. Adekanye (2017) stated that one of the parameters for adjudging the extent a country has gone in achieving get sustainable development goals is the number of women that get access to financial services. Thus, in this sense, over 20 million women in Nigeria, are still unbanked as a result of unavailability of financial services in their domains (United National Organization, 2019). This scenario has deprived many of the women of the benefits of having unhindered access to financial services such as access to loans and advances, access to economic savings, and access to financial tools that make banking services reach the doorstep of the women, thus, making Nigeria not to be able to attain sustainable development that enhances the economic status of the women.

Sustainable development is a development that is beneficial to the most vulnerable of women in society. This shows that with sustainable development women's accessibility to financial inclusion improves, thus, enhancing the economic and social status of the women as a result of access to financial instrumentality such as loans and advances that increase the economic, social, and business status of the women. Akinlo (2020) argued that with women's accessibility to financial instrumentality, better change in economic status, educational status, social status, poverty status, and reduction income occur, thus, facilitating the attainment of sustainable development in Nigeria in this regard. But the problem is that an adequate number of women in rural areas in Nigeria are still far from enjoying financial services due to the lack of functioning Deposit Money Banks in their

communities. Even those that enjoy the services are only offered once in a while services by DMBs and other microfinance within their areas, thus, making financial inclusion difficult for these set of women. The resultant effect of this was an increase in the poverty rate due to a lack of accessibility to finance, thus, creating economic and social embarrassment for the women. This endangers the attainment of sustainable development in Nigeria. With this in mind, unemployment, underemployment, income inequality, and social and economic injustice became the daily scenario for women.

The works of Adekanye (2017), Ashiru (2018), Akinlo (2018), and Akomolafe and Folorunsho (2019) found a positive relationship between women's financial inclusion and sustainable development in Nigeria. Oguntade and Omoniyi (2018), Olorundare (2018), and Pius and Fashina (2020) found negative effects of women's financial inclusion women sustainable development in Nigeria. All the studies used questionnaires to address the problem raised, failed to incorporate the variable of employment among women which is an important parameter for ascertaining the extent Nigeria has gone in achieving sustainable development, and used chi-square methods that might provide reasonable inference for the studies. This current study intends to address the gaps in past works by the inclusion of employment, with the use of secondary data and the aid of the Autoregressive distributed lag (ARDL) mechanism to address the gap in the past studies.

On this premise, the board objective of the study is to examine the effect of women's financial inclusion on sustainable development in Nigeria for the period 1990-2022. Specifically, the study aims to evaluate the long-run relationship between women's financial; inclusion and sustainable development in Nigeria. To investigate the objective, the paper is divided into five sections, namely, introduction, literature review, methodology, result and discussion, and conclusions and recommendations.

2. Literature Review

This section focuses on the review of literature under three sections, namely, conceptual, theoretical, and empirical review of literature.

Conceptual review

Meaning and Definition of Women Financial Inclusion

Women's financial inclusion is defined as the integration of women into financial services provided by formal financial institutions (Akinlo, 2020). Akintunde and Ojo (2018) defined women's financial inclusion as the accessibility of women to financial services. The authors continued by arguing that women's financial inclusion includes but is not limited to access to financial loans and advances, access to online banking, access to enjoy electronic banking, and others. To this end, Olagunju (2020) defined women's financial inclusion as the accessibility of financial services to the most vulnerable women in society. Thus, in this sense, financial inclusion may be said to be around inclusive if women in rural areas in Nigeria can get access to formal financial services provided by financial institutions in Nigeria. Akinlo and Ojo (2019) opined that the failure of financial institutions in Nigeria to extend financial services to most women in rural areas can deprive this category of the populace's essential sustainable development. The consequence of this is a high rate of poverty, lack of reliable income, and increase social and economic injustice may be the order of the day among these women. Ogunlade and Ashiru (2021) defined women financial inclusion as the availability of banking services to the most vulnerable of women in society. In this sense, financial services are said to be women-inclusive when it is accessible to most women in society. The study may like to adopt the definition given by Akintunde and Ojo (2018) that sees women financial inclusion as the accessibility of women to financial services in a society.

Effect of Financial Inclusion

To enable us to gain insight into the impact of financial inclusion on the economy, understanding the role women play at the microeconomic level i.e. household, as well as the importance of providing better financial products and services for women (in their daily lives within the home) is fundamental. Some researchers have studied these gender effects over the years, and an example is a

study performed by Swamy (2014); Swamy studied the impact of financial inclusion on households, and to perform this study, Swamy employed the difference-in-difference estimator approach with Panel Least Squares and Generalized Methods of Moments using standard errors for a robust analysis; the results showed that the impact of financial inclusion was significantly higher in women than in men (8.40% and 3.97% respectively). Studies have been put forward to verify the impact of women's income on the household. Afridi et al., (2012); Kafle, (2017); Siddik, (2017), and Koomson & Danquah, (2021) further elucidate the role women who control or have access to finance play in providing education and well-being to their children and wards in Bangladesh, Ghana, India, Zambia, and Tanzania.

Barriers to Financial Inclusion and Economic Empowerment for Nigerian Women in Poverty Reduction

These barriers include the prevalence of the patriarchal system in the country, the peculiarity of the regional geographic divide that affects the level of exposure to financial offerings, low-income levels further sustained by gender roles and social norms, and poor education and financial literacy. It has been deduced that these factors when resolved or improved are believed to be capable of closing the FIGG in Nigeria. On the other hand, investigations have called our attention to the various components that could potentially drive an increased FI to result in the economic empowerment of women in Nigeria and around the world. financial exclusion means patriarchy, gender roles & cultural norms within a geographical location, the income, level of education, and financial literacy barriers to the financial inclusion of Nigerian women resolved barriers financial inclusion account ownership saving loan/microfinance digital banking fin indicators researched to potentially influence the economic empowerment of women economic empowerment financial literacy (Onukogu, 2021).

Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) seek to realize fully, human rights and empower women and girls through equality. The SDGs envisage an equal world where legal, social, and economic barriers to women's empowerment are removed. While acknowledging the effect of women's equality and empowerment as a crucial element in achieving its goals and targets, it encourages initiatives geared at bridging the gender gap; therefore, SDG Goal 5 (Achieve gender equality and empower all women and girls) is key to national progress. Goal 5 further seeks a complete end to all forms of violence, discrimination, and harmful cultural practices against women and the promotion of women in leadership, use of technology, gender equality, rights to economic resources and financial services, inheritance, control over land, and natural resources (in line with the national law).

Similarly, Nigeria as a member state of the United Nations is obliged to comply with the provisions of the United Nations Security Council Resolution 1325 (2000) and the SDGs. Narrowing it all down, these frameworks set the international fundamentals for financial inclusion, which is hinged on women's emancipation, elimination of sociocultural barriers, and removal of institutional blocks limiting women from social and economic equality which are the drivers of financial inclusion. Unfortunately, after over 30 years of ratifying the CEDAW and 20 years of consenting to the SDGs, Nigeria still sees a significant lag in the achievement of women's rights, when compared to other signatories of these frameworks (WEF, 2021). In the WEF Global Gender Gap Index ranking, Nigeria was ranked 136 out of 156 countries, coming after the likes of Togo, Guinea, and Malawi, which are considered worse countries in a political and economic sense. Nigeria was ranked 78, 146, and 149 on economic participation and opportunity, educational attainment, and political empowerment respectively (WEF, 2021).

Within Africa, some regional financial inclusion frameworks are currently utilized, such as the African Financial Inclusion Policy Initiative (AfPI) and the African Development Bank framework (AfDB), which focuses on the propagation of FI in Africa through policies, programs, and initiatives

that can increase the regional drive towards a reduction in the FIGG in Africa; while the African Development Bank framework advocates for growth and strengthening of African countries through the inclusion of the financially underserved population especially women (AfDB, 2021; AfPI, 2021).

Relationship between Women Financial Inclusion and Sustainable Development in Nigeria

The relevance of women's financial inclusion in sustainable development cannot be underestimated. Essentially, an increase in the number of women that can get access to financial services may reduce the poverty rate, enhance income equality, improve employment, improve women empowerment, and sustain a meaningful living for women in Nigeria. To this end, Ogunmodede (2020) opined that access of women to financial services may improve women empowerment and enhance women contribution to the achievement of the sustainable development goals in Nigeria. Women financial inclusion increases women access to financial benefits and if appropriately utilized in businesses and other entrepreneurial endeavours may reduce the poverty rate, increase economic and social status and enhance the standard of living of the women in Nigeria, thus, contributing effectively to sustainable development in Nigeria. Akinteju (2019) cited in Salius (2021) argued that the aim of sustainable development goal in relation to financial inclusion is to ensure that all bankable women benefit from the financial services provided by banks in Nigeria, which in turn contributed to their economic and social well-being. Ojo (2019) revealed that there is a positive relationship between women financial inclusion and sustainable development. This is because as the benefits of financial services are tricked down to the most vulnerable of women in society, sustainable development must have been realized. Thus, in this sense, sustainable development is achieved if poverty rate, income inequality, lack of empowerment, poor standard of living, high illiteracy rate, and unemployment be a thing of the past among women in Nigeria. Therefore, financial institutions in Nigeria must ensure that the benefits of financial services the banks provide can be accessed by women that use their services while other women outside the financial services must be persuaded and encouraged to use the banking services for their financial transactions and safe guiding of their wealth not needed now.

Theoretical Framework

This study is anchored on the Systems theory of financial inclusion. According to Ozili (2020), the systems theory of financial inclusion states that financial inclusion outcomes are achieved through the existing sub-systems on which financial inclusion rely on and that greater financial inclusion will have positive benefits for the systems it relies on. A significant change in a sub-system (one part of the system) can significantly affect the expected financial inclusion outcome. For instance, imposing regulations on economic agents and suppliers of financial services can align their interests with that of the users of basic financial services, and can compel economic agents and suppliers of financial services to offer affordable and quality financial services to users within defined rules that protect users of financial services from exploitation and price discrimination. In line with this theory, the rural communities will be financially included if the financial regulatory authorities in Nigeria will increase the loan-to-deposit ratio of commercial and Microfinance banks' loans to the rural populace.

Empirical Review

Okafor et al., (2020) investigated the impact of various factors that could impede financial inclusion in Nigeria and discovered from their research that the first and most prominent factor was low/inconsistent income level. These findings were in harmony with that of Allen et al., (2016) who conducted worldwide research on the barriers to ownership of accounts. The results of their findings disclosed that about 66% of the adult population who have no formal accounts have pointed to low income and poor earnings as the reason why they do not need an account. Research has shown that the income levels of adults have a direct relationship with their chances of being financially excluded. Low-income earners around the globe typically constitute single parents, people with disabilities, people living on benefits, and unemployed persons; and their income level makes them unattractive to bankers, and uninterested in seeking financial services.

Honohan (2007) tested the significance of his financial access indicator in reducing income equality. His results show that higher financial access significantly reduces income inequality as measured by the Gini coefficient. However, the link between the two variables depends on which specification is used, i.e., when the access variable is included on its own and/or includes a financial depth measure, the results are significant, but the same does not hold when per capita income and dummy variables are included.

Honohan (2007 and 2008) constructed a financial access indicator that captures the fraction of the adult population in a given economy with access to formal financial intermediaries. The composite financial access indicator was constructed using household survey data for economies with available data on financial access. For those without household surveys on financial access, the indicator was derived using information on bank account numbers and GDP per capita. The data set was constructed as a cross-section series using the most recent data as the reference year, which varies across economies. However, Hoonah's (2007 and 2008) measure provides a snapshot of financial inclusion and might not be applicable for understanding changes over time and across economies.

3. Methodology

This study hinged on the system theory of financial inclusion Ozili (2020). Ozili (2020) argued that the system theory of financial inclusion was based on the benefits the financial services might provide for the users. Thus, in this sense, Akintaju (2021) stated that the users of financial services must deprive financial benefits that might uplift them from the danger of poverty to better economic status by using financial services. Thus, this study covers the period 1990-2022 to be able to meaningfully investigate the objective of the study. The period is chosen based on the fact that it was in the early 90s that the Nigerian government started putting a policy in place on how to address women financial exclusion in Nigeria, till now the country has not achieved much in this regard. The study used secondary data sourced from the Central Bank of Nigeria, the Ministry of Women Affairs, Non-Government Organizations on women empowerment, and the National Bureau of Statistics. Furthermore, the study used both descriptive and econometric statistics of Auto-regressive Distributed Lag (ARDL). The Autoregressive Distributed Lag (ARDL) was adopted for the study because it has the advantage of working with relatively small data, unlike the Vector error correction mechanism. Thus, to capture the long-run relationship between women financial inclusion and sustainable development the need to deploy ARDL becomes essential.

Model Specification

The model for this study follows the work of Ozili (2020) and Akintaju (2021) but with slight modification. Functionally, the model is stated as;

$$SDEV = f(WFI, POV, BCWE, INF, EXR, WUNEMP) \quad (3.1)$$

In mathematical form, the functional equation in 3.1 is redefined as;

$$SDEV = \beta_0 + \beta_1 WFI + \beta_2 POV + \beta_3 BCWE + \beta_4 INF + \beta_5 EXR + \beta_6 WUNEMP + \mu \quad (3.2)$$

Where,

SDEV= Sustainable Development proxy as per capita income

WFI = Women Financial Inclusion proxy as the number of women that use financial services in Nigeria.

POV= Poverty rate

BCWE= Banks Credit to Women Entrepreneurs

INF= Inflation

EXR= Exchange Rate

WUNEMP= Women Unemployment Rate

Also, β_0 = Intercept or Constant term and β_1 - β_6 = Estimated Regression Parameters.

In addition, μ = Error term

A Priori Expectation

A priori expectation for the model was that; $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 > 0$, $\beta_4 < 0$, $\beta_5 < 0$ and β_6

4. Results and Discussion

Table 1 Descriptive Result

Descriptive Statistics	SDEV	WFI	POV	BCWE	WUNEM P	INF	EXR
Mean	256.371	2398806.	90329.69	229046.8	3.830000	19.0539	141.039
Median	275.630	221600.0	42802.70	78943.67	4.000000	15.1181	96.8800
Maximum	546.680	1365432	786543.9	866689.0	4.000000	59.4615	450.560
Minimum	33.8300	1	3746.900	12274.80	3.000000	8.72683	2.96000
Std. Dev.	175.598	7260.800	3746.900	12274.80	3.000000	7	0
Skewness	0.07357	4574523.	199435.5	276672.0	0.297546	6	6
Kurtosis	1.44746	1.654711	3.144293	1.217199	-1.639130	5	0
Jarque-Bera	2.73602	3.843054	11.15617	2.988883	4.708775	8	5
Probability	0.25461	0.126790	1.326782	2.667223	2.111271	9	3
Sum	6922.04	0.886745	0.546320	0.264320	0.302420	0	0.243214
Sum Sq.	801701.	6476776	2438902.	6184264.	61.28000	514.456	3808.06
Dev.	4	5.445614	2	2	1.328000	1	9
Observation	33	33	33	33	33	33	33

Source: Researcher's Computation, 2023

Table 1 presented the result of the descriptive statistics obtained for the parameters of the study. Looking at the result in the table, it was found that all the variables of the study except inflation were normal and might exert a significant influence on the variable of sustainable development. This inferred was based on the fact that the p-values of the Jarque-Bera statistics computed for the variables were greater than the critical value of 5% except the variable of inflation which had a p-value of 0.0000 that was less than the critical value of 5% showing that inflation was significantly high in Nigeria, thus, impeding the capacity of the women in Nigeria to make use of financial services due hyper increasing the prices of goods needed for survival.

Result of the Diagnostics Test

Due to the presence of spurious values in time series data, there was the need to filter out the unit root test to make the data effective for computation. This section presented the result of the unit root test and cointegration test obtained for the study.

Table 2 ADF Unit Root Test

Variable	Level		1st Difference		Order of
	ADF Stat.	P-value	ADF Stat.	P-	Integration
			value		
SDEV	-0.825673	0.7949	-3.953668	0.0230	I(1)
WFI	-0.792926	0.8045	-5.099436	0.0004	I(1)
POV	2.918931	1.0000	-6.411563	0.0000	I(1)
BCWE	-1.753000	0.3942	-3.899829	0.0067	I(1)
WUNEMP	-4.847998	0.0053	-	-	I(0)
INF	-2.532668	0.1192	-7.350503	0.0000	I(1)
EXR	-0.447252	0.9812	-3.494515	0.0168	I(1)

Source: Researcher's computation, 2023 (E-view 10)

Table 2 presented the result of the unit root test computed for the variables of the study. From the result in the table, it was found that all the variables of the study were freed from the unit root problem at 1st difference except the variable of women unemployment rate which was stationary at level. This assertion was premised on the fact that the variables of SDEV, WFI, POV, BCWE, INF, and EXR were not stationary at levels because the p-values of the ADF statistics obtained for the variables at the level of 0.7949, 0.8045, 1.0000, 0.3942, 0.1192 and 0.9812 were greater than the critical value of 5%. It was discovered that SDEV, WFI, POV, BCWE, INF, and EXR were stationary at the first difference since the p-values of the Augmented Dickey-Fuller statistics computed for the variables at 1st difference were less than the critical value of 5%. This implied that the variable was of integration of order I(1). More so, it was found that WUNEMP was stationary at the level since the p-value of the ADF statistics calculated for the test variable of 0.0053 was less than the critical value of 5%, thus, showing that the variable was of integration of order I(0). The status of the order of integration for the variables revealed that Autoregressive Distributed Lag (ARDL) could be achieved to achieve the objectives of the study.

VAR Lag Order Selection

In using the Auto-Regressive Distribution Lag the order of lag selection must be determined.

Table 3 VAR Lag Order Selection Criteria

Model Selection Criteria Table

Dependent Variable: GDP

Date: 17/07/23 Time: 11:48

Sample: 1990 2022

Included observations: 30

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
1	-70.675838	10.084480 *	10.567348 *	10.109207	0.894529	ARDL(1, 0, 0, 0, 0, 0, 0, 0, 0)

Source: Researcher’s Computation, 2023 (E-view 10)

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

The desired level of lag length of the variables included in the ARDL model with a critical band of 5% significant level, was selected based on the AIC, BIC, and HQ, indicating an optimal lag length of one (1) as presented in table 3 with ADL specification of (1, 0, 0, 0, 0, 0, 0, 0, 0).

Long Run Relationship between Women Financial Inclusion and Sustainable Development

In investigating the objective of a long-run relationship between VAT and economic growth there was the need to check for the existence of the long-run relationship through the Auto-Regressive Distribution Lag Bound test otherwise called ARDL Cointegration Bound Test. Table 4 presented the result of the ARDL Bound Test

Table 4 ARDL Co-integrating Bound Test

Test statistics	Value	Lag	Critical level	Bound Critical Values	
				Lower Bound I(0)	Upper Bound I(1)
F-statistics	4.814787	1	10%	1.95	3.06
			5%	2.22	3.39
			2.5%	2.48	3.7
			1%	2.79	4.1

Source: Researcher's Computation, 2023 (E-view 10)

Table 4 presents the result of the long-run test between the dependent variable sustainable development and lists of independent variables of; WFC, POV, BCWE, WUNEMP, INF, and EXR. The essence of the test was to check whether the null hypothesis of no long-run relationship between sustainable development and women's financial inclusion hold. Thus, looking at the result in the table it was found that the F-statistics computed for the test of 4.814787 was greater than the critical values of 5% at lower bound of 2.48 and upper bound of 3.70. As a result of this, the null hypothesis of no long-run relationship between women financial inclusion and sustainable development was rejected. It was reasonable to state that there was a long-run dynamic relationship between the dependent and independent variables of the study. As a result of this the need to carry out the long ARDL to confirm the truthfulness or otherwise of the specific objective of the study on the long-run relationship between women financial inclusion and sustainable development in Nigeria.

Table 5 Short-Run ARDL Result

Dependent Variable = Sustainable Development (Proxy as Per capita Income obtained from Gini Coefficient)

Selected Model: ARDL(1, 0, 0, 0, 0, 0, 0, 0)

Variable	Coefficient	Standard Error	T-calculated	P-value
C	135.7469	214.6735	0.632341	0.5505
SDEV(-1)	0.862134	0.263214	3.275415	0.0169
WFI	9.500206	1.180205	8.049624	0.0000
POV	-8.490605	0.519455	-16.34422	0.0000
BCWE	0.908905	6.313005	0.143973	0.9740
WUNEMP	-7.203405	1.521205	-4.735328	0.0000
INF	-6.591716	0.594119	-11.09494	0.0000
EXR	-0.103341	0.561947	-0.183898	0.8602
TEST STATISTICS				
OTHER				
R-squared	0.957812		Mean dependent var	384.0294
Adjusted R-squared	0.894529		S.D. dependent var	100.8241
S.E. of regression	32.74388		Akaike info criterion	10.08448
Sum squared resid	6432.969		Schwarz criterion	10.56735
Log-likelihood	-70.67584		Hannan-Quinn criter.	10.10921
F-statistic	95.13552		Durbin-Watson stat	1.980321
Prob(F-statistic)	0.000000			

Source: Researcher's Computation, 2023 (E-view 10)

Table 5 presents the result of the short-run relationship between women financial inclusion and sustainable development in Nigeria. Looking critically, at the result, it was found that there was a significant short-run relationship between women financial inclusion and sustainable development in Nigeria. This inference was premised on the fact that the coefficient of determination obtained for the variable of 0.96 revealed that approximately 96% of women financial inclusion might have

caused sustainable development in Nigeria. More so, the p-value of the F-statistics computed for the test of 0.00000 was less than the critical value of 5% with a significant F-statistics value of 95.14. This implied that the null hypothesis which stated that women financial inclusion did not affect sustainable development in Nigeria was rejected. It was safe to assert that women financial inclusion had a significant effect on sustainable development in Nigeria. The results of the information criteria showed that women financial inclusion provided better information on sustainable development in Nigeria. Also, the Durbin-Watson statistics calculated for the test of 1.980321 showed evidence of no auto-correlation among the variables of the study. As a result of this, adequate inclusion of women in financial services in Nigeria might bring about meaningful sustainable development for women in Nigeria.

Table 6 ARDL Long Run Coefficients of ARDL Result

Dependent variable = Sustainable Development (Proxy as Per Capita Income)

Variable	Coefficients	Standard Error	T-calculated	P-Value
C	0.632374	0.730293	0.521872	0.6205
WFI	0.003069	0.014820	0.207085	0.5640
POV	-0.006616	0.001376	-4.808140	0.0006
BCWE	0.001138	0.000529	2.151229	0.0434
UNEMP	-0.004387	0.001198	-3.661937	0.0021
INF	-0.812646	0.080835	-10.05315	0.0000
EXR	-0.749577	0.036780	-20.38002	0.0000

Source: Researcher's Computation, 2023 (E-view 10)

Table 6 presents the long-run result of the ARDL used to investigate the long-run relationship between women financial inclusion and sustainable development in Nigeria. Looking critically at the result in the table, it was found that the relationship between women financial inclusion (WFI) and sustainable development was positive but not significant. This inference was premised on the fact that the regression coefficient computed for the variable of WFI of 0.003 was positive with an insignificant t-statistics value of 0.21 that a p-value of 0.5640 that was greater than the critical value of 5%. The economic implication of this was that the number of women using or having access to financial access in Nigeria might not be enough to accelerate the expected sustainable development among these women. As a result of this high rate of poverty, income inequality, high level of unemployment, economic and social injustices, and lack of foreseeable incomes to enhance the entrepreneurial pursuit of these women were a reoccurring decimal among a substantial number of women in Nigeria. Akintaju (2020) put this in proper perspective by arguing that the failure of the government at all levels to bring the needed financial services to the door post of women in Nigeria had continued to pose a serious problem to the achievement of sustainable development goals as it related to women and girl child. As a result of this, the benefit that should accrue to the women by having undeniable access to financial services had been consistently denied them. This was noticeable in the area of financial aid through loans and advances from the banks that should uplift and enhance the entrepreneurial pursuit of the women that had been persistently denied the women due to lack of access to banking services. This complicated the problem of poverty and increased economic problems of a low standard of living, high level of illiteracy, low life expectant, and multi-dimensional poverty among these women.

More so, it was discovered from the result that the relationship between poverty and sustainable development in Nigeria was negative and significant. This assertion was based on the fact that the regression coefficient computed for the variable of POV of -0.01 was negative with a significant t-statistics value of -4.81 that had an ap-value of 0.0000 that was less than the critical value of 5%. The values implied that a 1% increase in the poverty rate among women could cause a 0.01% reduction in sustainable development. The sign of the variable of poverty was in tandem with a priori expectation,

hence, as a result, poverty might be a significant determinant of sustainable development in Nigeria. The implication of a high rate of poverty on sustainable development had never been in doubt in Nigeria. This was because, with high levels of poverty, women became incapacitated and limited in terms of contributing to income and economic activities. This lacked contribution to economic activities might drag back economic sustainability, thus, adversely affecting sustainable development in Nigeria. Women lacked productivity due to poverty-induced income was a serious impediment to sustainable development in Nigeria. This was because the inability of the women to be productive due to lack of financial aid as a result of inaccessibility to financial services might worsen their poverty level, worsen social injustice, and cause economic embarrassment and social stigma for the women. This made the achievement of sustainable development unrealizable in Nigeria.

Moreover, the relationship between bank credit to women entrepreneurs and sustainable development was found to be positive and significant. This assertion was based on the fact that the regression coefficient computed for the variable of BCWE of 0.00114 was positive with a significant t-statistics value of 2.15 that had a p-value of 0.0434 that was less than the critical value of 5%. The values showed that a 1% increase in the variable of bank credit to women entrepreneurs might cause a 0.001% increase in sustainable development in Nigeria. The sign of the variable of BCWE conformed with a priori expectation for the variable. As a result of this BCWE was a good determinant of sustainable development in Nigeria. The extension of bank facilities to women entrepreneurs could enhance the sustainable development of women. Women needed financial aid with a single-digit interest rate from banks to survive cut-throat competition from larger entrepreneurs. They required loans and advances to improve their businesses through reasonable expansion in plants, expansion in the use of better technology, and an increase in the number of staff employed. This the bank must do to encourage women's financial inclusion. More so, with judicious use of the bank credits women might enhance their income level, increase their standard of living and create employment opportunities for the teeming youths in Nigeria. Ogunmodede (2021) noted that bank credit to women entrepreneurs was one of the necessary determinants that encouraged women to safe-guide their financial resources in banks, thus, the extension of a better interest rate to these women might facilitate an adequate number of them to use financial services.

Furthermore, the result in the table revealed that there was a significant negative relationship between unemployment and sustainable development in Nigeria. This inference was based on the fact that the regression coefficient computed for the test variable of -0.0043 was negative with a significant t-statistics value of -3.66 that a p-value of 0.0021 that was less than the critical value of 5%. The values indicated that a 1% increase in the variable of unemployment might cause a 0.004% decrease in sustainable development in Nigeria. The sign of the variable of unemployment was in tandem with a priori expectation. As a result of this unemployment might be an unfavorable determinant of sustainable development. The effect of unemployment on the ability of Nigerians and the Nigerian government to achieve meaningful sustainable development had been a mirage. The high Unemployment rate had made nonsense of meaningful policy of the government, thus, making sustainable development unattainable in Nigeria. The worse hit in this case were women whose figure was put in the range of over 67% as of the last quarter of the year 2022 without meaningful jobs (UNO, 2022). Many of these women had taken up unsustainable jobs while others had been engaging in prostitution to at least get their daily meat. This seriously hampered the capacity of the women to be able to contribute successfully to economic activities, thus, reducing their economic participation in financial inclusion, poverty alleviation, production, and economic reawakening in Nigeria. The resultant effect of which sustainable development among women had become unattainable. Therefore, unemployment and sustainable development were negatively related and significant.

In addition, the relationship between inflation and sustainable development was found to be negative and significant. This inference was based on the fact that the regression coefficient computed for the variable of inflation of -0.81 was negative with a significant t-statistics value of -10.05 with a p-value

of 0.0000 less than the critical value of 5%. The regression coefficient showed that a 1% increase in the variable of inflation might cause a 0.81% decrease in sustainable development in Nigeria. The sign of the variable of inflation conformed with a priori expectation. As a result of this inflation was a determinant of sustainable development in Nigeria. Inflation eroded the capacity of women to be able to contribute meaningfully to sustainable development goals. With inflation, purchasing power of women reduced. Inflation shrieked women ability to expand their enterprises. It derails women's extension to extend employment opportunities to others due to the high cost of production. It discouraged women to transact their financial activities through banks as a result of bulk bank charges. More so, with persistent rise in the general prices of goods and services, women might find it difficult to save, thus, the need for financial services might not arise. Akinteju (2020) argued that inflation denied women the opportunity that comes from financial inclusion by exposing their financial efforts to economic unpredictability that continues to deny the women the gain of financial inclusion.

The relationship between exchange rate and sustainable development was found to be negative and significant. This assertion was premised on the fact that the regression coefficient computed for the variable of -0.75 was negative with a significant t-statistics value of -20.38 with a p-value of 0.0000 that was less than the critical value of 5%. The values showed that a 1% increase in the exchange rate might cause a 0.75% reduction in sustainable development in Nigeria. The sign of the variable of the exchange rate was in tandem with a priori expectation. As a result of this, the exchange rate was a determinant of sustainable development. The consequence of the high exchange rate on the ability of the women in Nigeria to take up financial inclusion could not be underestimated. This was because with an increase in exchange rate the capacity of women to meet the needs of their enterprises was reduced. This could negatively affect the ability of the women to procure materials needed for production particularly if the materials were not available locally. It might erode the capacity of women to expand plants and create more job opportunities, thus, reducing the contribution of women to sustainable development. Existing employees might be reduced in size for the women to be able to continue production. Innovation might not be forthcoming due to inadequate financial aid for women entrepreneurs. Therefore, exchange rates and sustainable development might become unachievable in this situation.

1. Conclusions and Recommendations

Conclusions.

This study found that women financial inclusion could improve sustainable development in Nigeria and vice-versa. On this basis, the study concluded that women financial inclusion had a significant effect on sustainable development. Moreover, there was a positive long-run relationship between women financial inclusion and sustainable development but not significant. Bank credit to women entrepreneurs and sustainable development were positive and significant. Women unemployment rate, inflation, and exchange rate adversely affected sustainable development in Nigeria. Poverty and sustainable development were negative and significantly related.

Recommendations

The following recommendations are made for the study.

- There is a need for the government in Nigeria to put in place a monetary policy that may encourage women financial inclusion in Nigeria. This may be achieved through a single-digit interest rate, lower inflation, and exchange rate.
- The various poverty alleviation of the government particularly the ones that focus on women must be redesigned to enhance the program's effectiveness. This program initiatives are found not to affect positively the women that need it. Thus, the need to redesign the programs becomes necessary.
- Bank credit to women entrepreneurs must be in single digits to encourage women financial inclusion.
- Inflation and exchange rates must be reduced by the government in Nigeria through effective monetary and fiscal policy.



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AUDIT QUALITY AND FINANCIAL REPORTING QUALITY: EVIDENCE FROM NIGERIA

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Abstract

The quality of audit opinion on financial statements has been a concern since the 2001 Enron accounting scandal and the financial crisis that rocked various organizations despite unqualified audit opinions given over the years. This study thus investigates the impact of audit quality on the quality of financial reporting of quoted companies in Nigeria for the period 2011-2020. Ex-post facto research design using panel data was employed and the 25 companies in the consumer goods sector quoted on the Nigerian Exchange Group (NGX) constitute the population for this study. Applying the purposive sampling technique, a sample of 21 companies was selected. Secondary data relating to the variables were gathered from sampled firms' annual reports for the period and were analyzed using descriptive statistics and multiple regression techniques. Findings revealed that audit quality has a significantly positive effect on financial reporting quality (FRQ). It is concluded that audit quality significantly improves the FRQ of listed companies in Nigeria. It was thus recommended that policymakers and regulatory authorities should ensure the enforcement of policies towards ensuring quality financial reporting through quality audits.

Keywords: *Audit Quality, Financial Reporting, Nigerian Exchange Group, Listed Companies*

INTRODUCTION

The goal of financial reporting revolves around the provision of quality-embedded financial information about reporting entities helpful in making decisions (International Accounting Standard Board- IASB, 2018; Alwardat, 2019) as this will guide the suppliers of capital and other interest groups to make appropriate investment and other related economic and financing decisions to deepen general market efficiency (Herath, & Albarqi, 2017; IASB, 2018). However, appropriate accounting policies that underlie the preparation of financial reports are decided by the management (Farouk, 2014); which could be subjective in its recognition, measurement, and allocation of values to some items of expenditure and revenues in the financial statements. This could defeat the purpose of such disclosed information as to its adequacy, fairness, and completeness (Aifuwa, Embele & Saidu, 2018; Alwardat, 2019; Mstoi, 2020). As a regulatory and supervisory requirement, as well as a practice of great public interest to internal and external users of financial information, external audit plays a critical role in establishing quality financial reporting (International Auditing and Assurance Standards Board- IAASB, 2014; Ibrahim & Ali, 2018; Ito & Daferighe, 2019). The external audit of financial statements thus provides an oversight function by minimizing the information gap and protecting the interests of its diverse users which is carried out by providing reasonable assurance that material misstatements do not occur in the financial statements (Aledwan, Bani-Yaseen & Alkubisi, 2015; Alwardat, 2019). Corporate failures and scandals are increasing due to the intense depletion of quality reporting thereby paving the way for investor losses and plummeting confidence in the financial system (Nickolas, 2015; Adeleke, 2016; Amahalu, Abiahu & Obi, 2017; Ajape, Omolehinwa & Adeyemi, 2018). More so, stakeholders have also queried both the process leading to production and the credibility of accounting and reporting practices of firms; especially, what audit committee quality entails for companies' performance indicators (Olaoye, Akinleye, Olaoye &

Adebayo, 2020). Among the reasons adduced for the observed impotency of the audit committee include an increased number of its members appointed by management, non-remuneration for members, short term of office of members, and inability of committee members to ask relevant questions due to lack of technical knowledge (Olaoye, Akinleye, Olaoye & Adebayo, 2020).

Noticeably, perpetrators of fraud usually leveraged on high reliance placed on audited reports by diverse stakeholders to focus on ways of covering lapses concerning known misappropriations or financial scandals. This tends to impact negatively the operational results of firms and could result in an overall lessening of companies' outcomes and FRQ (Olaoye, Akinleye, Olaoye & Adebayo, 2020). Specifically, reduced audit quality is usually prompted by dependence occasioned by large fee income to audit companies from client companies leading to economic ties between the auditors and clients' management who may pressurize auditors to accede to management's demands thus compromising their independence (Akhidime, 2019). Though recent provisions of the Nigeria Code of Corporate Governance (NCCG, 2018) empower the audit committee to closely monitor the financial reporting process of an enterprise, there has been a disparity between corporeality and what is reported following non-compliance with this provision. Accountants, companies' management, and directors have also been found to connive to window-dress companies' financial statements as a result of the yielding attitude of external auditors (Oboh & Ajibolade, 2018).

Despite the volume of research in this area, cases of FRQ problems are still prevalent which therefore necessitate a study on audit quality and FRQ in Nigeria. Also, audit quality has been more expatiated in developed countries than in developing countries like Nigeria (Soyemi, Olufemi & Adeyemi, 2020). Besides, there are conflicting results of their relationship due to differences in data, size, and even methodological approach used. Hence, this study examines the extent of audit quality impact on the FRQ of listed companies in Nigeria with a particular focus on the organizations operating within the consumer goods industry during the financial year period of 2011 to 2020. Specifically, it examines the extent to which the auditor's independence, auditor's engagement performance, audit committee quality, and audit fee affect the FRQ of Nigerian listed companies.

LITERATURE REVIEW

Conceptual Review and Hypothesis Development

Financial Reporting Quality (FRQ)

A financial report is a typical account of a business, person, or entity's financial operations that contains all essential financial information about the same presented in an orderly and understandable manner (Unuagbon & Oziegbe, 2016; Ibrahim, 2017; Nnenna & Ugwoke, 2019) which serves as a means of communication to be used for decision making by several parties (Olowokure, Tanko, & Nyor, 2016; Teguh, & Zaenal, 2020). The accounting process ends with reporting which is the third and last stage which provides high-quality financial reporting information concerning the reporting entity thereby availing diverse stakeholders the opportunity to make sound investing, controlling, and regulatory decisions (Al-Dmour, Abbod & Al-Qadi, 2018, Herath & Albarqi, 2017; Tang, Chen, & Lin, 2016). The value of financial reports depends on their quality (Enofe, Edemenya & Osunbor, 2015; Shakhathreh, Alsmadi & Alkhataybeh, 2020) as quality financial reporting is an essential property of financial reports (Alwardat, 2019). The quality of the process is adjudged by its clarity and transparency in the treatment of each transaction in the financial statement as well as strict adherence to the legislation and accounting policies of the entity (Nnenna & Ugwoke, 2019). It also depends on each of its components, such as the company's transaction disclosure, accounting procedures applied, information regarding the selection, and knowledge of the judgments made (Ajape, Omolehinwa & Adeyemi, 2018).

Quality financial reporting is full and designed not to misinform or misguide users (Aifuwa, Embele & Saidu, 2018). High-quality financial reporting is necessary as it contributes to national public finance by enhancing the company's income tax assessment and collection (Babatunde & Adeniyi, 2019). In Nigeria, the Securities and Exchange Commission (SEC), Central Bank of Nigeria (CBN), Nigerian Insurance Commission (NAICOM), and Pension Commission (PENCOM) are vested with

the obligation of financial reporting regulation and communication of up-to-date and credible financial information to users. Also, enacted into law in the year 2011, the Financial Reporting Council of Nigeria (FRCN), is duty-bound to ensure the improvement, dependability, and quality of financial statements towards restoration, protection, and heightening of public trust in them (Kibiya, Che-Ahmad & Amran, 2016).

Audit Quality

Primarily, auditing exists as one of the measures to lessen the information gap in accounting numbers and minimize the residual loss which results from managers' opportunism in the accounting process (Ogbodo, Akabuogu & Nzube, 2018; Usifoh, Adegbe & Salawu, 2019). Thus, a quality audit is imperative. Audit quality is a structure that comprises audit professionals, audit processes, and audit results. Researchers agree that a quality audit is achievable when the expressed auditor's opinion is reliable, backed by adequate and proper audit evidence obtained by an engagement team with requisite features. These attributes include an exhibition of suitable values, morals, and mannerisms; demonstration of adequate knowledge and experience, allocation of sufficient time to carry out the audit task; application of a comprehensive audit process and quality control methods; delivery of useful and timely reports; and appropriate collaboration with a variety of stakeholders (Oladejo, Olowookere & Yinus, 2020; Chae, Nakano & Fujitani, 2020).

There have been several attempts to conceptualize "audit quality", though since time passed and the definition has achieved universal acknowledgment and approval (IAASB, 2014; CAQ, 2016, Ajape, Alade & Agbaje, 2021). One of the most instructive definitions of audit quality is premised on the technical competence of the auditor to detect any material errors and exhibit independence to ensure correction and disclosure in the audit report (Ibrahim & Ali, 2018; Zalata, Elhazar & McLaughlin, 2020; Oladejo, Olowookere & Yinus, 2020).

The input, process, and outcomes/results of the audit process all influence audit quality (Assad & Alshurideh, 2020; Husain, 2020). Audit quality ensures that financial statements accurately reflect the company's economic conditions, attributes, and financial reporting systems (Onaolapo, Ajulo & Onifade, 2017). While higher audit quality is thought to imply greater assurance of high FRQ (DeFond & Zhang, 2014), audit quality is primarily defined by adherence to professional auditing standards, whereas investors place a greater emphasis on the characteristics of the engagement team conducting the audit (Christensen, Glover, Omer & Shelley, 2016). Because investors place such a high value on auditor characteristics, additional input-related disclosures may be beneficial to financial statement users in determining audit quality (Christensen, Glover, Omer & Shelley, 2016).

Measurements of Audit Quality

There is no consensus yardstick for measuring the concept of audit quality (IAASB, 2014; CAQ, 2016). The most widely employed surrogates for audit quality are rooted in DeFond and Zhang's (2014) model, where measures of audit quality proxies are classified as either input or output-based (Matoke & Omwenga, 2016; Smii, 2016). Output-related metrics typically involve significant restatements initiated by the auditor; going concern opinions; financial reporting attributes including the use of absolute discretionary accruals, the Dechow-Dichev (2002) measure of earnings quality or Basu's timely loss recognition measure (Basu, 1997). It also relates to the firm's propensity to meet or beat quarterly analyst earnings estimates as well as perception-based measures such as the earnings response coefficient, stock price reactions to auditor-related events, and cost of capital measures (Rajgopal, Srinivasan & Zheng, 2018). The input-based proxies which include the auditor's independence, auditor's engagement performance, audit committee quality, and audit fee were however adopted for the study due to the client's demand for audit quality based on observable inputs (Christensen, Glover, Omer & Shelley, 2016; Rajgopal, Srinivasan & Zheng, 2018).

Auditors Independence

Auditor independence is viewed as the bedrock of the audit profession as it is regarded as the basis for public trust (Akther & Xu, 2020). It is conceived to mean both “independence of mind and independence in appearance” (Ajape, Alade & Agbaje, 2021) and ensure the possibility that an external auditor would report any detected material misstatements in the financial statements caused by fraud or error (Otuya, 2019). The requirements from the IFAC code serve as a guideline for auditors to ensure conformance with statutory and professional requirements for rendering audit services (Salawu, 2017). Empirical studies (Ebo; 2016; Okezie & Uchenna, 2019; Olanisebe, Ekundayo & Adeyemo, 2020) have measured audit independence using audit fees, tenure, and firm rotation and have reported significant relationship and impact on financial reporting. This study however measured the auditor's independence using the years of service of the audit firm to the audited company (tenure). The proposition is therefore that auditor independence does not have a significant impact on the quality of financial reporting of listed companies in Nigeria.

H₀₁ - Auditor independence does not have a significant impact on the quality of financial reporting of listed companies in Nigeria.

Auditor's Performance Engagement

Guaranteeing compliance with established standards and procedures on every audit engagement is the focus of auditors' performance engagement. Auditing standards, according to Saha and Roy (2016), are a set of norms accepted by the profession as guidelines for measuring transactions, events, and conditions that have an impact on financial results and financial information provided to beneficiaries. International standards have been developed to harmonize auditing methods across countries and are to be utilized if local standards do not exist (Alzeban, 2015; Akinleye, Olaoye & Talabi, 2020). In Nigeria, for example, where Nigerian Auditing Standards do not exist, corporations listed on the Nigeria Exchange Group (NGX) are required to follow the International Standards on Auditing (ISA). Using this metric as one of the proxies for audit quality, Iwarere, Abdullahi, and Pavtar (2016) and Nwanyanwu (2017) studies indicated the existence of a strong, positive, and significant relationship between audit quality and reporting quality of Nigerian listed companies financial statements. In this study, auditor engagement performance is proxied by the operational years of the audited company. The longer the period, the more reliable the accounting and internal control system of the company which will produce quality audits when the audit engagement is performed. Therefore, it is hypothesized that the auditor's engagement performance does not significantly impact on FRQ of Nigerian listed companies.

H₀₂ - Auditor's engagement performance does not significantly impact on FRQ of Nigerian listed companies.

Audit Committee Quality

The audit committee comprises a working group with members selected from the company's board of directors and put in place to connect the managers of a firm to the outside assessors (auditors) and play an important role in monitoring the company financials (Gonthier-Besacier, Hottegindre, & Fine-Falcy, 2016; Aduwo, 2019). Ideally, a Chairperson is selected from among the members of the committee. The NCCG (2018) in its Section 11.4(1), required every company to set up a committee of the board to be responsible for audit (Majiyebo, Okpanachi, Nyor, Yahaya & Mohammed, 2018; Alwardat, 2019). The committee would review the company's accounting policies, assess its internal control system and evaluate external reporting systems, compliance, and regulations (SEC Code, 2011; Putri, Azhar & Erlina, 2017) which is carried out through official correspondence between management's board, external auditors, and internal auditors (Firnanti & Karmudiandri, 2020). Consequently, the features of the audit committee include size, independence, expertise, and diligence. The committee's independence is assumed when members do not carry out executive duties (Aifuwa, Musa & Gold, 2020). The NCCG (2018) expressly highlighted financial literacy including the ability to read and understand financial reports as some of the attributes of all audit

committee members. Also, the Companies and Allied Matters Act (1999 as amended in 2020) provides that the “Audit Committee of a public limited liability company should be composed of a maximum of six members representing an equal number of directors and shareholders.”

The audit committee's size is pertinent in prompt corporate financial reporting. Olaoye, Akinleye, Olaoye, and Adebayo (2020) documented the existence of a positive relationship between audit committee composition (proxied by size, financial expertise, meetings, and non-executive directors on the audit committee) and FRQ, with the conclusion that errors and financial misrepresentation in annual report occur less frequently with the existence of an audit committee. Kibiya, Che-Ahmad, and Amran (2016) focused on audit committee characteristics (share ownership and financial expertise) and FRQ of Nigerian quoted companies. The relationship was significant, suggesting that audit committee monitoring mechanisms influence the FRQ of listed non-financial firms in Nigeria. In this study, audit committee quality is proxied by size, committee independence, financial expertise, and audit committee meetings. The hypothesis is therefore that audit committee quality does not significantly impact the FRQ of listed Nigerian companies.

H₀₃ - Audit committee quality does not significantly impact the FRQ of listed Nigerian companies.

Audit Fee

An audit fee represents the service charge for the official assignment of an audit (Ilechukwu, 2017) and represents the fees paid for annual audits and review of financial statements for the most recent fiscal year (Afesha, 2015). Section 361 of CAMA stipulates that the remuneration of auditors may be fixed by the directors. However, in other cases, the remuneration shall be fixed by the company at the annual general meeting or in such a manner as the company in its general meeting may decide (Nwakaego, Ikechukwu, & Benedict, 2019). It also provides that under no circumstance must the audit fee from an audit client constitute 25% or more of the gross practice income of an audit firm or the gross earned income of a member (Dabor & Nosa, 2014; Chinedu, Nwoha & Udeh, 2020).

Saidu and Danjuma (2018) examined the impact of audit fee on the FRQ of listed insurance companies in Nigeria and found that audit fee has a positive and significant impact on FRQ. Abdulmalik and Che-Ahmad (2016) who explored the impact of audit fees on FRQ in Nigeria reported that audit fees have a negative significant influence on discretionary accruals. In this study, audit fee is measured using a natural log of the audit fees paid by the company to achieve normality of the data. The study hypothesizes that audit fee has no significant impact on the FRQ of listed Nigerian companies.

H₀₄ - Audit fee has no significant impact on the FRQ of listed Nigerian companies.

Theoretical Framework

Agency theory

The agency theory expounds on the agents (organizations management) - principal (shareholders) relationship and was propounded by Jensen and Meckling (1976). Conflicts of interest between managers and stakeholders are created as a result of the diffusion of ownership from control in modern business. The agent, in making decisions, may naturally act contrary to the principal's direction who could in turn establish an appropriate incentive for the agent thereby incurring monitoring costs (Aliyu, Musa & Zachariah, 2015). The limited information available to the shareholders makes it difficult to determine the (un)favorableness of decisions made by the management (Estitemi & Omwenga, 2016). This could induce the shareholders to establish a monitoring process such as auditing to control the action of the management in making some decisions for the organization. Thus, the audit fee arises as a bonding cost paid by agent (s) to a third party to satisfy the principals' demand for accountability (Estitemi & Omwenga, 2016). According to Okpala (2015), auditing increases stakeholders' confidence in the financial statements as a result of the element of credibility it provides. Agency theory thus serves as a useful economic theory of accountability on the part of the management to the shareholders. Thus, a quality audit could minimize the information gap between the management and stakeholders and thus, serves as the backbone of quality financial reporting.

METHODOLOGY

The study employed an ex-post facto research design using panel data. The panel data allows a complete assessment of the financial report's quality of the consumer goods sector in Nigeria as it contains more information, more variability, and more efficiency than pure time series data or cross-sectional data (Erica, 2019). The population of this study consists of 25 companies in the consumer goods sector of the NGX (2021). Purposive sampling technique was deployed in ascertaining the sampled companies to produce characteristics or criteria that are defined for the study's purpose and 4 companies were unable to meet up-to-date requirements thereby, resulting in a sample of 21 companies. Secondary data extracted from the audited annual reports of the sampled firms whose information content has been certified by an independent firm of chartered accountants (Ajape, Agbaje & Uthman, 2016) were adjudged valid and reliable for use in the study.

Model Specification

A multivariate econometric model was specified and estimated using the Ordinary Least Square (OLS) due to its characteristics of Basic, Linear, Unbiased, and Estimator (BLUE) (Stewart, 2016). In the equation, FRQ (dependent variable) is modeled as a function of the four proxies of the independent variable (audit quality).

$$FRQ = \beta_0 + \beta_1 IND + \beta_2 PERF + \beta_3 COMM + \beta_4 FEE + \mu \quad (1)$$

where:

FRQ = Financial Reporting Quality measured by discretionary accruals (DA)

IND = Auditors Independence (AQ1 = Component of the Independent variable)

PER = Auditors' engagement performance (AQ2 = Component of the Independent variable)

COMM = Audit committee Quality (AQ3 = Component of the Independent variable)

FEE = Audit fee (AQ4 = Component of the Independent variable)

it = 'i' stands for company while 't' for time ranging from 2011 to 2020

β_0 = Intercept

$\beta_1, \beta_2, \beta_3, \& \beta_4$ = Coefficients of the independent variables

A priori Expectation: $\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 > 0$

Measurement of Variables

FRQ is the dependent variable while audit quality (AQ), represented by auditor independence, engagement performance, audit committee quality, and audit fees, is the independent variable. Each of these variables is measured as described below.

Financial Reporting Quality (FRQ)

The level of discretionary accruals (DA) can be a good indicator of earnings management (EM) and an inverse proxy of FRQ (Hundal, 2016). Thus, FRQ was measured using DA. Good FRQ and earnings quality is indicated through low levels of DA (Qawqzeh, Endut, Rashid & Dakhllalh, 2019). The commonly used Modified-Jones Model (1995) has been shown to outperform other DA models in ensuring corporate FRQ. Thus, the study estimates the following model and used its estimated residual as the proxy for FRQ following (Hundal, 2016). In the modified Jones model, total accrual (TA) is given as:

$$TA = \alpha_0 \frac{1}{A_{-1}} \alpha_1 \frac{\Delta REV - \Delta REC}{A_{-1}} + \alpha_2 \frac{PPE}{A_{-1}} + \varepsilon \quad (2)$$

Where; TA = Total Accruals in year t ; $\alpha_0, \alpha_1, \alpha_2$ = Regression parameters to be estimated; A = Total Assets in year t ; REV = Annual change in revenues in year t ; REC = Annual change in receivables in year t ; PPE = Gross property, plant, and equipment in year t ; ε = The error terms

However, according to Soyemi, Olufemi, and Adeyemi (2020), DA is derivable by deducting non-

discretionary accruals (NDA) from TA after decomposing TA into DA and non-discretionary accruals (NDA).

Therefore,

$$DA = TA - NDA \quad (2)$$

A high level of DA, positive or negative, indicates a greater level of earnings management. The outcome of equation (2) is the Jones model of discretionary accrual which represents the FRQ in this study.

Auditors' independence (IND)

In this study, we measured the auditor's independence with audit tenure, that is, the number of years that the audit firm or partner has been auditing the company (tenure). We deviated from the usual dichotomous “0” and “1” (Bassey, Ubi, Aminu, Asi & Emmanuel 2020) to avoid spurious results which could not aid the furtherance of analysis. Therefore, if the number of years is 3 years, 1 is assigned; if 4 years, 2 is assigned; if 5 years, 3 is assigned; if 6 years and above, 4 is assigned. This measure becomes imperative as some companies are audited by an audit firm beyond the usual 3 years up to 6 years and above. Auditor independence is influenced by a long auditor tenure of 5 years or more (Yip & Elvy, 2017).

Auditors' engagement performance (PERF)

This study measured auditor's performance engagement using the length of years the company has been in operation. It is measured this way because the longer the operations of the company, the more reliable the accounting and internal control system will be, thereby eliminating levels of material weaknesses and aiding quality audit engagement which will ultimately lead to quality audit. For companies with a 1-year operation, represent with 1, for 2 years of operations, represent with 2, for 3 years represent with 3, for 4 and above years and above represent with 4.

Audit committee quality (COMM)

Consistent with prior literature (Festus, Gideon, Clement & Adesodun, 2020; Olaoye, Akinleye, Olaoye & Adebayo, 2020), we measured audit committee quality by size, committee independence, financial expertise, and audit committee meetings. For independence, if there is 1 non-executive director represented with 1, 2 non-executives represent with 2, and if there are 3 non-executives represented with 3 when there are 4 and above non-executives represent with 4. The audit committee size is the number of people on the audit committee board. If they are 2 directors represent with 1, if they are 3 directors represent with 2, if 4 directors represent with 3, if they are 5 directors and above represent with 4.

Audit committee finance and accounting expertise is the number of non-executive directors with accounting or finance qualifications. If there is at least one person, represent with 1; if there are 2 people represent with 2, if there are 3 people represent with 3 and if there are 4 people and above represent with 4.

Audit committee diligence was measured by the number of meetings held in a year. If the meeting is held 4 times in a year represents 1, if 5 times represent 2, if 6 times represent 3, if 7 times and above represents 4.

The average score from the four proxies is taken as the value of audit committee quality. In line with how other proxies were measured, the limitation of the dichotomy variables caused spurious results measured to be modified this way.

Audit fee (FEE)

In this study, the audit fee is proxied by the natural logarithm of the audit fee as disclosed in the annual report in line with Chinedu, Nwoha, and Udeh (2020). The audit fees variable is transformed into a natural log to achieve the normality of the data.

RESULTS AND DISCUSSION

Descriptive Analysis

Table 1: Descriptive Statistics of the variables

	FRQ	IND	PER	COMM	Log FEE
Mean	0.52	2.87	3.04	3.32	4.21
Median	0.48	3	3.7	3	4.16
Max.	20.01	4	4	4	5.40
Min.	0.01	1	1	1	3.18
Std. Dev.	0.277	0.215	0.3431	0.411	3.551
Skewness	0.2131	0.2113	0.6711	0.3450	0.2122
Kurtosis	0.44266	0.1901	0.4483	0.4592	0.1673
Jarque-Bera	0.79312	0.2011	0.3411	0.235	0.1721
	P=.0156	P=.0020	P=.0061	P=0.007	P= 0.0000
	172	172	172	172	172

Source: Computed by Authors (2023)

Table 1 shows that FRQ has a mean value of 0.52 which indicates that the sampled firms recorded positive DA for the period. The median of 0.48 and standard deviation of 0.277 indicated that the sampled firms are clustered around the mean resulting in insignificant variations in FRQ status hence, the normality of the data for the period under consideration. FRQ Skewness is 0.2131, Kurtosis is 0.44266 and the Jarque-Bera is 0.6131 with a p-value of 0.0121 < 0.05 confirming that the data are normal and lower likelihood of outliers in the series.

Auditors' independence (IND) has a mean value of 2.87 which is above the general mean of 0.25 (based on the 1-4 scale of measurement used in this study) indicates that the average level of auditor's independence is high across all sampled firms as the audit firms have spent about 4 to 5 years with the sampled firms, which can influence high-quality audit according to the NCCG.

IND median of 3 indicates that the medium audit tenure across the sampled firms is 5 years which is higher than 4.5 years (based on the general 1-4 scale of measurement) thus indicating high independence. A maximum value of 4 indicates that the highest number of years that the audit firms have spent auditing the sampled firms is 6 years while a minimum value of 1 indicates that the audit firm has audited the sampled firms for least 3 years which is a good indicator for quality audit. A standard deviation of 0.215 indicates that the sampled firms are clustered around the mean for the period under consideration. The Skewness is 0.2113, Kurtosis is 0.2011 and the Jarque-Bera is 0.2011 with a p-value of 0.00201 < 0.05 confirm that the data are normal and lower likelihood of outliers in the series and that since the mean falls above 0.25, it implies that IND is positively related to the audit quality.

Auditors' engagement performance (PERF) has a mean value of 3.04 which reflects an average number of years of operation of the sampled firms as 3 years but falls above the mean of 2.5 years analyzed from the scale measurement which implies that the auditors must have benefited from the accounting and internal control systems that have been improved over the years to improve their performance engagement because the longer the company operations, the more reliable the accounting and internal control system to produce quality audit from the audit engagement. A median of 3.7 indicates that the middle level of operations across the sampled firms is 3 years meanwhile the scale measurement has the mid value as 2.5 and since 3 is greater than 2.5, the audit engagement performance has a high ability to produce quality audit. Maximum and minimum values of 4 and 1 indicate the number of years of operation of sampled firms ranges between 1 year and above 4 years. A standard deviation of 0.3431 indicates that there are no wide variations around the mean for the period of 2011-2020 under consideration. Skewness is 0.6711, Kurtosis is 0.4483 and the Jarque-Bera is 0.7431 with a p-value of 0.00612 < 0.05 which confirms that the data are normal as well as the unlikelihood of outliers in the series and that since the mean falls above 0.25, it implies that PERF is positively related to the audit quality.

Auditors' Committee Quality (COMM) is divided into four parts namely (size, independence, financial expertise, and diligence) with a mean value of 3.32 indicates that the average audit committee size is 4; the average audit committee independence (number of NEDs on the board) is 3; average directors with financial and accounting expertise is 3 and the average meetings held across sampled firms is 6.

The measures of COMM thus indicate the following; the standard audit committee size to assess high committee quality is 3 according to the NCCG and these firms have 4 on average, it, therefore, poses an influence for a high audit quality also the mean of 3.32 falls above the mean of 2.8 according to the scale of measurement employed in this study, this represents high committee size quality as well, for committee independence, the increased number of NEDs implies that the audit committee board is independent, the average financial expertise of 3.32 which represents 3 is higher than the mean of 2.5 which shows that there is a high quality of financial expertise and fulfills the NCCG requirement of having at least one person that has financial and accounting expertise. A median of 3 shows the middle level of the size, independence, expertise, and number of meetings is 3, a maximum value of 4 shows the highest board size is 4 i.e. 4 independent directors; 4 directors with financial expertise and 4 meetings held. A minimum Value of 1 indicates lowest board size is 1 i.e. the minimum number of independent directors is 1; a minimum of 1 director has financial expertise and there is at least one meeting while a standard deviation of 0.411 shows that there are no wide variations among the sampled firms audit committee within the period of 2011-2020. COMM Skewness is 0.3450, Kurtosis is 0.4592 and the Jarque-Bera is 0.235 with a p-value of 0.00734 < 0.05 which confirms that there is normality of the data and that since the mean falls above 0.25, audit committee quality (COMM) is positively related to the audit quality.

Auditors' fee (FEE) with a mean of 4.21 indicates that the average fee paid to auditors of the sampled firms is ₦4,210,000; a median of 4.16 indicates that the middle value paid by all the sampled firms to the auditors is ₦4,160,000 this, in turn, supports the average paid by the sampled firms, maximum value of 5.40 indicates that the highest amount paid across all firms is ₦5,400,000, minimum value of 3.18 indicates that the lowest amount paid across all the sampled firms is ₦3,180,000. The standard deviation of 3.551 shows that there were variations in the fee paid to auditors. The Skewness of FEE is 0.2122, Kurtosis is 0.1673 and the Jarque-Bera is 0.1721 with a p-value of 0.00734 < 0.05 which confirms that the data are normal and that audit fee is positively related to audit quality.

Test of Hypotheses

Analysis of the hypotheses involved combining all four hypotheses in one multiple econometric statistical analysis which yielded results as follows:

	R	R square	Adjusted R²	Stand. Error of the Estimate
1	0.8313	0.691	0.679	0.311

Model	Sum of Squares	Df	Mean square	F	Sig.
1	Regression 40.72	3	13.57	59.3512	0.000*
	Residual 38.64	169	0.2286		
	Total 79.36	172			

Source: Computed by Authors (2023)

Table 2 shows the regression model results. Adjusted R² of 0.679 implies that 68% of the systematic variations in FRQ are explained by changes in IND, PERF, COMM, and FEE. This shows a good model fit as only 32% of the variation is unexplained by other factors not observed in the study. It also means that the auditor's independence, auditor's engagement performance, audit committee quality, and audit fee have a greater ability to influence FRQ than any other factors not observed in this study.

Adjusted R Square in the model of 0.679 however means that the independent variables explained only 67.9% of the dependent variable and the remaining percentage of 32.1% falls in the stochastic error term. The standard error of 0.311 indicates the standard deviation of the variations in the dependent variable FRQ not explained by the model. The F statistics (59.3512) indicates that the overall regression model is statistically significant thus the model is fit. The results thus show that audit quality has a significant effect on FRQ ($p < 0.05$).

Table 3: Regression Result of Hypothesis

Independent Variables	Coefficient	Standard Error	t-statistic	P value
(Constant)	66.872	0.255	13.122	.000**
IND	0.523	0.091	3.0255	.0002**
PERF	0.319	0.0106	4.8091	.000**
COMM	0.589	0.131	2.928	.000**
FEE	0.477	0.277	5.111	.000**

Significant at 0.05 ** Significant at 0.01, R-Square = 0.691; Adjusted R-Squared = 0.677 Prob t – statistic = 0.000

Source: Computed by Authors (2023)

The explicit econometric regression model for the study is thus given as follows $FRQ = 66.872 + 0.523IND + 0.319PERF + 0.589COMM + 0.477FEE$

The equation further reveals that an increase in any of the measurements of the independent variable (audit quality) will lead to a significant positive effect on FRQ. Table 3 also shows the individual significance of each of the independent variables. The regression coefficients of all the independent variables IND (0.523), PERF (0.319), COMM (0.589), and FEE (4.77) have p – values which are significant at 0.05 suggesting a significant positive impact of IND, PERF, COMM, and FEE on FRQ. By implication, an improvement in each of these proxies of audit quality will result in 5.23 percent, 3.19 percent, 5.89 percent, and 4.8 percent improvement respectively in FRQ. It also implies that these independent variables fit into the model and thus, the null hypothesis of no significant impact is rejected ($p < 0.05$).

Discussion of Findings

In this study, auditor independence was found to positively impact FRQ. This supports the findings of Aledwan (2015) and Ebo (2016). Although Olanisebe, Ekundayo, and Adeyemo (2020) had contrasting results. The auditor's engagement performance was found to have a positive significant relationship with FRQ. The higher or lower the engagement performance, the higher or lower the FRQ. This corroborates the findings of Nwanyanwu (2017). In this study, audit committee quality has a positive significant relationship with FRQ. Findings that support this notion were taken from the studies of Gonthier-Besacier, Hottegindre, and Fine-Falcy (2016) and Aduwo (2019). Meanwhile, the findings of Moses, Ofurum, and Egbe (2016) are negative.

Also, audit fee has a positive significant relationship with discretionary accruals. The higher the fee, the more the FRQ. Onaolapo, Ajulo, and Onifade (2017) and Saidu and Danjuma (2018) results support this while Abdulmalik and Che-Ahmad (2016) did not.

Thus, all four proxies of audit quality namely auditor's independence, auditor's engagement performance, audit committee quality, and audit fee exhibited a positive significant relationship with discretionary accruals. Thus it is concluded that audit quality has a positive significant impact on FRQ which is similar to the findings of Nwanyanwu (2017); Itoro and Daferighe (2019) even though, other studies such as Okezie and Uchenna (2019); Olanisebe, Ekundayo, and Adeyemo (2020) found a negative significant relationship between audit quality and FRQ. The difference in findings may be attributed to country-specific factors, the regulatory environment guiding any sector that is being studied, the level of accounting system sophistication in the country, and other firm and industry-specific factors.

SUMMARY AND CONCLUSION

The study examined the extent of the impact of audit quality (proxied by auditor's independence, auditor's engagement performance, audit committee quality, and audit fee) on FRQ which is an essential feature of financial reports. Investors' trust in the reliability of these reports regarding their truthful representation of the performance of publicly held companies will shape investors' views and guide their investment decisions. From the study, it has been seen that the auditor's independence greatly influences the quality of the financial report. Hence, any actual or perceived impairment of independence would have a serious adverse effect on how audit reports are perceived.

The auditor's engagement performance is also an important ingredient that determines the turnout of the financial statement. Therefore, the higher the engagement performance, the better the quality of the financial report which will ultimately increase the confidence of investors and all other users of the report. This study also revealed the important function of a quality audit committee which is to constrain accrual-based distortion of financial reporting credibility towards improving FRQ. Finally, the higher the audit fee, the more improved the FRQ. Given the expectation of a high audit fee, the auditor is likely to perform his duty by complying with the relevant professional ethics which will lead to improved performance. The study thus concluded that audit quality is significant in improving the FRQ of listed consumer goods companies in Nigeria.

It is thus recommended that there is a need to improve on certain policies and ensure enforcement of these policies towards ensuring quality financial reporting through quality audits.

For example, the NCCG which has provisions for audit committee independence, size, diligence, and financial expertise should be mandated by law and a penalty specified for non-compliance.

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THE EFFECT OF PRESUMPTIVE MALARIA ON RURAL FARMING HOUSEHOLDS' INCOME IN OSUN STATE, NIGERIA.

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Abstract

This study was carried out to examine the effects of Presumptive Malaria, defined in terms of Workdays Lost to Presumptive Malaria (WDLPM) on the income of rural farming households in Osun State. A three-stage sampling technique was used to collect data from 171 farming households. *Data were analysed using descriptive statistics* and Instrumental Variable Regression (ivreg) model at $\alpha_{0.05}$. The analysis shows that annual farm income was ₦426,839.50k and presumptive malaria episodes per household were 17.49 ± 4.28 while the average WDLPM was 73.42 ± 23.87 . The ivreg results indicate that age and sex of household head, family labour, distance to the health center, use of mosquito nets, and malaria awareness campaign have significant effects on the number of WDLPM. The coefficient of WDLPM was negative ($\beta = -0.00168$) and statistically significant at the 5% level. The result confirmed that households lost a substantial part of their income to malaria and missing workdays and recommended that government should give priority attention to malaria control programmes and improvement in the healthcare delivery system. Also, free distribution of mosquito nets must be vigorously pursued and adequately extended to rural areas to improve their income generation ability.

Keywords: Presumptive malaria, Farming households, workdays lost.

1. Introduction

The major roles of agriculture are the provision of food and the generation of employment opportunities for the people. It also enhances export revenue generation and overall input to the nation's GDP (Oparinde and Daramola, 2014). The sector share in the Gross Domestic Product (GDP) ranges between 30% and 40% while the food crop sub-sector contributions to GDP is almost 28% which represents almost 75% of the agriculture share of the GDP (CBN, 2012). Agriculture also provides self-employment and paid jobs for more than 70% of the nation's labour force (CBN, 2009).

Despite a range of research on the efficiency and productivity of agriculture in Nigeria (Adeleke *et al.*, 2008; Umoh, 2006; Rahji, 2003; etc), the problems undermining agricultural productivity persist. It is an indication that some other factors outside socioeconomic characteristics, inputs combination, and marketing issues still require adequate attention for appropriate planning and productivity-oriented policy. Olatunji *et al.* (2013) reported that agricultural production is affected by several health problems which include malaria, musculoskeletal disorders, diarrhea, yellow fever, respiratory and skin disorder, and operational hazards like farm injuries. World Bank (2007) observed that illness and death from HIV/AIDS, malaria, tuberculosis, and other diseases reduce agricultural productivity through loss of labour and death of productive adults. Nigeria's agriculture is labor-intensive and rain-fed, which requires farmers to timely prepare land, plant, weed, and harvest to ensure that the crops' growth stages coincide with the most favourable growth conditions. The success of agricultural livelihoods, therefore, depends on the health of the workforce.

In tropical and subtropical regions of Africa, particularly sub-Saharan Africa (SSA), malaria is noted as the most common ailment in the group of communicable diseases constituting a problem for public health and the performance of African economies (WHO, 2012). Malaria, a communicable disease, comes as a result of attacks on red blood cells by protozoa parasites belonging to the genus *Plasmodium*. The protozoa get introduced into the human body through female anopheles mosquitoes. Human beings are infected majorly by *Plasmodium falciparum* (WHO, 2009). The early



symptoms of malaria are indistinguishable and comparable with the symptoms of other febrile diseases: they include fever, chills, vomiting, headache, fatigue, muscle and joint pain, abdominal discomfort, anorexia, perspiration, and lassitude.

In malaria-endemic countries, people commonly assume they have malaria when sick and treat themselves accordingly (Whitty, 2008; Juma, 2011). Presumptive diagnosis implies diagnosing the illness based on symptoms associated with the illness without other confirmatory tests. This method of diagnosis gained a lot of popularity because most presumed malaria treatments in endemic areas especially in sub-Saharan Africa (SSA) were already done at home (Chukwuocha, 2016). Malaria treatment in Nigeria is largely based on **presumptive** diagnosis and in this case, every fever is almost entirely attributed to malaria illness and is used in diagnosis at home.

World Malaria Report (2010) reported that about 25% of all estimated malaria cases in the African region occurred in Nigeria. Mortality in Nigeria is largely due to being ill with malaria (CDC, 2013). The illness single-handedly accounts for about 11,000 maternal deaths per 100,000 live births, 250 infant mortality per 1,000 live births, and 390 under-five mortality per 1,000 live births (CSLAC, 2012). WHO (2016) reported that Nigeria and the Democratic Republic of Congo accounted for more than 35% of global malaria deaths in 2015. In addition to the direct health impact of malaria, there are also severe economic burdens on the country as a whole, with about 480 billion Naira lost to malaria annually in the form of treatment costs, prevention efforts, loss of work time, and so forth (Federal Ministry of Health, 2012).

Malaria and agriculture are intimately related because agricultural environments provide suitable conditions for the breeding of mosquitoes. The peak of malaria transmission has been found to coincide with the peak of planting and harvest seasons when demand for labour is supposed to be high. According to Ajani and Ugwu (2008), achieving self-sufficiency in food production and the much-desired growth in the agricultural sector of the economy will continue to elude Nigeria if health issues in agriculture are not properly addressed. Malaria has been identified as one of the major tropical diseases plaguing the rural populace especially the farmers by affecting their productivity and efficiency and it also accounts for 80% of sickness in Nigeria (Alaba and Alaba, 2009).

Omotayo (2017) in his study on malaria treatment and farming households' income poverty in Lagos state, Nigeria found that household annual income was ₦700,505.20K, income loss of ₦21,500 due to 13 days of incapacitation, ₦12,650 treatment cost and 5.3% annual income loss per malaria episode by a household member. The disease's impact on the agricultural sector is widely felt through its deepening effect on farming households' poverty status. Nwakwasi *et al.* (2020) found that 83.3% of the rural farmers in Abia State lost between 1 and 10 days to malaria with an average of 6 days in 3 months.

To worsen the effects of malaria in Nigeria, out-of-pocket (OOP) expenditure is the major source of malaria treatment, which in most cases becomes catastrophic, especially for poor households (Onoka *et al.*, 2011; Onwujekwe and Uzochukwu, 2005). This, prevent people from seeking and obtaining needed care because they cannot afford to pay the charges levied for diagnosis and treatment (Xu *et al.*, 2007; Castillo-Riquelme *et al.*, 2008). Despite the devastating effects of malaria on agriculture, few studies have been carried out in Nigeria on the effects of this dreadful disease at the farming households' level. Hence, this study sought to:

- i. examine the determinants of workdays lost to presumptive malaria among rural farming households in Osun State;

- ii. estimate the effect of workdays lost to presumptive malaria on the income of rural farming households in the study area; and
- iii. give policy recommendations based on the findings of the study.

2. Methodology

Study Area

The study was carried out in Osun State, Nigeria. The State is an inland State in Southwest Nigeria, with its capital at Osogbo. It is bounded in the north by Kwara State, in the east partly by Ekiti and partly by Ondo State, in the South by Ogun State, and the West by Oyo State. The State has thirty (30) Local Government Areas and one (1) Area Office. The population of the State was 3.4 million in 2006 (NPC, 2006) while the estimated population currently is about 5.5 million. It occupied a total land area of 14.875Km² which lies between latitude 7° 30'0" N and longitude 4°E 30'0"E. The Climate is humid tropical type with a mean annual temperature of about 28^oC and a mean annual rainfall of over 1600mm. Osun state is predominantly an agrarian society with about 70% of its labour population engaged directly or indirectly in agriculture and related activities. Osun State is divided into three agricultural zones by Agricultural Development Project (ADP). These zones include Osogbo, Iwo, and Ife / Ijesha zones.

There are two distinct seasons, the rainy season, which lasts from April to October, and the dry season which starts in November and ends in March. The distribution of rainfall varies from about 1000mm to about 2000mm. Important cash crops such as cocoa, kola nut, citrus, rubber and oilpalm are grown in the region. Savanna parts of the region produces food crops such as tubers, grains, plantain/banana and vegetables.

Nigeria Demographic and Health Survey (2013; 2018) indicated that south west is the zone with the lowest number of households with at least one Insecticide Treated Nets (ITNs) or Long-lasting Insecticidal nets (LLINs) in Nigeria. The hot and humid climate of the area favours proliferation of the mosquito vectors (Babalola *et al.*, 2009).

Sampling Procedure

A three-stage sampling technique was used. The first stage was a simple random selection of three (3) rural Local Government Areas (LGAs) from the state. The second stage was the random selection of five villages from each of the LGAs, making a total of 15 villages in all. In the third stage, simple random selections of twelve (12) rural households in each of the fifteen (15) villages were carried out, making a total of one hundred and eighty (180) respondents in all. Out of the one hundred and eighty (180) questionnaires administered to the respondents, nine (9) were discarded for incomplete information and inconsistency. Consequently, data from 171 questionnaires were analyzed for the study.

Method of Data Collection

This study was an empirical and not a clinical or epidemiologic study of malaria. Following Leighton and Foster (1993) and Attanayake *et al.* (2000), the study focused on "perceived" or "self-reported" malaria. That is, what people perceived to be "malaria" and what exactly health workers presumptively diagnosed as "malaria". It is not about the prevalence of malaria as measured by the presence of parasites in the blood that is yet to manifest in illness symptoms.

During the interview, efforts were made to ensure that people reported malaria episodes based on symptoms as closely as possible to accept clinical symptoms. Following Tangpukdee *et al.*, (2009) and Looareesuwan (1999), the following symptoms were taken as indicative of malaria: fever, headache, chills/shivering, abdominal pain, diarrhea, nausea/vomiting, altered taste, loss of appetite (anorexia), lassitude (general body weakness), muscular pain and joints pain.

Primary data used for this study were obtained from the respondents with the aid of a structured questionnaire. The data collected from the households include socio-economic and demographic characteristics such as age and sex of household head, household size, level of education, primary occupation, and other source(s) income, as well as their annual income. Malaria-related information such as access to electricity and mosquito nets, knowledge on the cause of malaria, mode of transmission, symptoms, attitudes, and practices of households to malaria prevention (i.e. use of mosquito nets, insecticides, repellants, coils, etc) were sought. Also obtained were data on the number of episodes of malaria attacks suffered by the households in 2014, type/place of treatment, distance to the nearest health centre, cost of treatments, transportation, subsistence, as well as days of incapacitation due to malaria attacks and workdays lost by the caregiver(s).

Baseline malaria symptoms for different age categories

Age category	Baseline Malaria Symptoms
Children (<5 years)	Fever, diarrhea, vomiting, abdominal discomfort, loss of appetite, and possibly coughs are sufficient to suspect and treat malaria.
= 5 years	Fever, loss of appetite, shivering/chills (or coldness), vomiting, headache, diarrhea, coughs, coloured urine (usually yellow), blister around lips (herpes labialis).
Adults =12 years	Fever, headache, myalgia-(muscle and joints pain), vomiting, loss of appetite-(anorexia), altered taste (bitter taste), shivering/chills (or coldness), yellowish urine, blister around lips, and body weakness-(lassitude).

Source: Tangpukdee *et al.*, 2009; CDCP, 2008; NMCP, 2005; Sowunmi *et al.*, 2000.

Method of Data Analysis

Statistical tools used in data analysis are the descriptive Statistics and Instrumental Variable Regression model *at* $\alpha_{0.05}$. The descriptive statistics included frequency, means, percentages, tables, and standard deviation. These were used to profile the demographic and socio-economic characteristics of the respondents. The Instrumental Variable Regression model estimated with Two-Stage Least Square (2SLS) was used to analyze the influence of workdays lost to Presumptive malaria on households' income.

For this study, days of incapacitation due to malaria illness for any household member who is less than 18 years old, especially school children, were not computed as part of workdays lost (Agbonlahor *et al.*, 2009; Akazili, 2000) except, if adult caregiver lost workdays in the course of such malaria illness. Also, the man-days were calculated using the average male adult working for 8 hours a day (Olukosi and Erhobo, 1998). Thus, the real total hours committed to farming activities was transformed to an equivalent by multiplying those of male by 1, those of female by 0.75, and that of children by 0.5, based on the assumption that average working condition is maintained.

Ethical considerations

Written informed consent was obtained from all the heads of the households that participated in the data collection (interview) and assurance was given to them that all information received would be handled confidentially. Participants were informed that participation is voluntary and that they have the right to withdraw from the interview at any time they would wish during the interview. Ethical clearance for the research was received from the Osun State Specialist Hospital Osogbo Health Research Ethics Committee with Clearance number: HREC/27/04/2015/SSHO/027

Model Specification

Effect of presumptive malaria illness on rural households' Income

To examine the effect of presumptive malaria on rural households' income, this study estimated the effect of workdays lost to presumptive malaria illness on household income. Assuming that the influence of household characteristics on income is the same across all households, in that case, household income is a function of a vector of household characteristics (h) such as age, household size, and sex of the household head. It is also determined by the epidemiological environment of the household. This last factor can be represented by workdays lost to presumptive malaria (M).

This study assumed that changes in household income are accounted for by its characteristics, the epidemiological environment, and institutional factors such as education. Institutional effects may alter household productivity or its behavior towards prevention and treatment of an illness. Following Wooldridge (2002); Laxmanayan (2004); Mwabu (2009); Andr n and Palmer (2008); Kioko *et al.* (2013); Mwai and Muriithi (2016), and with appropriate modifications, the model for the effect of workdays lost to presumptive malaria on household income is presented thus:

$$\ln Y = \alpha_1 M + \sum_{j=1}^n \alpha_j h_j + \varepsilon_1 \dots \dots \dots (1)$$

$$M = \sum_{i=1}^n \beta_i h_i + \varepsilon_2 \dots \dots \dots (2)$$

The effect of workdays lost to presumptive malaria on household income was examined by estimating equations 1 and 2.

Where $\ln Y$ is the log of household income, M is the malaria variable that captures the workdays lost to presumptive malaria, and h_j is a vector of exogenous variables. h_i is a vector of exogenous variables consisting of instrumental variables that affect malaria (workdays lost to presumptive malaria), but have no significant effect on household income. h_i are covariates belonging to the income equation (eqn. 1) and equation of the workdays lost to presumptive malaria (eqn. 2). The notations α_1 , α_j , and β_i are parameters to be estimated as ε_1 and ε_2 are the disturbance terms.

While estimating household income equation 1, certain econometric specifications need to be taken into account. We may encounter the problem of simultaneity which is due to the possibility of reverse causality between income and malaria. This relationship implies that an increase in malaria episodes in a household might reduce worker productivity and hence farm income. On the other hand, an increase in household income status may improve the household's ability to seek prompt treatment or adopt control and preventive measures against malaria. Hence, reduced malaria attacks and reduced workdays lost to malaria as a result of the reduction in the occurrence of malaria illness.

The endogeneity nature of M implies that if equation 1 is estimated by OLS, the point estimates would be biased and inconsistent since the error term will be correlated with M . We, therefore, used an instrumental variables approach to account for the possibility that malaria is endogenous to household income. The study assessed the validity of the instruments (Staiger and Stock, 1997) and then used distance to the nearest health centre, access to mosquito nets (ITNs or LLINs), and malaria awareness campaign as the instruments for workdays lost to malaria. Two-stage least squares method was used to estimate the model where workdays lost were captured in man-days lost, hence a continuous variable. The estimation of the IV regression model in the above equations was carried out using the STATA software package because it combines the two steps (first-stage and second-stage

regression) into one step and the output is given in one step.

This model is used to show how the numbers of workdays lost to presumptive malaria by the households affect household income by showing that the number of workdays lost to presumptive malaria is an endogenous variable that depends on the distance to the health center, access to mosquito nets (ITN or LLINs) and household head participation in the malaria awareness campaign.

The explanatory variables included in the model are similar to those used in previous related studies (Mwai and Muriithi, 2016; Kioko *et al.*, 2013; Omotayo and Oyekale, 2013; Adesopeet *et al.*, 2012; and Tugume, 2011).

X_1 =Age of household head (years)

X_2 =Age squared of household head (years)

X_3 =Sex of household head (male=1, 0=female)

X_4 =Years of schooling of household head (number of years)

X_5 =Household size (in number)

X_6 =Farm size cultivated by the household (hectares)

X_7 =Family labour utilized (Manday)

X_8 =Hired labour utilized (manday)

X_9 =Distance to the health centre (km)

X_{10} =Access to mosquito nets (ITNs or LLINs), if access=1, 0= if no access

X_{11} = If ever participated in malaria awareness campaign before (if participated=1, 0=otherwise)

$X_9=X_{11}$ are the instruments for Workdays lost to presumptive malaria by the household.

3. Results and Discussion

3.1 Results of Descriptive Analysis

Table 1. Results of Descriptive Analysis

Variables	Frequency	Mean	Standard deviation	Percentage of total
Sex of the household head				
Male:	145	-	-	84.8
Female:	26	-	-	15.2
Age of Household head (years)	-	57.01	9.39	-
Marital status of household head:				
Married	145	-	-	84.8
Widow	26	-	-	15.2
Household size	-	6	1	-
Household head's years of Schooling	-	4.70	4.60	-
Farming experience (years)	-	29.50	10.94	-
Farm size (Hectares) cultivated	-	1.60	0.53	-
Household's farm income (₱ / Annum)	-	426,839.50	147,465.90	-
Household's malaria Episodes in the year 2015	-	17.49	4.28	-
Workdays lost to malaria attacks	-	73.42	23.87	-
The financial cost of treatment (?)	27,642.33	-	-	-
Malaria Prevention cost (?)	10,434.10	-	-	-
Value of workdays lost to presumptive malaria (?), valued at the wage rate during the survey	58,358.51	-	-	-
The total cost of Malaria (?)	96,434.94	-	-	-
Total cost of malaria as percent (%) of annual household farm income	-	-	-	22.6

Source: Field survey, 2015.

Table 1 above shows that the majority (84.8%) of the heads of rural farming households were male. The age was 57.01 ± 9.39 years. This indicates that most of them are getting older and this has a negative effect on their level of productivity and tolerance to malaria attacks. The majority (84.8%) of the farming households' heads were married while the remaining (15.2%) were widows. The average household size was 6 ± 1 persons. The average year of schooling was 4.70 ± 4.60 , which is far below the current required universal basic education of junior secondary school education. The mean year of farming experience was 29.50 ± 10.94 years, implying that the majority of them are old people with many years of experience on the farms. The average farm size stood at 1.60 ± 0.53 hectares, indicating that they are smallholder farming households. The mean farm income in the study area was $N426,839.50 \pm 147,465.90k$ while the total cost of malaria as a percent (%) of annual household farm income was estimated at 22.6%.

3.2 Distribution of respondents by workdays lost to presumptive malaria

Table 2. Distribution of respondents by total workdays lost to presumptive malaria per year

Workdays Lost (Days)	Frequency	Percentage	Mean and Mode
Less than 40	10	5.8	Mean = 73.42
40-59	38	22.2	S.D = 23.87
60-79	60	35.1	Mode = 61
80-99	38	22.2	Minimum = 20
100-119	16	9.4	Maximum = 153
120 and above	9	5.3	
Total	171	100	

Source: Field survey, 2015.

Table 2 shows the workdays lost to presumptive malaria attacks as reported by the households, which stood at 73.42

Dependent variable is log of household income, except first stage of ivreg. Explanatory variables	OLS Estimate	Instrumental variable (IV) Estimate	
		First Stage Estimation ¹	Second Stage Estimation
Workdays lost to malaria	0.000275 (.000258)	----	-0.001683** (0.000779)
Age of household head	0.014164*** (0.004743)	-5.227616*** (1.042919)	0.020651*** (0.005567)
Square age of household head	-0.000139*** (0.000041)	0.052543*** (0.009065)	-0.000205*** (0.000051)
Sex of household head	0.043445** (0.018922)	11.455630*** (2.905951)	0.025258 (0.021242)
Years of schooling of household head	0.000775 (0.002298)	0.488847 (0.446719)	0.000680 (0.002343)
Household size	0.003801 (0.003336)	0.569071 (0.577682)	0.003109 (0.003476)
Farm size cultivated	0.128004*** (0.019783)	4.016701 (3.275579)	0.123183*** (0.019840)
Family labour utilized	0.000106** (0.000053)	0.073195*** (0.009661)	-5.26e-06 (0.000076)
Hired labour utilized	0.000891*** (0.000189)	-0.087717*** (0.033890)	0.001021*** (0.000193)
Constant	4.876994 (0.143036)	149.8384 (31.00948)	4.685464 (0.165702)
Model Test (Prob>chi)	0.0000	0.0000	0.0000
F- value	71.42	31.15	
Number of Observations	171	171	171
R ²	0.6436	0.4443	0.6113
Adjusted R ²	---	0.4284	---
Wald Test or Wald Chi ²			599.14
Instruments			
Distance to the health centre	---	1.221876**** (0.269922)	---
Access to ITNs or LLINs	---	-23.51718*** (3.416145)	---
Malaria awareness campaign	---	15.01911 (9.350486)	---
<i>Endogeneity Test</i>			
Robust (score) Chi2(1)			4.00879 (p=0.0453)
Robust regression F (1, 160)			4.28198 (p=0.0392)

Source: Author's computation from field survey data. 2015.

Figures in parentheses are the robust standard errors.

*, ** and *** significant at 10%, 5% and 1% respectively.

¹Workdays lost is the dependent variable for the first stage of the instrumental variable model

Factors that Affect the Number of Workdays Lost to Presumptive Malaria.

The first stage regression model (Table 3, third column) results indicated that age of household head, squared age of household head, sex of household head, family labour utilized, distance to the health center, use of mosquito nets (ITNs or LLIN) and malaria awareness campaign were the variables that have a significant effect on the number of workdays lost to presumptive malaria. The coefficient of the age of the household head was negative (-5.2276) and significant at 1%. This implies that a unit increase in the age of household heads will reduce the workdays lost to presumptive malaria by 5.23. However, the coefficient of squared age of household head was found to be positive (0.0525) and significant at 1%, implying that the inverse association of age with workdays lost to malaria will weaken over time. Also, the coefficient of the sex of household heads was positive and significant at 1%. This implies that being a male household head increases the number of workdays lost to malaria by 11.46. This is because farm activities are mostly done by males, especially in male-headed households.

The co-efficient of family labour was found to be positive and significant at 1%, implying that the more household members were involved in farming activities, the more their days of incapacitation due to presumptive malaria resulted in workdays lost. Conversely, the co-efficient of hired labour was negative and significant at 1%. This is because, the more hired labour involved in farming activities, the less the number of family labour required and fewer workdays lost since hired labour may be substituted for family labour, though at a cost.

Distance to health centers, which indicates households' access to medical facilities for prompt treatment, had a positive coefficient and was significant at a 1% level. This implies that the far the distance to the health center, the more difficult for households to access medical facilities, and hence, more workdays are lost to malaria illness. Access to mosquito nets, which represents households' access to malaria preventive measures, had a negative coefficient and was significant at a 1% level. This indicates that access to mosquito nets (ITNs or LLINs) reduces the frequency of mosquito bites, hence fewer malaria attacks and reduced workdays lost to malaria.

The coefficient of the malaria awareness campaign had positive signs but was insignificant. Most people who have participated might have assumed to have known most precautionary measures incidental to malaria occurrence. This attitude of many households often caused them to neglect important professional advice that might be given to them. The first stage regression model results confirmed that workdays lost to malaria are an endogenous variable and depend on the distance to the health center, access to mosquito nets (ITNs / LLINs), and malaria awareness campaign.

Effect of Workdays Lost to Presumptive Malaria on Household's Farm Income

According to the model results from the second stage regression presented in Table 3 (fourth column), the coefficient of workdays lost to presumptive malaria was negative (-0.00168) and significant at 5% level. This implies that a unit increase in workdays lost to presumptive malaria will reduce households' income by 0.17%. This is an indication that workdays lost to presumptive malaria illness affect household income negatively. Other factors that were found to have a significant influence on the households' income include the age of the household head ($\beta = -0.02065$), farm size cultivated ($\beta = 0.12318$), and hired labor utilized ($\beta = 0.00102$), all have a positive influence on households' income. The squared age of household heads had a significant but negative association ($\beta = -0.00021$) with household income, implying that as household heads get older, they become economically inactive which in turn affects their productivity and income generation ability. The low income associated with age squared suggest that as people advanced in age, the quantity of

time devoted to farm work is reduced. This can either be driven by a preference for more leisure at older ages or a negative effect of depreciation in health on work time or both.

Diagnostic tests

The test for endogeneity revealed that there was endogeneity at 5% level of significance in the model and it is justifiable to use Instrumental Variable (IV) regression model. Since both Robust (score) χ^2 and Robust regression statistics tests were significant, the null of exogeneity was rejected; workdays lost to presumptive malaria were confirmed to be endogenous. The results of the testing for joint significance of the instruments indicated that the model has very strong instruments because the F-value = 31.15 is greater than 10, the rule of thumb value for strong instruments. The test for the over-identification restriction was used to find out if we have more instruments than required to estimate the parameter estimates. Using *estat overid* command in the STATA after the 2SLS regression with robust standard error, *Wooldridge's score test of overidentifying restrictions* was achieved: Score $\chi^2(2) = 10.3944$ ($p = 0.0055$). Here the null hypothesis that our instruments are valid at 1% significance level was accepted. That is, we accept the hypothesis of no over-identification restrictions at 1% level of significance. In summary, this study found the instruments for the workdays lost to presumptive malaria as the distance to the health center, access to mosquito nets (ITNs or LLINs), and malaria awareness campaign, because all the tests (endogeneity, **weak instruments**, and over-identification restrictions) were satisfied.

4. Conclusion and Recommendations

The findings of this study indicated that rural farming households lost a substantial part of their income to malaria prevention and treatment as well as missing workdays. The loss in households' income is largely due to the loss of productive time by the sick household members and the time spent by household members taking care of the sick ones. Loss of workdays due to presumptive malaria illness implies lower farm output and reduced household capacity to earn income at a time when it needs extra income to pay for medical expenses. It is therefore concluded that households tend to spend a substantial proportion of their income on malaria prevention and treatment, and also missed workdays to malaria illness and caregiving to the sick household member(s). Therefore, the government should give more priority attention to malaria control programmes and improvement in the healthcare delivery system, especially in the rural areas where the majority are into farming as means of livelihood. There is a need for rural people to adopt the use of mosquito nets while the efforts at mosquito nets-free distribution must be intensified to cover the rural households in the study area. Finally, rural households and others in the informal sector should be enlightened on the need to embrace the Osun Health Insurance Scheme (OHIS) which aims at reducing the out-of-pocket expenditure on health care services.

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DETECTING UNACKNOWLEDGED PLAGIARISM USING STRING MATCHING-BASED CONTENT FRAMEWORK

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ABSTRACT

Plagiarism is a ugly trend that posed global concerns and challenges to information resources and documents spanning the internet repository and academia. Most often, an individual or some authors in teamwork usually have parallel construction in written text, term paper, and research article which connotes similar phrases, vocabulary overlap, and collaboration between texts across multiple pages of the same document. In this paper, we present a functional mechanism for higher performance in plagiarism detection especially in a collaborative manner. An iterative development technique was adopted involving 'String Matching Based Content' to handle text parsing and document analysis from file to file. The system functionality was modelled from the users' perspective by providing an algorithm for internal control and to check text similarity.

Keywords: Algorithm, Detection system, Plagiarism, String matching

1. INTRODUCTION

Plagiarism is an attempt and/or act of claiming credit for written ideas, published text, and intellectual works of others in academia. It is a trait of academic dishonesty involving undergraduate and postgraduate students, as well as intermediate researchers in different fields of endeavor. Although, this has enhanced teaching and learning the havoc done to academia is high, one of which is plagiarism. Digital computers and the advent of the internet have made published text plagiarism-prone in every facet of life (Faloore, 2014). However, plagiarizing by use of substitutions to elude detection software has rapidly evolved as students and unethical academics seek to stay ahead of detection software (Grove & Jack, 2014).

Predicated upon an expected level of learning being achieved, all associated academic accreditation becomes seriously undermined if plagiarism becomes the norm (Cully, 2013). On the other hand, Plagiarism is the stealing of someone's idea and claiming to be one's original work which may be written ideas (Atayero et al., 2011). Plagiarism is the illegal presentation of someone's ideas, words, expressions, data, computer programming, or any other creative endeavor and claiming it to be one's original work without giving the author credit. Since the emergence of digital computers and the internet, documents can no longer be handled in paper and ink form as they were decades ago. This has led to the "copying and pasting" of textual documents since these menus cannot be disabled in application programs to curb plagiarism.



Obinna (2012) noted that plagiarism and poor writing skills are the bane of Nigeria's educational system. Plagiarism affects not only the integrity of the individual concerned but also the integrity of the institution associated with the individual. Students' level of knowledge and ability in their respective places of work after graduation is a result of their disciplinary engagement in achieving the integrity of their academic experience. Ignorance and unawareness of the legal implication of plagiarism are also responsible for the verbatim copying of scientific texts (Jamali et al., 2014). Recently, computer-aided methods of plagiarism detection are in use but not all already existing tool supplement completely new comparison algorithms (Atayero et al., 2011).

Nowadays, it is generally believed that attribute counting is inferior to content comparisons since even small modifications can greatly affect fingerprints (Atayero et al., 2011). Meanwhile, a clever plagiarist that knows the best way of paraphrasing can easily use word substitution to outsmart the detection system. Parsing and document analysis are quite germane to the performance of any plagiarism detection system. The functional mechanism may be a desktop-based or web-based application for document comparison or text similarity. It appears that developing countries suffer more from severe and obvious cases of plagiarism since the scientific foundation of developed countries was long established and the fight against plagiarism started earlier (Jamali et al., 2014).

Inconsistencies within the written text itself such as changes in vocabulary, style, or quality of an article can also be attributed to plagiarism except that such cases are known or described as unacknowledged and collaborative kind of plagiarism. Atayero et al. (2011) described unacknowledged and collaborative plagiarism as the occurrence of similar phrases, quotations, sentences, or parallel construction in two or more pages of the same article. Consequently, situations in which spelling mistakes or lexical errors occur between text; overlapping one's phrases and content within a document, and as well as preparing correctly cited and referenced write-ups from individual research or handling part of that work twice for separate purposes or publications like journal articles, therefore, a framework to provide detection mechanism using string matching based content in two or more documents for text similarity with unlimited text size to check for unnecessary tautology is of necessity.

2. LITERATURE REVIEW

Plagiarism has been defined as an act of reproducing another individual's idea or any other form of information without giving credit to the source of the information. Plagiarism is a deliberate appropriation of others' ideas and statements without proper referencing (Smith et al., 2007). However, there are currently many measures designed towards combating it, such as the implementation of plagiarism detecting systems, as well as establishing penalties for the act. The advent of the Internet, the World Wide Web, and Social Media has undoubtedly taken our civilization a step higher, and especially, provided scholars with a useful avenue for the rapid spread and exchange of ideas and information. Centre for the Study of higher education said "Plagiarism in higher education can take many forms. Some of the more common forms are listed below, however, it



should be noted that definitions of plagiarism vary somewhat across the disciplines following differences in knowledge of authorship conventions and traditions.

Accordingly, the 'who is who' among American high school students- a survey conducted on American best students revealed that eighty percent (80%) of them plagiarized to get to the top of their class, as corroborated by another study in which fifty-five percent (55%) of the respondents admitted to having plagiarized (Wanetal.,2011). Dupree and Sattler (2010) pointed out that seventy-four percent (74%) of students in their report admitted to having plagiarized in the previous year. In addition, students and faculty admitted that plagiarizing via the Internet is fairly common. One of the causative factors of plagiarism could be unawareness. Wanetal. (2011) on engineering students studying in Malaysia revealed that most of the students know very little about plagiarism and what makes it a serious offense.

Furthermore, the research revealed that the students had not been given a very formal and concise orientation about it by the school. Although, at the moment, several plagiarism detection tools have been developed which effectively detect plagiarism. Alietal.(2011) reviewed these tools, pointing out their merits and demerits. Their findings show that none of the tools are hundred percent (100%) efficient, but considering the different features of the existing detection tools, they argue that a hybrid system could raise the capability of detection. In Nigeria, there are disturbing reports about a plague of plagiarism at different levels of the academic sector (Onuoha & Ikonne, 2013). Studies from the westernregionofNigeriaonuniversitystudentsrevealedvaryingacademicdishonestyamongrespondent s,ranging from those that plagiarize from the Internet to those that copy from their colleagues (Babalola,2012).

This fault in the educational background of some Nigerians contributed to their failure to perform optimally abroad where academic rules are taken seriously (Orimetal.,2013). Confusion between plagiarism and paraphrasing among students is another influencing factor of plagiarism. Quite a significant number of students are unaware of the rules guiding paraphrasing. In fact, this is common when students are confronted with paraphrasing paragraphs from unfamiliar subjects or technical jargon. Students fall prey to unintentional plagiarism due to their inability to decipher the thin line between paraphrasing and plagiarism. Of utmost importance also is the place of poor writing skills of students among the various factors and reasons students plagiarize. Faculty members in related courses in a department must help students develop strong writing skills.

3. METHODOLOGY

Given the problems inherent in the existing system, it is necessary to seek an improvement because a hash function computes digital fingerprints for each chunk which are inserted into a hash table: a collision of hash codes within the hash table indicate matching chunks. Meanwhile, a clever plagiarist can easily maneuver by smooth paraphrasing; a detection mechanism with a string-matching algorithm as a functional framework is bound to perform better. Most of the works in plagiarism detection are meant for academic purposes where cheating, rewording, rephrasing, or restating

without referencing are strictly prohibited. In this regard, numerous plagiarism detection systems have been developed.

But, the functional mechanism of the proposed framework is stand-alone with the following operational modules and algorithms:

1. Load files to be checked
2. Ignore white spaces and special characters
3. Compare the files line by line
4. Detect similar phrases
5. Extract and store in memory the similar phrases
6. Check the online server for similar phrases
7. Displays the links having similar phrases.

```
Int match //value to return int I, j, k;
match = -1; j = 1; k = 1; i = j;
while (end Text (T, j) == false) if (k > m)
match = I //match found break;
if (t[i] == p[k]) j++; k++;
else // b a c k u p
overmatched characters int backup
=k-1;
j = j - backup;
k = k - backup; //slide pattern forward,
start over j++; i = j;
return match;
```

System design

An iterative development technique was adopted in providing a functional mechanism of the proposed framework which was code-named “plag-detect”; blueprints were presented through the use of visual aid like procedure, data flow, activity, and use case diagram. Meanwhile, the top-down approach was chosen for the design to build the system from the main module and later incorporate all other sub-programs as shown in Figure 1 and Figure 2 below.

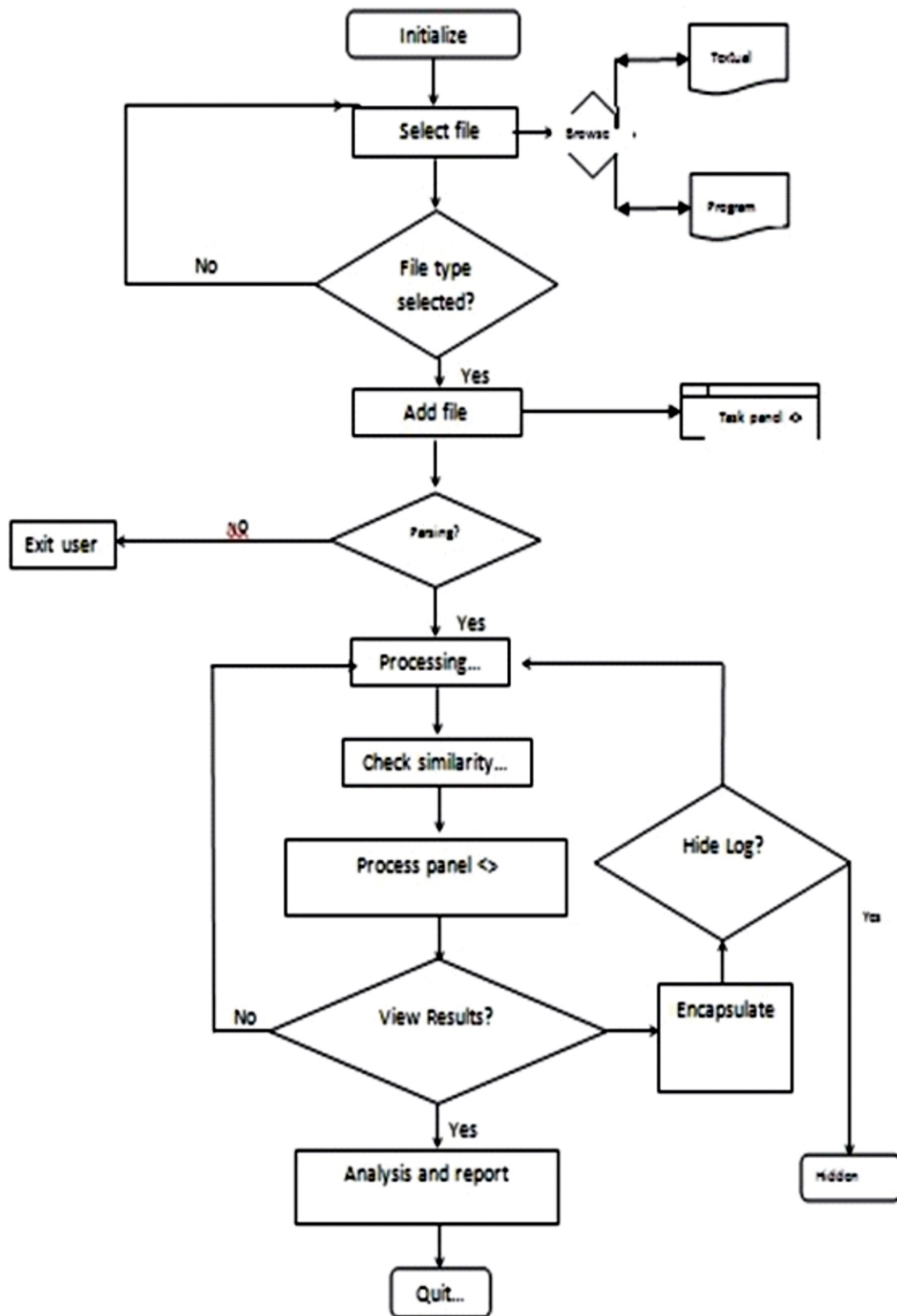


Fig. 1 Procedure and data flowdiagram

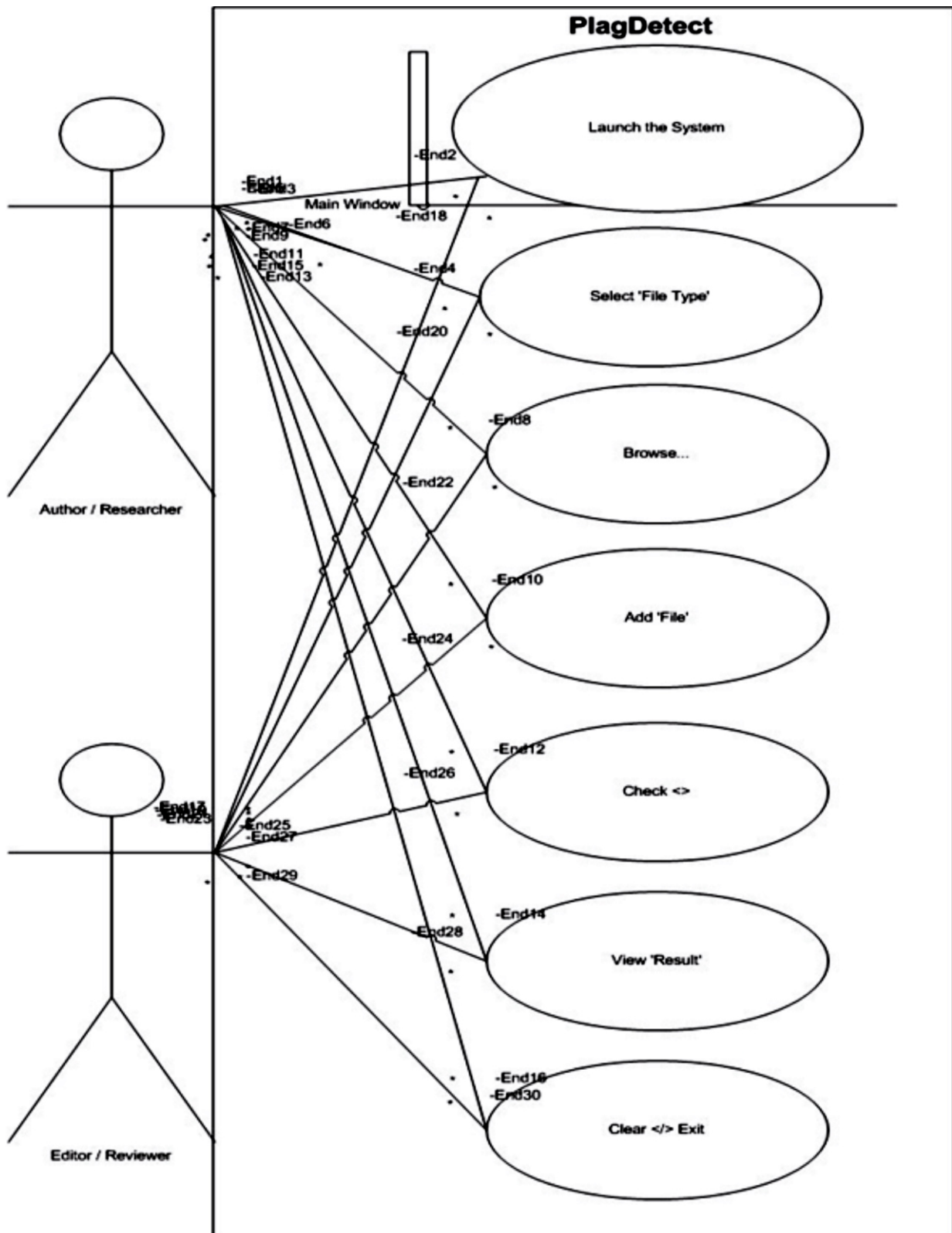


Fig.2 Use casediagram



1. CONCLUSION

Natural language processing is of great importance to the functionality and modern construction of plagiarism detection systems as detecting plagiarized phrases in the given document becomes easier after the semantic analysis of the document. The algorithm has been provided with a formal representation as a detection mechanism using string-matching-based content for better performance. Thus, handles file-to-file similarity checks within textual search and program codes, like copy detection in large comparison from electronic resources. Enterprise-level plagiarism check software would normally compare input documents against databases.

2. FUTUREWORK

Computational intelligence is of great importance to the modern construction of plagiarism detection tools and their functionality. The application of natural language processing (NLP) to similarity tests and document analysis will be considered as part of the areas for further study.

Its features can leverage pattern matching to handle ambiguity and unconstrained vocabulary to resolve lexical overlap in large files. Multi-lingual capability can also handle language issues in detecting exact copied percentages in part or wholly, translating documents in different languages irrespective of the writing style of the author.

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PERCEIVED IMPACT OF STRATEGIC PLANNING IMPLEMENTATION ON INTERNAL EFFICIENCY OF SMALL AND MEDIUM SCALE ENTERPRISES IN SOUTHWEST NIGERIA

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Abstract

Quality service is a challenge facing our small and medium-scale enterprises, as *many organizations now find themselves in circumstances where old methods of strategy management and planning no longer serve their purpose for an edge as a competitive advantage. Externally-oriented planning also called strategic planning positions an organization to predict changes in the environment and act proactively.* This paper examined the perceived impact of strategic planning implementation on the internal efficiency of small and medium-scale enterprises. A descriptive survey research design was employed for the study. A structured questionnaire and oral interview were used to collect data for the study. A sample size of thirty small and medium business enterprises from Ogun, Oyo, Ondo, and Ekiti States were selected for the study and 120 business owners and managers were selected using a purposive sampling technique. Data generated for the study were analyzed using frequency tables, simple percentages, and Chi-square test. The results showed that strategic planning implementation was perceived to significantly assist SMEs to gain competitive advantage ($\chi^2=23.04$; $p<.05$); to increase their sales ($\chi^2=9.34$; $p<.05$); and to improve their profit levels ($\chi^2=42.8$; $p<.05$). The paper concluded that strategic planning implementation significantly influences internal efficiency of small and medium scale enterprises and recommended that strategic planning implementation should be adopted by all small and medium business enterprises.

Keywords: Strategic management implementation, Strategic planning, competitive advantage, small and medium scale enterprises (SMEs)

1. INTRODUCTION

The economic sector in our world today is fast developing a great interest in quality provision and service delivery. Quality provision starts from efficient management to evaluation of inputs through to quality outputs that meet or increase the standard of living of the people. Effective service delivery is a challenge facing our small and medium-scale enterprises. Externally-oriented planning also called strategic planning positions an organization to predict changes in the environment and act proactively, because, strategy is about achieving competitive advantage through being different whilst delivering a unique value added to customers, having a clear view of how to stay ahead. Strategic planning is about developing a good match between the activities of an institution and the demands of the environment in which it operates (Nte, 2007). It focuses on the institution's mission, objectives, strengths, weaknesses, opportunities, and threats. In essence, strategic planning aims at ensuring the internal efficiency of an organization. Strategic planning is seriously advocated for because many institutions and organizations now find themselves in circumstances where old methods of planning and management are no longer effective in dealing with the future. Implementation is the carrying out, execution, or practice of a plan, a method, or any design for doing something, it enables an enterprise to behave following its purposes, guidelines, and strategies. As such, implementation is the output that must follow any preliminary thinking for something to happen. Anyieni and Damaris, 2016 opined that implementation is a hands-on operation and action-oriented human activity needing executive leadership and key managerial skills. In addition, implementing a newly crafted strategy often entails a change in corporate direction and frequently



requires a focus on effecting strategic change. Small-scale enterprises have been recognized globally by government and development experts as a potential engine of economic growth and a major factor in promoting private development and partnership. Leaders of small-scale enterprises should address important issues continuously and simultaneously to have effective strategic planning, which can only be achieved by constantly seeking answers to several problems that may likely affect the business operation and ensuring that every unit in the organization plays a significant role in making the organization strategic. Thus, the role of small-scale enterprises in economic growth brought the need to understand the role of strategic planning implementation in small-scale enterprises in Nigeria.

In today's fast-growing global economy in which the quest for innovation has taken centre stage of all human drive for progress and well-being, the implementation of a strategic plan must constitute prime elements in the growth strategy of small and medium-scale enterprises in Nigeria. Every small and medium-scale enterprise needs to develop a competitive advantage to enable its effective competition. Most owners and managers of small and medium-scale enterprises in Nigeria are inadequately aware of the contribution of strategic planning implementation to the success of their organization and how it can be undertaken. It is pertinent therefore that if improved service is desired by owners and managers for customers, adequate attention should be given to strategic planning in small and medium-scale enterprises and this has to do with ensuring that adequate resources, equipment, facilities, funds, and serious policy support from the government are needed to galvanize this sub-sector of the economy so managers can plan strategically and hope to maximally achieve the enterprise objectives. The researcher has however noted that the challenge for small and medium-scale enterprises in the southwest, of Nigeria have been those of poor finance, staff capacities, leadership, and lack of innovation resulting in poor service delivery.

Strategic Planning

It is through strategic planning that an organization can predict changes in the environment and act proactively (Chan, 1993), and it has been observed that most organizations do not bother with the implementation of strategic plans formulated.

Internal Efficiency

Efficiency is defined as the optimal relation between inputs and outputs. Wastage of inputs or outputs is an indication of internal inefficiency, which is recorded when an investment does not yield the desired gain or product, or when the investment produces a result that is considered to be lower than the targeted value (Adesina, 1990). (Abdulkareem, 1990) noted that avoidance of wastage is largely related to resource allocation and utilization.

Strategic Planning Implementation

After a policy has been formulated, processes should be enacted to execute that policy. This implementation process may encompass several actions at a variety of levels, which are developed following the statement of that policy. Plan implementation is a process that takes place once the policy has been formulated. He also notes that policy implementation represents the achievement of a policy's objectives.

Strategic Management Practice in Small and Medium-Scale Enterprises

Strategic management is an important aspect of any country's economy already employing large numbers of people and embodying future growth potential. Given the importance of small business enterprises to the economy, it is disheartening to note that scant attention in the small business enterprise research literature is given to the study.

Heneman, Tensky, & Camp (2000) reasonably opined that strategic management theory can't be valid if it is based almost entirely on research conducted on large organizations, i.e., is it relevant to the needs of practitioners or general managers in small or medium-sized enterprises; and the bulk of business fall into the small business category.

While there was much research into the determinants of growth in small and medium-scale enterprises, there has been little attention in the area of the influence of strategic planning implementation and internal efficiency of small and medium-scale enterprises in south-west,

Nigeria, hence this study. The objective of this study is to assess the influence of strategic planning implementation and internal efficiency in small and medium-scale enterprises in southwest Nigeria. Specifically, the study assessed the extent of the use of strategic management plans in SMEs; examined the factors affecting strategic planning implementation in SMEs' operations; and evaluated the importance of strategic planning implementation to SMEs' internal efficiency in Nigeria. These were done to determine if the practice of strategic planning implementation can be a major solution to the problems that may likely affect service delivery, quality operations, and internal efficiency of SMEs in southwest Nigeria.

The following three hypotheses were tested:

H₀1: Strategic planning implementation does not significantly lead to a gain in competitive advantage by SMEs.

H₀2: Strategic planning implementation does not significantly lead to an increase in the sales volume of SMEs

H₀3: Strategic planning implementation does not significantly lead to an increase in profits of SMEs

2. METHODOLOGY

The study covered small and medium-scale business establishments with staff between ten and one hundred in four selected southwestern states of Ogun, Oyo, Osun, and Ekiti. A descriptive survey research design was adopted for the study.

It involved the researcher collecting information directly from participants by posing relevant questions about the study to them. The questions were presented orally, through interviews, and designed questionnaires. The sample population for the study was 325, which comprised small and medium-scale business owners and managers across four states in southwest Nigeria.

From the population, thirty respondents (SME owners) were selected from each state, making a total of one hundred and twenty respondents using purposive sampling technique. The questionnaire used to collect data was divided into three sections; the first section covered bio-data, the second section was about questions that determined, examined, and assessed strategic management practice in small and medium-scale enterprises, and the third section contained open-ended questions that recommended solutions and provided information that is relevant to the study. Out of the 120 respondents selected for the study, only eighty-four questionnaires were completed correctly and were used for the analysis. Data collected were analysed using relevant descriptive and inferential statistical techniques.

4. RESULTS AND DISCUSSIONS

Table 1: Extent of the use of strategic management plans in SMEs

Items	Often (%)	Seldom (%)	Rarely (%)	Not at all (%)
How often do you apply strategic plans to the business?	52 (61.9)	12 (14.3)	4 (4.8)	16 (19.1)
How often do you review or adjust your strategic plans?	47 (56.0)	15 (17.9)	6 (7.1)	16 (19.1)
How often do you encounter problems in formulating strategic plans?	12 (14.3)	16 (19.1)	35 (41.7)	21 (25.0)
How often do you encounter problems in implementing strategic plans?	8 (9.5)	12 (14.3)	40 (47.6)	24 (28.6)

Source: Field survey (2022)

From Table 1, the majority of the respondents (61.9%) indicated that they often applied strategic plans to their business, 14.2% seldom applied them, 4.8% rarely applied them, and 19.1% did not

apply them at all. On how often they reviewed their strategic plans to meet the current situation in the market, 56.0% said often, 17.9% said seldom, 7.1% said they rarely review their strategic plans, and 19.1% of respondents did not review their strategic plans. However, on encountering problems while formulating strategic plans, 14.3% often have problems during this course, 19.3% seldom have problems during this course, 41.7% rarely have problems during this course and 25% don't have problems during this course. In conclusion, respondents were asked if they encountered problems during the implementation of strategic plans; 9.5% indicated they often encounter problems, 14.3% respondents said they seldomly encounter problems, 47.6% indicated they rarely encountered problems during implementation of strategic plans, while 28.6% respondents indicated not at all. The implication of this is that small and medium business owners believed in the use of strategic plans to sustain and develop the enterprise's internal efficiency.

Table 2: Factors Affecting Strategic Planning Implementation in SMEs Operations

Items	Frequency	Percentage
1. Factors responsible for problems encountered in formulating and implementing strategic plans		
Finance	23	27.4
Lack of innovation	59	70.2
No reason	2	2.4
Total	84	100.0
2. Factors affecting business success in your environment		
No reason	21	25.0
Leadership	35	41.7
Staff Capacities	28	33.3
Total	84	100.0

Source: Field Survey (2022)

From Table 2 majority of the SME owners (70.2%) indicated that lack of innovation affects the formulation and implementation of strategic management plans for the operations of their businesses. In addition, 27.4% of these respondents, agreed that finance is a problem for SMEs as they find it difficult to finance the strategic plans laid down to achieve certain business success. Furthermore, few respondents (2.4%) have no reason for the problem encountered in the formulation and implementation of strategic plans for their businesses. Also, the majority of respondents (41.7%) indicated that leadership limits their business success in operations. Business owners (33.3%) indicated that staff capacities add as a factor affecting their business success as respondents (25.0%) also indicated no reason is a barrier to business success. The implication is that strategic planning is significant to SMEs' internal efficiency.

Table 3: Impact of Strategic Planning Implementation on SMEs' Internal Efficiency

Items	Agreed (%)	Undecided (%)	Disagreed (%)
Strategic planning is relevant in small and medium-scale business operations	64 (76.2)	- (-)	20 (23.8)
Strategic planning aid in both short-term and long-term planning to achieve SMEs success	65 (77.4)	1 (1.2)	18 (21.4)
Strategic planning influences your business positively	57 (67.9)	- (-)	27 (32.1)
Strategic planning implementation assists in gaining a competitive advantage over others in the same business	64 (76.2)	2 (2.4)	18 (21.4)
Strategic planning affects sales growth and contributes significantly to the increase in profits of your business	57 (76.2)	3 (3.6)	24 (28.6)

From Table 3, the majority of the respondents (76.2%) agreed that strategic planning is relevant in small and medium-scale business operations, while a few respondents (23.8%) disagreed. Also, the majority of the SME owners (77.4%) agreed that strategic planning should be employed by all to achieve success. This was corroborated with agreement from a majority of the respondents (67.9%) to the fact that strategic management influences business positively by assisting in gaining a competitive advantage over others in the same business line (76.2%) and increasing sales growth as well as contributing significantly to increase in the profit level of those who applied it (76.2%).

Hypothesis Testing

Hypothesis One

H₀1: Strategic planning implementation does not significantly assist in gaining a competitive advantage.

To test this hypothesis, the respondents' responses to the section that seek to test this aspect were obtained and subjected to Chi-square test. A summary of the result is presented in Table 5.

Table 4: Significance of impact of strategic planning implementation on gaining competitive advantage

Strategic management	O	E	O-E	(O-E) ²	(O-E) ² /E	
Assist	64	42	22	484	11.52	
Does not assist		20	42	22	484	11.52
Total	84			x ²	23.04*	

Expected Frequency, E= 84/2 = 42.
x²tabulated = 3.84

* means significant at 5%
Level of significance = 0.05

The Table above shows that the value of x² calculated is greater than x² tabulated. Hence, the null hypothesis was rejected, which implies that strategic planning implementation assists in gaining a competitive advantage.

Hypothesis Two

H₀2: Strategic planning implementation does not significantly increase sales volume.

To test this hypothesis, the respondents' responses to the section that seek to test this aspect were obtained and subjected to chi-square test. A summary of the result is presented in Table 5.

Table 5: Influence of strategic planning implementation on Sales Volume

Strategic management	O	E	O-E	(O-E) ²	(O-E) ² /E
Increase sales	56	42	14	196	4.67
Does not increase	28	42	14	196	4.67
Total	84			x ²	9.34*

Expected Frequency, E= 84/2 = 42. * means significant at 5%

5. CONCLUSIONS AND RECOMMENDATIONS

This study shows that strategic planning implementation can go a long way in influencing small and medium-scale enterprises. It was discovered that there was a significant link between strategic planning implementation and organization efficiency. Generally, it was discovered that many small businesses never become large and many were unsuccessful, but with the adoption of strategic management practices, small businesses can grow and even become large. This contributes to the findings of Akande, Ireferin, and Oyebola, (2014). It is therefore recommended that individuals that may wish to start a new business imbibe a strategic management process to achieve the firm's vision and mission with an analysis of the firm's internal and external opportunities and threats for sustainable competitive advantage in our emerging economy.



The underlying concept of strategic planning implementation for small and medium firms was borne out of the constant failure of small and medium-scale businesses in Nigeria, which is why the researcher makes the following recommendations

- There should be a general overview of the organization's goals and objectives
- Small business owners should adopt a particular strategic plan to help manage the process of achieving internal efficiency for the desired quality of their business
- The link between strategic plan implementation and human resource management practices should be capitalized upon
- Communication is key in strategy implementation.

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IMPLICATION OF REVOCATION OF RIGHTS OF OCCUPANCY AND NON-PAYMENT OF COMPENSATION AT EBONYI STATE UNIVERSITY PERMANENT SITE

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ABSTRACT

The study analyzed the implication of revocation of rights of occupancy and non-payment of compensation at Ebonyi State University Permanent Site Land in Ebonyi State. It was glaring that changes in income levels families composition, farming practices as well as changes in land ownership structure gave rise to the problem of the study. In order to achieve the aim, the following objectives were derived; to identify the challenges facing the people of the communities, to examine the effects of revocation of rights of occupancy and non-payment compensation. Four research questions were formulated to guide this study. The survey research method was used. The use of a stratified random sampling method was adopted for this study. Questionnaire were formulated and distributed to the respondents. Data collected were presented with tables. Chi-square tests and percentages were used to analyze the data. A contingency table was used in testing the hypothesis. Some findings were made which include cases of omission of interest, incompetence, and haphazard assessment as well as inadequate payment of compensation. The following recommendations were made; that adequate compensation should be paid, that the omission of interest and haphazard assessment should be addressed, and also the purpose for every revocation must be strictly on overriding public interest.

Keywords: Land, Revocation, Rights of occupancy, Compensation

INTRODUCTION

The importance of land to man on Earth through all ages can hardly be overemphasized. It provides a platform on man's activities is predicated. It is however ironic that while the world population increases, the land in supply appears to be receding. Hence land never thought to be sufficiently available to meet the need of man in a society. The ownership of jealousy guarded against. For few available land to be equitably administered among the people and be maximally utilized there is need for a good land policy to be put in place for effective control and management of land in order to witness the desired development in the society. Umeh, (2001) states that whatever touches on land touches on the fabric of the society. Williams (1991) argues that land is a free gift of nature and as such, no person but government can claim exclusively or absolutely thereto. Osomo, (2004) remarks that if at the age of forty one does not have a house of his own, he is already at the threshold of poverty. It is obvious that the various standpoints as stated above are essentially indicative of the fact that land is the fulcrum of man's existence. It is globally recognized as a significant basic need of man alongside shelter and clothing. People rely on land for their physical environment, for the food they eat, for fibre and other materials needed to clothe their bodies and to provide housing and manufactured goods, for building sites, recreational opportunities, scenery and open space (Barlowe. 1978).

A respected family was one with plenty of landed property that prospective wives sought for suitors from such families as possession of land meant plenty of food and thus satisfaction against hunger (Mbadiwe 1998).



However, it was in 1986 that the Anambra State Government acquired a large parcel of land within Umuagara, Ntsurakpa and Ishieke communities in the present Ohaukwu and Ebonyi Local Government Areas for the development of Abakaliki Campus of the then Anambra State University of Science and Technology (ASUTECH). Following the creation of Ebonyi in 1996 and the subsequent establishment of the Ebonyi State University (EBSU), the Government started a fresh negotiation with the affected communities under the leadership of Dr. Sam Ominyi Egwu, the first executive Governor of Ebonyi State. This led to some adjustments, a fresh survey as well as the former Revocation Order published in the Daily Sun Newspaper on Monday, 30th May 2005. Consequent upon the former acquisition of Umuagara and Ntsurakpa communities and the commencement of some major structural development thereon, a team of Estate Surveyors and Valuers, Land Officers, and Field Enumerators from the Lands Department of the State Ministry of Lands, Survey and Urban Planning, Abakaliki was drafted to carry out inspection survey and enumeration of crops, economic trees as well as any other form of unexhausted improvement therein to assess the compensation payable to the affected persons. As a result of this revocation, there is a high rate come to the advantage of the opportunities being provided in terms of education, commerce, and employment and these have brought about an increase in demand on the existing properties at Umuagara and Ntsurakpa communities of Ohaukwu Local Government Area of Ebonyi State.

The revocation of rights of occupancy and compensation is anchored on the principle of reciprocation by which each party gives up something and gains another. The acquiring authority procures the land or property it requires and gives money by way of compensation while the victim loses his land or property in return for monetary compensation (or an alternative settlement).

The intention or expectation of this simple arrangement is that it will be transacted without inflicting much hardship on the people of Umuagara and Ntsurakpa communities where Ebonyi State University Permanent Site land is located. As this will enable government to embark meaningfully on those activities that will have overall effect of bettering the living condition of the generality of the people of Umuagara and Ntsurakpa communities.

However, the problem lies in the fact that the acquiring authority (government) prefers an arrangement where it will eat its cake and at the same time have it, as it often embarks on the revocation of land belonging to individuals without being prepared to live up to its billing in the mutual bargain by paying compensation as provided in the Act to cushion or assuage the hardship suffered as a result of that act by the affected person. Many residents from Umuagara and Ntsurakpa communities were homeless and stranded because some of them have not been paid are grossly inadequate that cannot get another settlement for their families. All their buildings in the University's permanent site land were demolished and the same people has gone to their relative's houses in the village to live with them to survive which was not what they expected during the time of revocation. This state of affairs appears to be prevalent in Nigeria by virtue of the 'Nigeria factor syndrome.

Land is the only visible legacy and indeed the last hope of every common man. It is, therefore, adorable to even think of dispossessing the communities without an adequate arrangement backed by the willingness to palliate the residents adequately not by putting them in a position similar to that in which they were before the acquisition but they bringing them to a position better than that which their ware before the acquisition.

Since the government is finding it too difficult to meet this essential consequence of the revocation of rights of occupancy and compensation by consistently showing that it lacks the will so to do so, the enabling legislation for the practice (Act) should accordingly be stopped so that the victims will not suffer.

Statement of the Problem

The practice of revocation of rights of occupancy and non-payment of compensation is not new to human society. Ordinarily, it should be a simple arrangement over generalization by which a party forfeits compulsorily his holdership of real property and in return gets either an alternative site for re-settlement or monetary term. It is thought that government can carry on effectively with its developmental obligation to the people and society; the people, particularly victims of revocation of rights of occupancy can conveniently carry on with normal live hood as if no revocation of rights of occupancy and nonpayment of compensation at Umuagara and Ntsarakpa communities are enormous. These challenges include a reduction in the agrarian land in the two communities that resulted in poverty and hunger for the residents. Also the increase in crime wave is serious concern to the people of Umuagara and Ntsarakpa communities because their children have engaged themselves in cultism, robbery, and stealing, raping and other social vices. However, another major cause of worry arising from the revocation of rights of occupancy is the inadequate payment of compensation to the affected individuals as well as the dispossession of individual land which made many landlords landless.

This is intending to identify areas of success and failure which are critical to finding out what needs to be done to ensure a better practice of revocation of rights occupancy and non-payment of compensation on Umuagara and Ntsurakpa communities of Ohaukwu Local Government Area of Ebonyi State.

Objective of the Study

The study aimed to analyze the implication of revocation of rights of occupancy and non-payment of compensation at Ebonyi state university's permanent site To achieve the aim, the following specific objectives were derived.

1. To identify the challenges facing the people of Umuagara and Ntsurakpa communities due to revocation of rights of occupancy and non-payment of compensation
2. To examine the effects of revocation of rights of occupancy and non-payment of compensation at Ebonyi State University Permanent Site Land on Umuagara and Ntsurakpa communities.
3. To examine the reasons for inadequate payment of compensation in Umuagara and Ntsurakpa communities.
4. To suggest measures that need to be taken towards improving the practice of revocation of rights of occupancy and non-payment of compensation in Ebonyi State

Research Hypotheses

For this study, the null hypothesis (Ho) was adopted.

Hypothesis 1: Revocation of rights of occupancy and non-payment of compensation has no significant effect on the Umuagara and Ntsurukpa communities of Ohakwu Local Government Area of Ebonyi State.

Hypothesis 2: Revocation of rights of occupancy and non-payment of compensation has significant effect on Umuagara and Ntsurukpa communities of Ohaukwu Local Government Area of Ebonyi State.

Methodology

The description survey design was adopted for this study and data collected for the study were primary and secondary data through questionnaires administered to the landowners. The study was carried out in Ebonyi State Land in Ohaukwu Local Government Area of Ebonyi State. The parcels of land are located at km. 16, along Abakaliki-Enugu Highway. The area is bounded between Ezzangbo Building Materials in Ohaukwu Local Government Area and Ishieke Junction in Ebonyi Local Government Area of Ebonyi State. The two communities playing host to the University are

Umuagara and Ntsurakpa communities in Ohaukwu Local Government Area of Ebonyi State. The parcel of land was acquired for the development of the permanent site of the Ebonyi State University, consisting Umuagara and Ntsurakpa communities respectively, in Ohaukwu Local Government Area. The parcel covers about 4/5th of the 380.952 hectares of land. These sectors comprised farmland and clusters of traditional settlements especially in Ntsurakpa sector/community. The affected parcels of land contain buildings and other structure improvements of varied descriptions such as kitchens yam bans, earth roads, and ponds as well as some scared objects such as gave yards, shrines, groves, woodlands, economic trees, and seasonal farm crops of varied species at different stage of growth/maturity.

The Population of the Study

The population of the study is made up of the following categories of people; Estate Surveyors and Valuers, Real Property Investors/Owners, Officials of the State Ministry of Lands, Survey and Urban Planning Abakaliki, Land Surveyors, Village Heads and Victims of Land acquisition from both Umuagara and Ntsurakpa communities in Ohaukwu Local Government Area. According to the information obtained from the Nigeria Institution of Estate Surveyors and Valuers Ebonyi State branch shows that the population of Estate Surveyors and Valuers in Ebonyi is 17. Also, the information gathered from Ohaukwu Town Planning Authority Ezzargbo shows that there are about 14 Real Property Investors/Owners. Similarly, the payroll department of the Ministry of Lands, Survey and Urban Planning Abakaliki shows that the Senior Staff of the State Ministry of Land Survey and Urban Planning is made up of 34 Staff. Also, the office of Survey General Ebonyi State Ministry of Land, Survey and Urban Planning Abakaliki shows that they are 16 Land Surveyors. According to the information obtained from the Traditional Rulers of both Umuagara and Ntsurakpa communities in Izhia shows that the village Heads and victims of Land acquisition are about 64 and 81 persons respectively.

Sample and Sampling Techniques

The study employed stratified random sampling techniques to select the population for the study

Table 1. Pattern of Selection of the Different Respondents

S/N	Categories of Respondents	Population	Sample Size
1	Estate surveyors and Valuers	17	17
2	Real property Investors/Owners	14	14
3	Senior Staff of State Ministry of Lands and Urban Planning, Abakaliki	34	34
4	Land surveyors	16	16
5	Traditional/ village Heads	64	64
6	Victims of Land Acquisition	81	81
	Total	226	226

Source: Field survey 2023.

Method of Data Analysis

Data collected in the course of this research work were presented in tables. Non-parametric statistics particularly, the chi-square (χ^2) test were used to analyze the data collected. The null hypotheses were tested with chi-square at 0.05 level of significance and the critical value methods respectively. The computation is based on the difference between the actual and expected values. The formula for the calculation of chi-square is given by:

$$\chi^2 = \frac{(f_{ij} - e_{ij})^2}{e_{ij}}$$

The critical value is a test statistics technique used in determining whether the sample statistics have fallen into the rejection or acceptance region. The formula for the degree of freedom is given by $(r-1)(c-1)$.

Results and Discussion

This section presents the questionnaire distribution to each respondent, the number returned, the number not returned and their percentage. The various responses were analyzed which include Registered Estate Surveyors and Valuers, Real property investors, Senior Staff of the State Ministry of the Lands and Urban Planning Abakaliki, Land Surveyors, Traditional/Village Heads, and Victims of Land Acquisition. A total of 226 questionnaires were distributed and details of the distribution are shown as follows:

Table 2: Responses on Questionnaire Distribution

√ Group	No Questionnaire Distributed	No Questionnaire returned	No Questionnaire not returned	Percentage of Returned Questionnaire	Percentage of Unreturned Questionnaire
Estate Surveyors and Valuers	17	16	1	94.12	5.88
Real Property Investors/owners	14	12	2	85.71	14.29
Senior Staff of State Ministry of Lands and Urban Planning Abakaliki	34	31	3	92.18	8.82
Land Surveyors	16	13	3	81.25	18.75
Traditional/village Heads	64	59	5	92.19	7.81
Victims of Land Acquisition	81	77	4	95.06	4.94
Total	226	208	18	92.04	7.96

Source: Field survey 2023.

Table 2 above indicates that 226 questionnaires were distributed to different respondents, out of which 208 questionnaires representing 92.04% were returned while 18 questionnaires representing 7.96% were not returned. It equally revealed the individual respondents level viz: 17 questionnaires were administered to Estate Surveyors and Valuers, 16 questionnaires representing 94.12% were returned while 1 questionnaire representing 5.88% was not returned. Also, 15 questionnaires were administered to Real Property Investors/owners, out of which 12 questionnaires representing 85.71% were returned while 2 questionnaire representing 14.29% were not returned. Again, 34 questionnaires were administered to the Senior Staff of the Ministry of Lands, Survey and Urban Planning Abakaliki, 31 questionnaires representing 92.18% were returned while 3 questionnaires representing 8.82% were not returned. 16 questionnaires were administered to Land Surveyors in the study area out of which 13 questionnaires representing 81.25 were returned while 3 questionnaires representing 18.17% were not returned. Likewise, 64 questionnaires were administered to Town planners, out of which 59 questionnaires representing 92.19% were returned while 5 questionnaires representing 7.81% were not returned and 81 questionnaires were administered to Victims of land acquisition, out of which, 77 questionnaires representing 95.06% were returned while 4 questionnaires representing 4.94% were not returned.

Finally, this infers that a good number of people responded to the question distributed to them. And this will equally help the researcher to achieve a good result.'

Research Question 2: The effect of revocation of rights of occupancy and nonpayment of compensation at Ebonyi State University Permanent site land on Umuagara and Ntsurakpa communities. In this section, the researcher tries to find out the effects of the revocation of rights of occupancy and compensation for Ebonyi State University's permanent site land on Umuagara and Ntsurakpa communities. The questionnaire was distributed in regards to the question to know the responses of the respondents in the study area and their opinions were presented in table 6 below.

Table 3: Responses of the Respondents on the Effects of Revocation of Rights of Occupancy and Non-payment of Compensation at Ebonyi State University Permanent Site Land on Umuagara and Ntsurakpa communities.

Response	Estate Surveyors	Real Property Investor	Senior staff of min. of land	Land Surveyors	Village Heads	Victims of Land Acquisition	Total	%
The revocation was excellent	5	2	5	2	7	11	32	15.39
Good	8	7	19	7	43	41	125	60.09
Fair	3	3	7	4	9	25	51	24.52
Total	16	12	31	13	59	77	208	100

Source: Field survey 2023.

Table 3 indicates that out of 208 questionnaires returned from the respondents on the effects of revocation of the rights of occupancy and non-payment of compensation for Ebonyi State University Permanent Site land on Umuagara and Ntsurakpa communities, 32 respondents representing 15.39% believed that the revocation of rights of occupancy in Umuagara and Ntsurakpa communities was good because it brought a lot of development in the community, 125 respondents representing 60.09% viewed that the revocation was excellently well because both the communities and the benefit in term of Education, development, etc. While 51 respondents representing 24.52% believed that the revocation was fair stressing that they lost some of their properties and other valuable things that would have sustained them.

The above table infers that revocation of rights of occupancy and non-payment of compensation for Ebonyi State University Permanent Site Land on Umuagara and Ntsurakpa communities has recorded a great success in Ebonyi State with the largest number of 125 respondents representing 60.09% of the sample.

Test of Hypotheses

The researcher used the chi-square method in testing the formulated hypothesis

H₀: Revocation of rights of occupancy and non-payment of compensation has no significant effect on the Umuagara and Ntsuruakpa communities of Ohaukwu Local Government Area of Ebonyi State.

H₁: Revocation of rights of occupancy and non-payment of compensation has a significant effect on the Umuagara and Ntsuruakpa communities of Ohaukwu Local Government Area of Ebonyi State.

Having established the opinion of the respondents on the Effects of revocation of rights of occupancy and non-payment of compensation at Ebonyi State University Permanent Site Land on Umuagara and Ntsurakpa Communities, the table 3 was used to test the significance of the hypothesis. See the contingency table for computation of Chi-square Test value below.

Applying the chi-square formula,

$$X^2 = \frac{(f_{ij} - e_{ij})^2}{e_{ij}}$$

Table 4: Contingency Table for Computation of Chi-square (χ^2) Real Estate Surveyors.

Responses options	Observed frequency	Expected frequency	(Oij -Eij)	(Oij - Eij) ²	$\frac{(Oij - Eij)^2}{Eij}$
The revocation was excellent	5	2.46	2.54	6.4516	2.623
Good	8	9.62	-6.62	2.6244	0.273
Fair	3	3.92	-0.92	0.8464	0.216
Total	16	16			3.111

Source: Field survey 2023.

For Expected Value in each cell = $\frac{RT \times CT}{GT}$

Cell A: (i) $\frac{16 \times 32}{208} = 2.46$ (ii) $\frac{16 \times 125}{208} = 9.62$ (iii) $\frac{16 \times 51}{208} = 3.92$

$$\begin{aligned}
 X^2 &= \frac{\sum(O-E)^2}{E} = \frac{(5-2.46)^2}{2.46} + \frac{(8-9.62)^2}{9.62} + \frac{(3-3.92)^2}{3.92} \\
 &= \frac{(2.54)^2}{2.46} + \frac{(1.62)^2}{9.62} + \frac{(-0.92)^2}{3.92} \\
 &= 2.623 + 0.273 + 0.216 \\
 &= 3.111
 \end{aligned}$$

Table 5: Contingency Table for Computation of Chi-Square (χ^2) Real Property Investors

Responses options	Observed frequency	Expected frequency	(Oij -Eij)	(Oij - Eij) ²	$\frac{(Oij - Eij)^2}{Eij}$
The revocation was excellent	2	1.85	0.15	0.0225	0.012
Good	7	7.21	-0.21	0.0441	0.006
Fair	3	2.94	0.06	0.0036	0.001
Total	12	12			0.019

Source: Field survey 2023.

$$\begin{aligned} \text{Cell A} &= \text{(i)} \frac{12 \times 32}{208} = 1.85 \quad \text{(ii)} \frac{12 \times 125}{208} = 7.21 \quad \text{(iii)} \frac{12 \times 51}{208} = 2.94 \\ X^2 &= \frac{\sum(O-E)^2}{E} = \frac{(2-1.85)^2}{1.85} + \frac{(7-7.21)^2}{7.21} + \frac{(3-2.94)^2}{2.94} \\ &= \frac{(0.15)^2}{1.85} + \frac{(-0.21)^2}{7.21} + \frac{(0.06)^2}{2.94} \\ &= 0.012 + 0.006 + 0.001 \\ &= 0.019 \end{aligned}$$

Table 6: Contingency Table for Computation of Chi-Square (X^2) Senior Staff of Ministry of Land

Responses options	Observed frequency	Expected frequency	(Oij - Eij)	(Oij - Eij) ²	$\frac{(Oij - Eij)^2}{Eij}$
The revocation was excellent	5	4.77	0.23	0.0529	0.011
Good	19	18.13	0.87	0.7569	0.042
Fair	7	7.60	-0.60	0.36	0.047
Total	31	31			0.10

Source: Field survey 2023.

$$\begin{aligned} \text{Cell A} &= \text{(i)} \frac{31 \times 32}{208} = 4.77 \quad \text{(ii)} \frac{31 \times 125}{208} = 18.13 \quad \text{(iii)} \frac{31 \times 51}{208} = 7.60 \\ X^2 &= \frac{\sum(O-E)^2}{E} = \frac{(5-4.77)^2}{4.77} + \frac{(19-18.13)^2}{18.13} + \frac{(7-7.60)^2}{7.60} \\ &= \frac{(0.23)^2}{4.77} + \frac{(0.87)^2}{18.13} + \frac{(-0.6)^2}{7.60} \\ &= 0.011 + 0.047 + 0.047 \\ &= 0.1 \end{aligned}$$

Table 7: Contingency Table for Computation of Chi-Square (X^2) Land Surveyors

Responses options	Observed frequency	Expected frequency	(Oij - Eij)	(Oij - Eij) ²	$\frac{(Oij - Eij)^2}{Eij}$
The revocation was excellent	2	2	0	0	0
Good	7	7.81	-0.81	0.6561	0.084
Fair	4	3.19	0.81	0.6561	0.206
Total	13	13			0.29

Source: Field survey 2023.

$$\begin{aligned}
 \text{Cell A} &= \text{(i)} \frac{13 \times 32}{208} = 2 \quad \text{(ii)} \frac{13 \times 125}{208} = 7.81 \quad \text{(iii)} \frac{13 \times 51}{208} = 3.19 \\
 X^2 &= \frac{\sum(O-E)^2}{E} = \frac{(2-2)^2}{2} + \frac{(7-7.81)^2}{7.81} + \frac{(4-3.19)^2}{3.19} \\
 &= \frac{(-0)^2}{2} + \frac{(-0.81)^2}{7.81} + \frac{(0.6)^2}{3.19} \\
 &= 0 + 0.084 + 0.206 \\
 &= 0.29
 \end{aligned}$$

Table 8: Contingency Table for Computation of Chi-Square (X^2) Village Heads

Responses options	Observed frequency	Expected frequency	(Oij –Eij)	(Oij – Eij) ²	$\frac{(Oij - Eij)^2}{Eij}$
The revocation was excellent	7	9.08	-2.08	4.3264	0.477
Good	43	35.46	7.54	56.8516	1.603
Fair	9	14.46	-5.46	29.8116	2.062
Total	59	59			4.142

Source: Field survey 2023.

$$\begin{aligned}
 \text{Cell A} &= \text{(i)} \frac{59 \times 32}{208} = 9.08 \quad \text{(ii)} \frac{59 \times 125}{208} = 35.46 \quad \text{(iii)} \frac{59 \times 51}{208} = 14.46 \\
 X^2 &= \frac{\sum(O-E)^2}{E} = \frac{(7-9.08)^2}{9.08} + \frac{(43-35.46)^2}{35.46} + \frac{(9-14.46)^2}{14.46} \\
 &= \frac{(-2.08)^2}{9.08} + \frac{(7.54)^2}{35.46} + \frac{(-5.46)^2}{14.46} \\
 &= 0.477 + 1.603 + 2.062 \\
 &= 4.142
 \end{aligned}$$

Table 9: Contingency Table for Computation of Chi-Square (X^2) Legal Practitioners

Responses options	Observed frequency	Expected frequency	(Oij –Eij)	(Oij – Eij) ²	$\frac{(Oij - Eij)^2}{Eij}$
The revocation was excellent	11	11.85	0.85	0.7225	0.061
Good	41	46.27	-5.27	27.7729	0.600
Fair	25	18.88	6.12	37.4544	1.984
Total	77	77			2.645

Source: Field survey 2023.



$$\begin{aligned}
 \text{Cell A} &= \text{(i)} \frac{77 \times 32}{208} = 11.85 \quad \text{(ii)} \frac{77 \times 125}{208} = 46.27 \quad \text{(iii)} \frac{77 \times 51}{208} = 18.88 \\
 X^2 &= \frac{\sum(O-E)^2}{E} = \frac{(11-11.85)^2}{11.85} + \frac{(41-46.27)^2}{46.27} + \frac{(25-18.88)^2}{18.88} \\
 &= \frac{(-2.08)^2}{1.85} + \frac{(-5.27)^2}{46.27} + \frac{(-6.12)^2}{18.88} \\
 &= 0.061 + 0.600 + 1.984 \\
 &= 2.645
 \end{aligned}$$

Therefore; the calculated chi-square value
 = 7.8361 + 4.932 + 3.5144 + 4.7872
 = 21.0697 or 21.1

Level of significance of 5% (0.05)

The degree of freedom from the Chi-square table is given as (N-1) (K-1)

$$\begin{aligned}
 df &= (4-1)(5-1) \\
 &= (3)(4) \\
 &= 3 \times 4 \\
 &= 12
 \end{aligned}$$

Therefore; the chi-square (X^2) table value at 12 degrees of freedom in 5% level of significance = 21.026

Calculated Chi-square value (X^2) = 21.1

Chi-square (X^2) table value = 21.026.

Decision Rule

Accept H_0 , if the chi-square table valve > then calculated the chi-square valve.

Reject H_0 if calculated chi-square valve > than chi-square table valve.

Since the chi-square table value (21.026) is less than the chi-square table value (21.1), we therefore reject H_0 and uphold H_1 which states that the revocation of rights of occupancy and non-payment of compensation has a significant effect on Umuagara and Ntsurukpa communities of Ohaukwu Local Government Area of Ebonyi State.

CONCLUSION

It is true that in a state where individuals have property rights in land, the government can only have access to land for public purposes through the exercise of the power of eminent domain. This power in the case of Nigeria has been given legal backing by the Land Use Act.

However, the provision of this Act on the revocation of rights of occupancy and compensation arising there is far from being fair and adequate as the case of valuation of interests acquired at Umuagara and Ntsurakpa communities. The problem is accentuated when the provision of the Act is implemented by competent personnel. This situation places the landowner in an abysmally disadvantaged position after the acquisition, as the interest value of his land especially when valuation experts were not involved. Thus, there is a growing need to renew the provisions of the Land Use Act on compensation to reflect the true worth of the loss suffered by an interest holder in the event of revocation of rights of occupancy as well as greater involvement of land valuation experts on all revocation of rights of occupancy and compensation exercise.

It is incorrect to assume that the Land Use Act has transferred ownership of land to the Governor of a State in Nigeria. It is argued that the natives could not claim any interest in any other beyond their occupation because such interest has been lost under section 1 of the Land Use Act, which provides that subject to the provisions of this act, all land comprised in the Territory of each State in the



Federation are hereby vested in the government of that State and such land shall be held in trust and administered for the use and common benefits of all Nigeria.

Recommendations

From the foregoing, it is apparent that some glaring lapses were inherent in the revocation of rights of occupancy and non-payment of compensation at the Umuagara and Ntsurakpa communities of Ohaukwu Local Government Area of Ebonyi State. In the face of such lapses and concerning the practice of the provision of the Land Use Act on the revocation of rights of occupancy, the following recommendations are made.

That the land officers should ensure that cases of omission of interest and haphazard assessment during compensation should be addressed.

That the displaced person should be resettled as of right and where claimants are willing to accept alternative houses, Government should advance loans or provides an enabling environment for the claimants to achieve their desire. The Nigeria Government should borrow a leaf from the developed and even some developing countries where the practice of revocation of rights of occupancy and compensation is being professionalized. By so doing, the government can engage the services of Estate Surveyors and value firms to negotiate and procure land on its behalf at a fee whenever it requires land for any purpose. This will have the effect of making land acquisition conflict-free, fair and prompt.

That there should be a radical harmonization of all conflicting laws on compulsory acquisition and compensation as this will enhance the building of a logical and sound valuation basis that would ensure that a person deprived of his property through acquisition is entitled to no more and not less than what he is deprived and should be adequately compensation.

That serious attention be given to the assessment of compensation payable for shrines, graves, and sacred grounds, animal traps to avoid denying claimants their legitimate rights.

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PREDICTING SURVIVAL TIME OF VICTIMS OF BRAIN TUMOR WITH ASSOCIATED RISK FACTORS IN OSUN STATE, NIGERIA.

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ABSTRACT

This paper assessed the length of life of patients and prognostic factors associated with the survival of brain tumour victims in Osun State, Nigeria. Data used were taken from patients' medical records on gender, age, status (survived or dead), admission, and discharge dates of brain tumours victims in Uniosun Teaching Hospital Osogbo, Osun State, from 2003 to 2022. Kaplan-Meier curve showed that $< 80\%$ of the brain tumor victims have a survival time of 210 days, there is more death in female patients than the male and 50% of the females have a survival time of 210 days whereas the males have no event but are censored. 15 out of 20 patients admitted survived brain tumour ailment with a median estimate of 405 days on an average of 50%. In Categorical Variable Coding of the hazard ratio, p -values > 0.05 and the effect of age on victims is insignificant but the chances of teenagers, youths, and adult dying compared to children are 88%, 91%, and 88% respectively while females with a brain tumour have 88% of dying compared to the males. Overall $< \alpha = 0.05$ son of the victim's model coefficients is significant and best for predicting (p -value (0.006) as well as the chi-square distribution.

Keywords: Time-to-event, Brain tumour, Censoring, Kaplan Meier, Survival

1. BACKGROUND OF THE STUDY

Cancer is one of the main causes of death worldwide and many treatments have been developed, such as chemotherapy, surgery, and radiation therapy. Tumour cells are abnormal cells that are classified into benign and malignant. The benign tumours do not invade the normal tissue, while the malignant tumor invades and can spread around the body (Cooper, 2000). Malignant tumours are cancerous tumours and they have a growth rate much faster than normal cells.

Brain tumors are serious health problems that can have a significant impact on the lives of patients and their families. In Osun State, Nigeria, the incidence of brain tumors is relatively low compared to developed countries, but the survival rate is also lower.

Brain tumours can be categorized as primary and secondary. Primary brain tumors originate in the brain itself and are less common than secondary brain tumours. Secondary brain tumours are metastatic tumours that originate in other parts of the body and have spread to the brain. Tumours in the brain can be benign or malignant. A brain tumour can occur at any age and certain risk factors like exposure to ionizing radiation and family history of brain tumours play an important role.

Surgery is the primary option for the treatment of a brain tumour. In this operation, the surgeon removes a part or all of the tumours from the brain. It may be combined with chemotherapy or radiation therapy to effectively destroy tumour cells. The surgery is conducted by a neurosurgeon along with a multidisciplinary team including neurologists, medical and other specialists like paediatrics oncologists, and radiation oncologists depending on the patient's condition and age.

Brain tumour surgery is a major operation and should be performed at a recognized medical facility that has the necessary infrastructure and surgical equipment. The hospitals in Nigeria lack appropriate technological support and do not have qualified doctors for complex procedures like brain tumour surgery. As the medical facilities in the country are not as advanced as many other countries and most patients prefer to travel abroad for their treatment. India ranks amongst the top medical tourism destinations of the world and a large number of Nigerian patients visit India on a

medical tourist visa for all kinds of health procedures like cancer treatment, cardiology problems, neurological disorders, kidney transplant, enlarged prostate, and many others. The brain surgery cost in India is lower than in many other countries with equally good services and excellent brain tumour surgery success rates. The overall cost of treatment in India is highly affordable even after including the expense of travel, accommodation, and other logistics.

Statement of the Problem

Brain tumors are a serious medical condition that can have a devastating impact on patients and their families. The survival time for brain tumor patients varies widely, depending on the type of tumor, the stage of the disease, and the patient's overall health. In Nigeria, the survival time for brain tumor patients is generally lower than in other parts of the world.

Justification of the Study

This study is justified by the need to better understand the factors that affect the survival time of brain tumor patients in Osun State, Nigeria. By identifying these factors, we can develop targeted interventions to improve the survival time of these patients.

Significance of the Study

This study would be significant for many reasons: (i) First, it would provide much-needed information about the factors that affect the survival time of brain tumor patients in Osun State, Nigeria. This information could be used to develop targeted interventions to improve the survival time of these patients. (ii) Second, this study would help to raise awareness of the issue of brain tumors in Nigeria. This could lead to increased funding for research into brain tumors and improved access to care for brain tumor patients. (iii) Third, this study would contribute to the body of knowledge about brain tumors. This knowledge could be used to improve the care of brain tumor patients around the world.

Aim: This paper assessed the length of life of patients and prognostic factors associated with the survival of brain tumours victims in Osun State, Nigeria.

The specific objectives of this paper are to

- (a) estimate the survival time of victims with brain tumours.
- (b) estimate mean and median time of survival.
- (c) assess the association of and impact of covariates (risk factors) on event status and survival time estimate survival time of victims with brain tumours.

2. LITERATURE REVIEWS

Brain tumours (BT) refer to a mixed group of neoplasms originating from intracranial tissues. There are two basic types of brain tumours: primary and metastatic brain tumours. Primary brain tumours originate and remain in the brain. Metastatic brain tumours originate from other organs in the body and spread to the brain. Primary brain tumours could equally be termed benign or malignant, depending on their ability to invade surrounding tissue. In 2015, the world annual incidence of primary brain tumour was estimated at 3.7 and 2.6 per 100,000 men and women, respectively, with a higher rate in developed (5.1/100,000) than developing countries (3.0/100,000). In African countries, little research has been conducted on the incidence of brain tumours. Davies in 1965 estimated central nervous system (CNS) tumours to represent 1.1% of all cancers registered in Uganda. A higher incidence was reported in a hospital-based cancer registry from 2009 to 2010 in Nigeria, where brain cancer represented 3.9% of total cancers.

There are a few rare, inherited genetic syndromes that are associated with brain tumours, including Neurofibromatosis 1 (NF1 gene), Neurofibromatosis 2 (NF2 gene), Turcot syndrome (APC gene), Gorlin syndrome (PTCH gene), Tuberous Sclerosis (TSC1 TSC2 genes) and Li-Fraumeni syndrome (TP53 gene). Although 5-10% of persons with brain tumours have a family history of a brain tumour, the vast majority of CNS tumours appear not to be a part of inherited genetic syndromes (Wrensch,

1997). Several studies have identified genetic variants that may be associated with an increased risk of certain brain tumours including glioma and meningioma. One such study is Gliogene, a study that was started in 2004 to find a familial link in brain cancer. A study from 2017 shows that while there are some hereditary similarities in glioma tumours between family members, there is not a statistically significant difference between families having tumours with similar hereditary features as compared to families with tumours having different hereditary features. Also, in families with more than one glioma, the tumours tend to have the same molecular markers.

In Africa, Davies's (1965) study was conducted in Uganda and found that the incidence of brain tumours was 1.1% of all cancers diagnosed in the country. The most common type of brain tumour was a meningioma, followed by a glioma and pituitary tumour. The average survival time for patients with brain tumours was 10 months. Eyenga *et al.* (2016) study was conducted in Douala, Cameroon, and found that the incidence of brain tumours was 2.6% of all cancers diagnosed in the city. The most common type of brain tumour was a meningioma, followed by a glioma and pituitary tumour. The average survival time for patients with brain tumours was 12 months.

In Nigeria, Soyemi and Oyewole's (2015) study was conducted in Nigeria and found that the incidence of brain tumours was 3.9% of all cancers diagnosed in the country. The most common type of brain tumour was a glioma, followed by meningioma and pituitary tumour. The average survival time for patients with brain tumours was 12 months. Soyemi and Oyewole (2015) observed that the peak age group for intracranial tumours in adults was 25–30 years. Owolabi *et al.* (2022) conducted research on brain cancer in Nigeria and found that the incidence of brain tumours was 4.1% of all cancers diagnosed in the country. The most common type of brain tumour was a glioma, followed by meningioma and pituitary tumour. The average survival time for patients with brain tumours was 12 months. Also, Adekunle *et al.* (2023) observed in their study conducted that the most common risk factors for brain tumours in Nigeria were exposure to ionizing radiation, family history of brain tumours, and genetic mutations. The study also found that the incidence of brain tumours in Nigeria is increasing and that this increase is likely due to a combination of factors, including environmental pollution, diet, and lifestyle. Idowu *et al.* (2023) found that the average age of diagnosis for brain tumours in the country is 45 years old. The study also found that the most common symptoms of brain tumours in Nigeria are headache, nausea and vomiting, seizures, and vision problems.

3. METHODOLOGY

The data used were taken from patients' medical records on gender, age, and status of victims (survived or dead), admission, and discharge dates of brain tumours victims in Uniosun Teaching Hospital Osogbo, Osun State, from 2003 to 2022.

Time-to-event models, commonly known as survival or reliability model, have been studied and applied in a variety of scientific disciplines such as medicine, biology, engineering, and business. Cox proportional hazards model is one of the most commonly used nonparametric/semi-parametric models; it does not require any specific assumption about the shape of the survival function. However, it usually does not provide a very good fit for the data through the simulation studies. On the other hand, if the assumption for parametric distribution is met for the data under consideration, it will be more efficient and easier to interpret estimates than nonparametric/semi-parametric models. Some well-established parametric models, such as Weibull, log-normal and log-logistic models have been widely used to model the time to event data in many applications.

Kaplan-Meier curve

Kaplan-Meier curve was used to estimate the survival time of the brain tumor victims. It estimates the survival chance at a specific time, which is given in the following models and associated standard error in model **:

$$S(t_{j+1}) = \prod_{j=1}^k \left(1 - \frac{d_j}{n_j} \right) \tag{1}$$

$$S(t) = \sqrt{\sum_{j=1}^k \frac{d_j}{n_j(n_j-d_j)}} \tag{2}$$

To compare the significance of two survival curves we use the **Tarone-Ware** approach as follows:

$$(T) = \frac{U^2}{V} \sim \chi^2(1) \tag{3}$$

$$U = \sum_{j=1}^m \sqrt{n_j} (d_j^A - e_j^A) \tag{4}$$

$$\text{while } V = \text{var}(U) = \sum_{j=1}^M \frac{n_j^2 n_j^B d_j (n_j - d_j)}{n_j (n_j - 1)} \tag{5}$$

Variables considered in survival analysis are:

- (a) Serial time: This is the duration of known survival which is terminated by the event of interest. This is graphed as a horizontal line
- (b) Status at the end of their serial time: This is the event of interest which can either be death or alive
- (c) The study group they are in: These are groups to which the subjects under study belong. to

Why censoring in survival analysis?

- (a) This happens when something negative happens such as: (a) Subject under study drops out. (b) The subject is lost to follow-up. (c) Required data are unavailable
- (b) This happens when something good happens such as the study ends before the subject had the event of interest occur i.e., they survived at least until the end of the study, but there is no knowledge of what happened thereafter. Censoring occurs within the study or terminally at the end.

The lengths of horizontal lines along the x-axis of Kaplan Meier survival curves of serial times represent the survival duration for that interval. The interval is terminated by the occurrence of the event of interest while the vertical lines are just for cosmesis; they make the curve more pleasing to observe. The vertical distances between horizontals illustrate the change in cumulative time probability as the curve advances. The non-continuous nature of the curve emphasizes that they are not smooth functions but rather step-wise estimates; thus, calculating a point survival can be difficult. The steepness of the curve is determined by the survival duration (length of horizontal lines).

Cox Regression (or proportional hazards regression): The coefficients in a Cox regression relate to hazard; a positive coefficient indicates a worse prognosis and a negative coefficient indicates a protective effect of the variable with which it is associated.

4. DISCUSSION OF RESULTS
KAPLAN-MEIER ANALYSIS

Total N	N of Events	Censored N	Percent
20	5	15	75.0%

Table 2: Means and Medians for Survival Time

Mean ^a				Median			
Estimate	Std. Error	95% Interval Lower Bound	Confidence Upper Bound	Estimate	Std. Error	95% Interval Lower Bound	Confidence Upper Bound
334.495	35.795	264.336	404.653	416.000	131.282	158.687	673.313

a. Estimation is limited to the largest survival time if it is censored.

Fig 1: KAPLAN-MEIER CURVE OF BRAIN TUMOUR VICTIMS

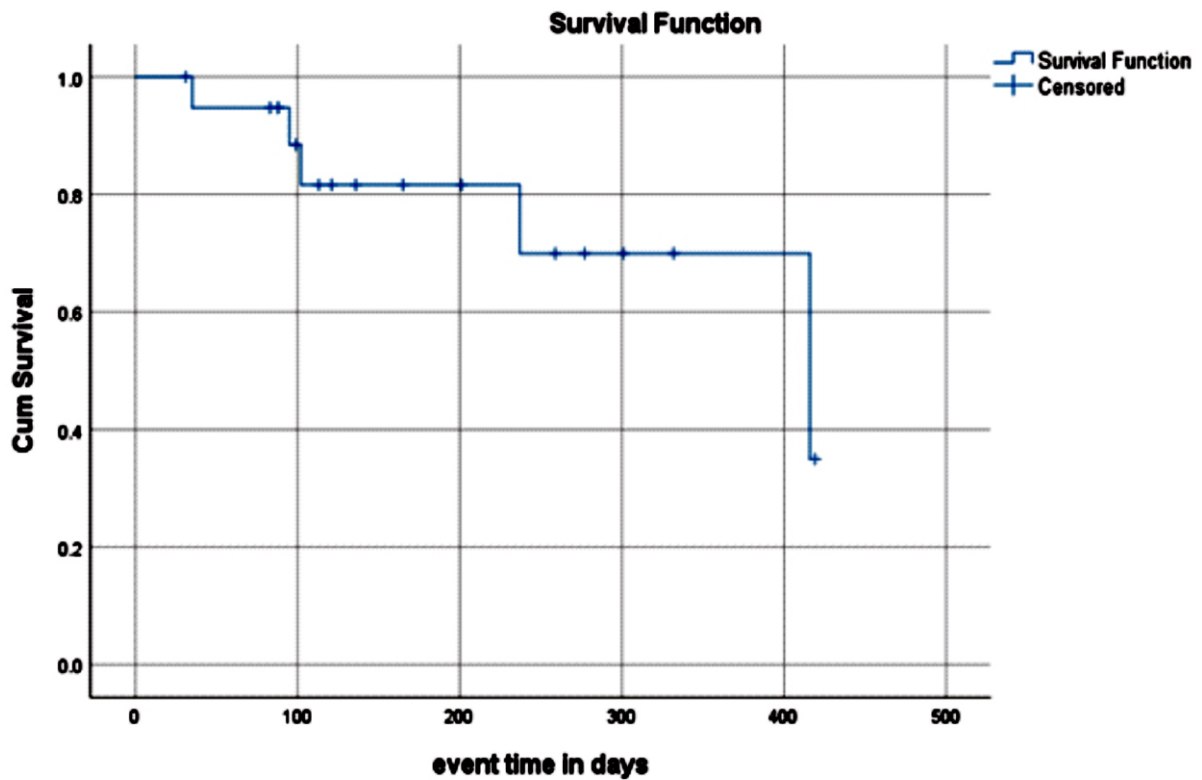


Fig 1: KAPLAN-MEIER CURVE OF BRAIN TUMOUR VICTIMS

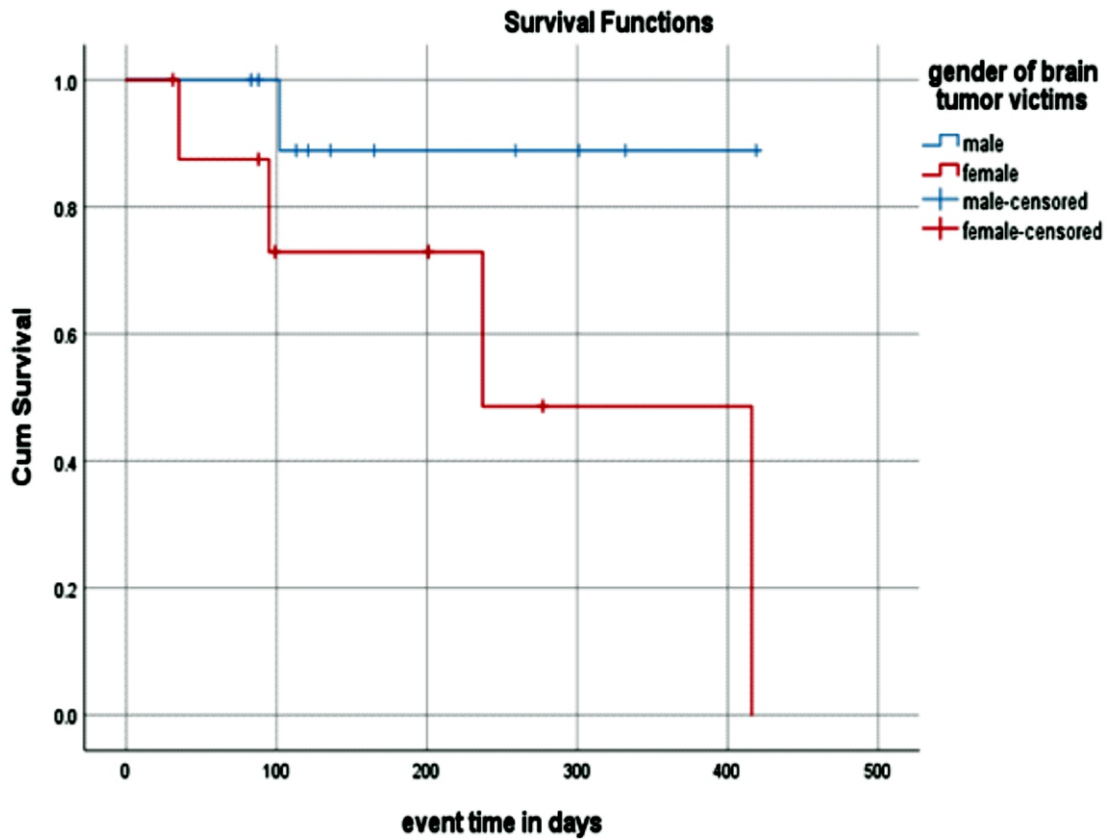


Fig 2: KAPLAN-MEIER CURVE OVER GENDER CATEGORIES

COX REGRESSION

Table 3: Categorical Variable Codings^{a,c}

gender of brain tumour victims	1=male	2=female	Frequency	(1)	(2)	(3)
			11	0		
			9	1		
age of brain tumour victims	1.00=<=12 (children)	years	6	0	0	0
	2.00=13-19 (teenagers)		4	1	0	0
	3.00=20-40 (youth)		4	0	1	0
	4.00=>40 adults		6	0	0	1

a. Category variable: gender of brain tumour victims (sex)

b. Indicator Parameter Coding

c. Category variable: age of brain tumour victims (age)

Admission date	Discharged date	Gender	Age	Status
19.02.2003	14.10.2003	Female	24.00	Death
02.05.2007	31.08.2007	Male	2.00	Alive
09.10.2008	25.06.2009	Male	13.00	Alive
11.03.2009	23.08.2009	male	35.00	Alive
05.12.2009	03.03.2010	female	6.00	Alive
20.01.2012	20.02.2012	female	50.00	Alive
12.03.2011	01.05.2012	female	7.00	Death
04.04.2011	27.05.2012	male	37.00	Alive
19.02.2012	16.01.2013	male	4.00	Alive
05.09.2012	09.06.2013	female	2.00	Alive
12.08.2012	09.06.2013	male	4.00	Alive
03.02.2014	09.05.2014	female	53.00	Death
14.04.2014	19.05.2014	female	17.00	Death
18.03.2014	09.06.2014	male	37.00	Alive
04.03.2021	18.07.2021	male	52.00	Alive
18.10.2021	14.01.2022	male	71.00	Alive
12.11.2021	22.02.2022	male	71.00	Death
09.12.2021	18.03.2022	female	15.00	Alive
21.01.2022	14.05.2022	male	71.00	Alive
05.02.2022	25.08.2022	female	5.00	Alive

4.1 SUMMARY OF RESULTS

The dependent variable in this study is the survival time data (T) of victims with a brain tumour. Survival time (T) is when patients who have brain tumour undergo treatment at Unioson Teaching Hospital Osogbo until the patient is declared dead, stopped or moved on treatment, survives, or lives in units of the day.

The provisions of the survival time (T) are as follows.

- (a) The time origin is when the initial patient enters the hospital for hospitalization due to a brain tumour.
- (b) Failure (failure event) is a condition when a victim with a brain tumor is declared dead.
- (c) The measurement scale of this study is in units of days. Patient status (D) is the occurrence or failure of a failure event that is dead during the study period.
- (d) Patient status $d = 1$, is censored data. It happens if the patient has not experienced a failure event until the study ends, stops, or changes treatment. Patient status (d) is the occurrence or failure of a failure event that is dead during the study period.
- (e) Patient status $d = 2$, is event or uncensored data. It happens if a brain tumor patient experiences a failure event, which is death.

Interpretation of Tables and Graphs

Table 1 above describes the available data collected for this research which includes: the age of patients, gender of patients, admission date of patients, discharge date of patients, and the status of events i.e., survive (15) and non-survive (5) of twenty patients who were victims of a brain tumour at Uniosun Teaching Hospital Osogbo, Osun State.

Table 2 shows the means and medians for Survival Time of the brain tumour victims under study with an estimate of 416 days when using the median estimate. Averagely, 50% of the brain tumour's victims survive in 416 days.

The Kaplan-Meier curve of brain tumour victim's Fig 1, revealed the distribution of the data as censored with the (+) sign on the stair of the graph while the vertical lines showcased the event (death) that occurred. Less than 80% of the victim has a survival time of 210 days. On the other hand, fig 2 Kaplan-Meier curve over gender categories shows there are more deaths in female patients compared to that of male where 50% of the female has a survival time of 210 days whereas the males have no event (death) but are censored.

Table 3 revealed Categorical Variable Coding which assesses the relationship between survival times of the risk factors (gender and age group) where a female is considered about the male and other age groups are considered about age group less than 12 years. The Exp(B) column shows the hazard ratio, the age has no significant effect same as gender on the survival time of the brain tumour victims since the sig values i.e., the p-values are greater than the alpha level of 0.05 or when the lower and upper limits contain 1. Although, the effect of age on victims is non-significant the chances of teenagers, youths, and adult dying compared to children are 88%, 91%, and 88% respectively. The females with a brain tumour have 88% dying compared to the males.

Table 5 showed the overall comparison of the victim's model coefficients is statistically significant and best for predicting since the p-value (0.006) is less than the alpha level = 0.05 same as the chi-square distribution.

5. CONCLUSION

Survival analysis has essential importance for brain tumours to assess the length of life of patients and prognostic factors associated with the survival of brain tumours victims in Uniosun Teaching Hospital Osogbo, Osun State. However, the following conclusions are drawn based on the results provided above:

- (a) The study found that the median survival time for brain tumor victims was 416 days. This means that 50% of the victims survived for at least 416 days. The Kaplan-Meier curve showed that less than 80% of the victims survived for 210 days.
- (b) The study also found that gender and age group were not significant predictors of survival time. However, the chances of death were higher for teenagers, youths, and adults compared to children. The females with brain tumors also had a higher chance of death than the males.
- (c) The overall model was statistically significant and best for predicting survival time. This means that the factors included in the model were able to explain a significant

6. RECOMMENDATIONS

The following recommendations based on this study should be looked into:

1. Workshops /awareness on early diagnosis of patients with tumours relating to the brain should be made available for the populace by the government through seminars and regular check-ups.
2. Treatments given to victims of brain tumour patients in Uniosun Teaching Hospital Osogbo should be improved or new interventions should be sourced to increase the survival time of patients with brain tumours visiting the hospital.



3. Government should assist in arming hospitals with advanced interventions and diagnostic tools which would be used in treating brain tumor victims.
4. Some of the patient's medical records did not have all the required risk factors needed for this study; hence we are limited by only the information at our disposal. Development of this study with more risk factors is advised.

7. FURTHER STUDY

Further research is needed to identify other factors that may affect the survival time of brain tumour victims.

Acknowledgment:

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EFFECT OF MONITORING AND EVALUATION PRACTICES ON CONSTRUCTION PROJECTS' COST IN OSUN STATE

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ABSTRACT

Construction project monitoring and evaluation is a vital component of project management. The paper examined the effect of monitoring and evaluation practices on construction projects delivery (cost) in Osun State. Questionnaires were designed to meet the research objectives and to test its hypotheses and were administered to construction professionals working with the state government in the ministry of works as well as construction professionals working with contractors that handled/ (were handling) construction projects in the state. The questionnaires were analyzed using descriptive and inferential statistics and deductions derived from the analysis. The results showed that there is a strong positive relationship between monitoring and evaluation practices and project cost. The hypotheses were tested and the test revealed that M & E Practices have significant impact on construction project cost. The study revealed that a unit increase in X1, X2, X3 and X4 causes Y (Project delivery defined by cost, to increase by -0.047, 0.062, 0.036 and 0.206 respectively. The study concluded that M & E practices have significant impact on construction project cost in the study area. The study recommended that construction projects staff should be trained in order to equip them with technical expertise necessary to carry out monitoring and evaluation to ensure timely completion of construction projects. The study further recommended that construction stakeholders' feedback should be well captured and analyzed for implementation of effective monitoring and evaluation

Keywords: *Monitoring, Evaluation, Monitoring and Evaluation practices, Construction, Projects*

INTRODUCTION

Monitoring and evaluation (M&E) is described as a process that assists project managers in improving performance and achieving results. According to United Nations Development Programme (2012) the goal of M&E is to improve current and future management of outputs, outcomes and impact. Williams (2000) asserts that monitoring provides management and the main stakeholders of a development intervention with indications of the extent of progress and achievement of expected results and progress with respect to the use of allocated funds. Monitoring provides essential inputs for evaluation and therefore constitutes part of the overall evaluation procedure.

Evaluation is an organized and objective assessment of an ongoing or concluded policy, program/project, its design, execution and results. According to Ballard (2010), monitoring and evaluation is a process that helps program implementers make informed decisions regarding program operations, service delivery and program effectiveness, using objective evidence. Monitoring and evaluation (M&E) should be an integral part of any construction project development process, unfortunately in most cases it is brought into the development planning process as a contingent element. Dialo and Thuillier (2010) pointed out that project monitoring and evaluation is even more critical than planning in achievement of project success. The construction industry plays a very significant role in the socio-economic development of any nation. In most countries, construction activity constitutes 6-9% of the gross domestic product (GDP) and more than

half of the fixed capital formation as infrastructure and public utilities required for economic development (Chitkara, 2009; Alade, Lawal, Omonori and Olowokere, 2016). In Nigeria, the construction industry is one of the main targets of government budget, in terms of government development programs. According to National Bureau of Statistics (2022), Construction contributed 10.16% to nominal GDP in the fourth quarter of 2022, higher than the 9.99% contribution a year earlier, and higher than the 9.50% contributed to the fourth quarter of 2021.

The client's need from the contractor is value for money, best quality work (product) with minimum or considerable cost at a required duration (timely delivery), which can be seen as the common criteria for a successful construction project. The traditional performance indicators in the construction industry are completion time, cost and quality control. The perception of failure and success of projects is usually based on personal indices and the experience of the project manager and it is not uncommon that two project managers would assess the performance of the same project but using the same data differently. The disparity of judgment is mainly due to the lack of a clear and consistent monitoring and evaluation procedures and methodology. There are many occasions where the project is under budget and progressing as schedule, yet it is considered a failure by upper management because of low quality and safety performance records. According to Charles and Humam (2015) in developing countries, lack of monitoring and evaluation capacity continues to cause non-sustainable outcome of the projects.

Aim and Objectives

The aim of the study was to assess the effect of monitoring and evaluation practices on construction projects' cost with a view to making stakeholders in the construction industry know the indispensability of monitoring and evaluation practices. The specific objectives of the study were to:

- i. assess the roles of monitoring and evaluation **practices in construction projects delivery** in the study area; and
- ii. examine the effect of monitoring and evaluation practices on construction projects' cost in the study area.

Study Hypothesis: H₀1: planning process, technical expertise, stakeholder involvement and management participation have no significant impact on construction projects delivery (cost).

LITERATURE REVIEW

Construction Projects' Monitoring and Evaluation Practices

Project Management Body of Knowledge (2001) explains that monitoring and control of construction project work is “the process of tracking, reviewing, and regulating the progress to meet the performance objectives defined in the project management plan”. It further explains that monitoring includes status reporting, progress measurement, and forecasting. According to Dyason (2010), Monitoring is the collection along with the analysis of information regarding a given program or intervention; and evaluation is an assessment whose focus is to answer questions relating to a program or an intervention.

Evaluation is more about the results/outcomes and impact of the project. It is usually a periodic assessment of changes in the predetermined results that relates to the program or the interventions of a project (Goyder, 2009). It helps the project manager to arrive at decisions on the project's destiny, and to determine if the project has attained the set goals and objectives.

Monitoring and Evaluation practices ensures that the project/program results at the levels of impact, outcome, output, process along with input can be quantified so as to offer a framework for accountability and in assisting in making informed decision at program and policy levels. Though monitoring and evaluation practices implementation have substantial cost, time as well as human

resource implications, they are very vital for successful projects and should not be overlooked at the beginning of the process (Khan, 2013).

Those involved in the process understand the importance of evaluation (Chaplowe, & Cousins, 2015). It is important that the project implementers recognize the methods and the thinking that is based on monitoring and evaluation techniques used (Ober, 2012). Project monitoring and evaluation should bring a way of considering goals achievement. Shenhar (2011) noted that community engagement and strengthening of local capacities that are applied throughout the programme cycle. That meant the community should be involved in a direct manner in the identification of their own needs, defining the objectives of the programme, implementing the activities and monitoring and evaluating the programme. Human resources management are very critical in project management. Particularly, they are essential for an effective monitoring and evaluation. The technical capacity and organizational know-how in carrying out evaluations, the value and participation of its human resources in the process of decision making as well as their motivation in executing the decision arrived at can significantly have an effect on the evaluation (Vanessa, 2016) Estimation of Financial resources done during planning for implementation of monitoring and evaluation (Dyason, 2010). A key aspect of planning for monitoring and evaluation is to approximate the costs, staffing, and other resources that are required for monitoring and evaluation work. It is essential for monitoring and evaluation specialists to weigh in on monitoring and evaluation budget needs at the project design phase so that funds are distributed to the implementation of key monitoring and evaluation tasks (Ahsan and Gunawan, 2010).

Construction Project Delivery (Cost)

PMBOK (2001) explains that project success (delivery) is measured by product and project quality, timeliness, budget compliance, and degree of customer satisfaction. Ling, Low, Wang and Lim (2009) as cited by Charles and Humam (2015) also assessed Scope management, Time management, Cost management, Quality management, Risk management, Human resource management, Procurement management, and Integration management in relation to project success where he established that there were significant associations.

Construction Project delivery is a process of using specific project management techniques to oversee the planning, design, and of course, the construction of a project from start to finish with the aim of handing over the construction project to time, cost, quality and users satisfaction. Monitoring and evaluation is regarded as a core tool when it comes to enhancing project management quality, considering that in the short run and in the medium term, the management of complex projects will entail corresponding strategies from the financial view point, that are required to adhere to the criteria of effectiveness, sustainability along with durability (Dobrea et al., 2010). The activity of monitoring supports both the project managers and staff in understanding whether the projects are progressing as predetermined (Houston, 2008). Therefore, monitoring offers the background for minimizing time along with cost overruns, while at the same time ensuring that the required standards of quality are attained in the implementation of the project. On the same note, evaluation is a tool for assisting project planners and developers in assessing the extent to which the projects have attained the objectives that are set forth in the documents related to the project (Crawford and Bryce, 2013).

The Roles of monitoring and evaluation practices in construction projects delivery

A study that was conducted by Singh, Chandurkar, & Dutt, (2017) highlighted that monitoring and evaluation was the major driving factor in development projects. The objective of this study was to determine the effect of monitoring and evaluation on development projects. However, the recommendation that was given in this study was that the management should provide full support and should fully engage themselves in the monitoring and evaluation process as this will help them in coming up with sound and well-informed decisions.



Mackay & World Bank. (2007) conducted a study in Washington, which indicated that planning for monitoring and evaluation was critical in enhancing better project performance on government projects.

Barasa (2014) conducted a study on '*Strategic Plan, Logical Framework, Budget, Stakeholder's Analysis & Construction Project Delivery in Kenya*' used Survey, Correlation and Multivariate Regression Analysis. The findings showed that Monitoring & Evaluation tools have influence on project delivery. Stakeholder's analysis had the most significant influence on project delivery followed by Strategic plan, Budget and Logical framework. The results showed significant correlation between monitoring and evaluation tools and project completion.

Also, Shihemi (2016) conducted a study on *Budgetary Allocation, Baseline Survey, Performance Reviews, Capacity Building & Project Performance* using Survey, Correlation, ANOVA, Multivariate analysis where ANOVA confirmed the importance of Baseline Survey to the performance of construction projects. Budgetary allocation has a significant positive relationship with project performance.

A study done by Vittal (2008) indicates technology awareness is important in project monitoring and controlling due to greater challenges in today's technology-enabled project, this is especially where technological tools are used in project management practices, This study helped to analyze fundamental connections between technical expertise and project performance. Subsequently, understand the indulgent function of expertise to the project team in cultivating enhanced project performance. The findings to this study were that project teams equipped with the right technical skills linked to project performance. The study demonstration that it is difficult to disassociate the use of technology with project performance and the absence of such relation induced project performance, being a technical expert in monitoring and evaluating a project can play a main role in supporting project team in handling projects effectively and efficiently.

Wayne (2010) noted that it is important to involve stakeholder participation when designing monitoring and evaluation tools. A multi-sectoral method, including delegating some work to stakeholders, enhances learning, strengthen ownership and encourages transparency among the actors involved. This is especially important when deliberating the purpose of monitoring and evaluation and how the information is used, analyzed and affects ongoing project planning (Wayne, 2010).

METHODOLOGY

This section of the study focused on the method and procedure of gathering data for the study. The researcher presented here the method or research design, study area, population, sample size and sampling technique, questionnaire design, method of data collection and analysis as well as model specification.

By observing the research title from various perceptions, and to avoid any likely controversies and discrepancies in the collecting data; Architects, Quantity Surveyors, Builders and Engineers in the Ministry of works and contracting firms were the professionals selected for this study. The research design used for this study is survey design. In carrying out the survey, the major instrument of data collection for the study was the questionnaire which was structured in such a manner that allowed the respondents to easily fill in their responses without difficulty as well as personal interview. The study was carried out in Osun State in which the projects in the State to which monitoring and evaluation practices were applied comprises construction of new roads, rehabilitation of existing roads, construction of various new public buildings as well as renovation of some existing ones. The population of this study is made up 106 construction professionals engaged in the service of the State and 555 construction professionals in

the construction companies and organizations, making a total of 661. The procedure that was adopted for selecting respondents for this research was purposive sampling. The sample size for this study was the representation of the population to be studied. The sample size for this study was determined using Yamane (1967) formula.

$$n = \frac{N}{1 + N(e)^2}$$

n = the sample size; N = size of the population, e = level of precision (or limit of tolerable error) i.e 0.05 or 95% confidence level.

With a population of 661 respondents: n = 661

$$1 + 661(0.05)^2 = 661 / 2.6525 = 249.20 = 250 \text{ respondents}$$

To assign the sample size of 250 to the two categories of respondents, Bourley's proportional allocation formula was used $n_b = n(n)/N$

Where : n_b = Bourley's Proportional Allocation Formula, n =Population allocated to respondent groups, n = Total sample size, N =Population of the study 40 respondents was selected for construction professionals in the ministry of works while 210 respondents was selected from the contracting firms and organizations. Regression analysis which is a statistical model was used in this study to establish relationship between Monitoring and Evaluation practices and project time. The study used following regression model:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e,$$

Where: Y = Project Cost α =Constant term, β =Beta

Coefficients, X1= Planning process, X2=Management participation X3=Technical expertise

X4=stakeholders' involvement, e = Error term.

RESULTS AND DISCUSSION

234 of the 250 distributed questionnaires were returned representing 93.6% of the total questionnaires distributed.

Demographic Characteristics of Respondents

Demographic features	Categories	Frequency	Percentage
Profession	Architects	18	7.7
	Quantity Surveyors	50	21.4
	Civil/Structural Engineers	56	23.9
	Builders	36	15.4
	Electrical/Mech. Engineers	42	17.9
	Others	32	13.7
	Total	234	100
Educational Qualification	PhD	0	0
	MSc/M.Tech	82	35.0
	PGD	28	12.0
	B.Sc/B.Tech	76	32.5
	HND	42	17.9
	OND	6	2.6
	Total	234	100
Years of experience	< 5years	28	12.0
	5-10years	84	35.9
	11-15years	64	27.4
	16-20years	14	6.0
	Over 20years	44	18.8
	Total	234	100

Source: Researcher's field Survey, 2022

The table also shows that 23.9% of the respondents were Civil/Structural Engineers, 21.4% were Quantity Surveyors, 15.4% were Builders, and 17.9% were Electrical/Mechanical Engineers while 7.7% of the respondents were Architects. This shows a balanced distribution of the Professionals in the construction industry. The table also shows that 35% of the respondents hold a Masters degree while 32.5% hold BSc/B.Tech, 17.9% hold HND while 12% hold Post Graduate Diploma Certificate and only 2.6% of the respondents hold National Diploma Certificate. This shows the respondents were well educated. 35.9% of the respondents had spent between 5 to 10 years in the construction industry, 27.4% had spent between 11 to 15 years, and 18.8% had spent well over 20 years while only 12% had spent less than 5 years in the construction industry. This shows that the respondents had requisite experience in the construction industry.

Roles of Monitoring and Evaluation (M&E) practices in projects delivery

Roles of M & E practices	Mean	Rank
M&E practices ensure successful and timely Delivery of Construction Projects.	5.47	1 st
M&E practices enhances compliance/adherence to specifications	5.43	2 nd
M&E practices from inception stage of a project can effectively keep the project within budget.	5.17	3 rd
M&E practices minimizes Project Risk	5.11	4 th
M&E practices can also aid in promoting greater transparency and accountability within Organizations and governments.	4.61	5 th
M&E practices leads to Cost effective Project implementation.	4.37	6 th
M&E practices can provide a highly Cost-Effective impact on development policies.	3.00	7 th
M&E practices assist the reformulation of objectives, policies and strategies when necessary in projects.	2.84	8 th

Source: Researcher's fieldwork, 2022

The table shows the roles played by monitoring and evaluation practices in construction project delivery in the study area. “M&E practices ensure successful and timely delivery of construction projects” was ranked 1st with a mean value of 5.47 followed by “M&E practices enhances compliance/ adherence to specifications” was ranked 2nd with a mean value of 5.43. Ranked 8th as revealed from the study is the fact that “M&E practices assist the reformulation of objectives, policies and strategies when necessary in projects”

Effect of monitoring and evaluation practices on construction project delivery in the study area

S/N	M & E practices	Mean	Remark
i.	Planning process	3.50	High
ii.	Management Participation	3.00	High
iii.	Technical Expertise	3.00	High
iv.	Stakeholders' Involvement	3.73	High

Source: Researcher's Fieldwork, 2022

The study revealed that the effect of monitoring and evaluation practices is high on construction projects delivery with the four variables: Planning process, management participation, technical expertise and stakeholders' involvement each having a high mean value of 3.50, 3.00, 3.00 and 3.00 respectively.

Descriptive Statistics

	Mean	Std. Deviation	N
Project_time	.8649	.34658	37
Planning Process	5.2432	.43496	37
Management Participation	7.5405	.50523	37
Technical Expertise	7.5946	.49774	37
Stakeholders' Involvement	4.7568	.64141	37

The table presents the descriptive statistics results. Mean is the average value of the series which is obtained by dividing the total value of the series by the number of observations. The above table showed that the mean score for the independent variables: Planning Process, Management Participation, Technical Expertise and Stakeholders' Involvement are 5.2432, 7.5405, 7.5946 and 4.7568 respectively.

Standard deviation is a measure of spread or dispersion in the series. From the table, the standard deviation for planning process, management participation, technical expertise and stakeholders' involvement are 0.435, 0.505, 0.498 and 0.641 respectively.

Model Summary

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.692 ^a	.478	.413	.17563

- a. Predictors: (Constant), Stakeholders' Involvement, Management Participation, Technical Expertise, Planning Process
- b. Dependent Variable: project_cost

The table shows that there is a strong positive relationship between monitoring and evaluation practices and project cost with an R value of 0.692.

The table further shows M &E Practices accounted for 47.8% of the variation in the dependent variable: Project cost ($R^2=0.478$). Other factors that may affect the dependent variable are outside the scope of this research work.

ANOVA^b

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.905	4	.226	7.333	.000 ^a
	Residual	.987	32	.031		
	Total	1.892	36			

- a. Predictors: (Constant), Stakeholders' Involvement, Management Participation, Technical Expertise, Planning Process
- b. Dependent Variable: project_cost

From the ANOVA Table, P (sig.)-value = 0.000 which is less than 0.05,
Decision: Reject Ho

Coefficients^a

Model		Unstandardized Coefficients		Standardized		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.523	.905		-.578	.567
	Planning Process	-.047	.079	-.090	-.599	.554
	Management Participation	.062	.060	.136	1.036	.308
	Technical Expertise	.036	.063	.078	.570	.573
	Stakeholders' Involvement	.206	.053	.576	3.895	.000

a. Dependent Variable: Project_cost

From the Table of coefficients above, Regression model for project cost is

$$Y = -0.523 - 0.047X_1 + 0.062X_2 + 0.036X_3 + 0.206X_4$$

The regression model shows that a unit increase in X_1 , X_2 , X_3 and X_4 causes Y (Project delivery defined by project cost) to increase by -0.047, 0.062, 0.036 and 0.206 respectively.

HYPOTHESES

H_0 : planning process, technical expertise, stakeholder involvement and management participation have no significant impact on construction project cost.

Level of significance (α) = 5% (i. e. 0.05), since P-value = 0.000

Reject H_0 : therefore, M & E Practices (planning process, technical expertise, stakeholder involvement and management participation) have significant impact on construction project cost.

CONCLUSION

The study examined the effect of monitoring and evaluation practices on construction projects delivery (cost) in Osun state. The study revealed that M&E practices ensure successful and timely delivery of construction projects and enhances compliance/ adherence to specifications.

Furthermore, the study revealed that the effect of monitoring and evaluation practices (Planning process, management participation, technical expertise and stakeholders' involvement) is high on construction projects delivery defined by cost.

The study also revealed that there is a strong positive relationship between monitoring and evaluation practices and project cost ($R=0.692$).

The test of hypothesis also revealed that monitoring and evaluation Practices (planning process, technical expertise, stakeholder involvement and management participation) have significant impact on construction project cost

Recommendations

In view of the findings and conclusion of the research, the following are suggested recommendations deduced from the study:

- i. Enough budgetary provision should be made for monitoring and evaluation of construction projects during the planning stage.
- ii. The project plans should contain the Monitoring and Evaluation planning process.
- iii. Management of construction projects should ensure effective use of lessons learned in different projects for future decision making and improved project delivery.
- iv. Construction project staff should be trained in order to equip them with technical expertise necessary to carry out monitoring and evaluation.
- v. Construction stakeholders' feedback should be well captured and analyzed for implementation of effective monitoring and evaluation.



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NIGERIAN POLYTECHNIC STUDENTS' PERCEPTION OF THE VOCATIONAL BENEFITS OF THE *USE OF ENGLISH* CURRICULUM

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Abstract

The focus of polytechnic education is on the development of *appropriate skills, abilities, and competencies*. The objective of teaching Use of English (UoE) should, therefore, be primarily to develop students' language skills so that they could practice the skills for self-reliance as advocated in the National Policy on Education. Given the dynamics of skill acquisition, this study was conducted to investigate the perception of the students on the vocational benefits they derived from the UoE curriculum. Two hundred students were randomly selected from ND and HND levels in private-, state- and federal-owned polytechnics. The UoE Vocational Benefits Questionnaire (UoE-VBQ) was designed by the researchers. Results showed that students' entry-level awareness of the vocational benefits of polytechnic education is very high (Mean=2.63) and students' assessment rating of the UoE curriculum content is high (Mean=2.09). However, students' value rating of the UoE as a vocational curriculum; students' assessment rating of the UoE curriculum implementation process; and students' assessment rating of the skill acquisition end-product of the UoE curriculum are all low with mean values of 1.63; 1.80; and 1.62 respectively. The Pearson Correlation coefficient ($r = -.039$) shows a negative correlation between students' entry-level awareness of the vocational benefits of polytechnic education and students' value rating of the UoE as a vocational curriculum; while the t.test reveals significant differences based on school type (7.115, $p > .05$) and course of study (11.664, $p > .05$) while gender (-1.418, $p < .05$) and program (.565, $p < .05$) are not significant. The paper concluded that though the content of the UoE curriculum is adjudged to be relevant and sufficient to meet the needs of the students wanting to study it for self-reliance, the low value rating of the UoE as a vocational curriculum; curriculum implementation process; and skill acquisition end-product implied that from their experience, the students did not feel that they have achieved that objective of self-reliance through the study of UoE. The paper recommended that to satisfy the yearnings of the polytechnic students, provisions should be made for skillful personnel and relevant instructional materials/equipment in the teaching of UoE for the vocational and self-reliance benefits of the students.

Keywords: Curriculum implementation strategy; vocational training; language skills; self-reliance

Introduction

The etymology of the word 'polytechnic' shows that it is loaned from French and its origin is from the Greek word *polutekhnos* which means 'multi-skilled' (Microsoft Encarta). A graduate of a polytechnic is therefore expected to possess more skills than one. Among the polytechnic objectives listed by Ale (2004) is 'to give training and imparting necessary skills for the production of technicians and other skilled personnel who shall be enterprising and self-reliant'. It becomes imperative therefore for every graduate of the polytechnic to learn other skill(s) apart from his course of study if he is to be self-reliant after graduation. This is the reason for the inclusion of the Use of English (UoE) in the General Studies Department.

The National Board for Technical Education (1999) is clear about the goals of the UoE course at various levels of polytechnic education. It is variously put as: 'to provide the student with the necessary language skills...(p.4); 'to consolidate the student's competence in the use of English



(p.10); and 'to further improve the student's level of proficiency and competence in language use' (p.15). Apart from the teaching of the rudiments of grammar, specific language skills all of which have vocational significance are listed to be taught – story writing (storytelling), drama (playwriting); registers (varieties of language use), poetry (poetic composition); and oral composition (broadcasting).

If we are guided by the objectives of polytechnic education, we must agree that there is more to the teaching of UoE in the polytechnic than passing an examination. The course is not an end in itself but a means to an end - which is to develop in the students the ability to acquire language arts skills. The focus of technical education is on the application of knowledge so, at the polytechnic level, the focus is on the development of *appropriate skills, abilities, and competencies*. Therefore, the objective of teaching UoE should be primarily to develop students' language skills so that they could through the practice of the skills attain the objective of self-realization advocated in the National Policy on Education.

Importance of Language Skills Acquisition

There is no gainsaying the importance of skill acquisition to individual and national development. Skill acquisition, according to Uzochukwu (2017), is the ability to be trained on a particular task or function and become an expert in it. To him, skill is like a key used in opening the door of fortune. As water is very essential to human life so is a skill needed in the life of every serious-minded human being. Skills can do a lot of great work in the life of every living soul. Lack of skills is a major cause of corruption. The importance of skill acquisition includes self-employment, diverse job opportunities, employment generation, effective function, and crime reduction. He believes that the reason why many technicians earn more than some university graduates is that the technicians acquire more skills than the theories the graduates were fed with when they were in universities.

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UoE is taught at all levels in polytechnic education and all four language skills – reading, writing, speaking, and listening – are taught apart from the grammar component. In recognition of the vocational significance, different skills are taught at different levels – prose writing and drama at the first and second levels of the national diploma stage respectively. At the two higher diploma levels students are respectively taught the skills of poetry and oral composition. Others are registers (varieties of language use), public speaking, small group (leadership), and dyadic communications (interviews). The implication is that after their national diploma course, polytechnic students are expected to have picked considerable interest and skill in story-telling/writing and playwriting/acting. Students who pass through the higher diploma training should be able to diversify to poetic composition, oral delivery skills, and public speaking on diverse channels, among others.

It goes without saying that for the students to benefit maximally in the acquisition of vocational language skills via the UoE course the practical dimension of the teaching must be emphatically, adequately, and expertly handled. This is where the shortcomings of the lecture method become glaring. Despite the advantages of the lecture method, Farooq (2012) explains that learning is an

active process thus students should be encouraged to actively participate in the classroom instead of just listening to the teacher. This is especially necessary when the learning content is more practical than theoretical. The current practice of teaching the UoE in the polytechnic does not give much premium to the practical aspect. One popular topic is Registers - which requires students to be taught the varieties of language use. The objective of teaching this topic should be for the students to attain a measure of proficiency in at least one or two of the identified varieties. A student should, for instance, be able to produce in the form of a project, an advertisement of a product, a jingle, a commentary on live events, or a poetic or dramatic composition. The only way this is possible is for students to undergo hands-on training under a specialist.

Dynamics of Skill Acquisition

In the acquisition of skills, Fitts and Posner (1967) recognize three stages: cognitive (or understanding) stage, associative (or practice) stage, and autonomous (or automatic) stage. The Associative stage in comparison with the cognitive stage is quite long. In this stage, the fundamentals and mechanics of the skill are learned and put into practice more consistently and with fewer errors because the student has developed the ability to detect and correct errors. At the autonomous stage, the skill becomes habitual or automatic. In this stage, there is good consistency of performance. Skill is performed without thinking and students can give more selective attention to higher-order cognitive activities and can detect and adjust errors and disguise actions. This develops self-confidence and risk-taking in performance situations. For a student to attain this level of automaticity in skill performance there is a need for specialized handling and practical modeling and tutoring which give a tremendous boost to the triple factors of students' motivation, interest, and attitude. Learning is a tedious activity that requires proper motivation to achieve. Motivation, according to Omrod (2014), is something that energizes, directs, and sustains behavior; it gets students moving, points them in a particular direction, and keeps them going. He observes that we often see students' motivation reflected in personal investment and cognitive, emotional, and behavioral engagement in school activities. In his write-up on '*How Motivation Affects Learning and Behavior*', he made the following points:

- *Motivation directs behavior toward particular goals:* Motivation determines the specific goals toward which learners strive; whether to spend an evening completing a challenging homework assignment or playing with friends.
- *Motivation leads to increased effort and energy.* Motivation increases the amount of effort and energy that learners expend in activities directly related to their needs and goals. It determines whether they pursue a task enthusiastically and wholeheartedly or apathetically and lackadaisically.
- *Motivation increases initiation of and persistence in activities.* Learners are more likely to begin a task they *want to do*. They are also more likely to continue working at it until they've completed it, even if they are occasionally interrupted or frustrated in the process.
- *Motivation affects cognitive processes.* Motivation affects what learners pay attention to and how effectively they process it. For instance, motivated learners often make a concerted effort to truly understand classroom material - to learn it meaningfully - and consider how they might use it in their own lives.
- *Motivation determines which consequences are reinforcing and punishing.* The more learners are motivated to achieve academic success, the more they will be proud of an A and upset by a low grade. The more learners want to be accepted and respected by peers, the more they will value membership in the "in" group and be distressed by the ridicule of classmates.

- *Motivation often enhances performance.* Because of the other effects just identified—goal-directed behavior, effort and energy, initiation and persistence, cognitive processing, and the impact of consequences—motivation often leads to improved performance.

In his contribution to 'What Keeps Students Motivated to Learn', Schwartz (2014) harps among others on making it hands-on. The implication of this is that lecturers should not just lecture but also get the students 'to do the work being told about it' sometimes in a way that requires collaboration. She also advises making the activities interest-based and relevant because she believes students like to know why they are learning something and they want to access that information through a lens that interests them. If teachers give broad guidelines for the project and then have students do something they are interested in it will bring students along the whole time. She advises that “If you let them know, and use real-life problems, it will help them understand it and they will feel like it's worth doing”.

Two other factors linked to students' motivation from the above are interest and values. Matthews (2001) opines that values are seen as antecedents of behavior. Values have a direct influence on learning behavior. When a student places high importance or value on a subject he is most likely going to develop a keen interest in it and invest much time and effort in it. Such students according to him study to learn and are motivated to go beyond the basic requirements for passing. Their learning involves a problem-solving approach and their interest carries them beyond a superficial understanding of what they are studying. These students are actively involved in the learning process and the process involves meta-cognitive activities that narrow any gaps in knowledge acquisition. In his study carried out to investigate the relationships between values and approaches to study, Matthews (2001) reports that the group that measured high on the values scale used a deep approach described by Marton and Säljö (2006) in terms of *phenomenographic* understanding - a deep process that precipitates a broad involvement in the learning process itself. Education through deep learning involves conceptual change that goes beyond the basic acquisition of information.

Whatever approach is undertaken, it is what the student does that is important. The teacher is only a facilitator, a person who enables learning activities and assists students to achieve desired outcomes (Biggs, 1999). This study is an attempt to actualize the *phenomenographic* involvement of polytechnic students in the learning of *Use of English* having appreciated its value as a vocational avenue for self-fulfillment apart from their core course of study. If this is done, the students will not mind immersing themselves in the practical activities that lead to the acquisition of language skills.

One other way to do this, according to Matthews (2001), is to awaken the interest of the students in the course. Paul(2013) defines interest as a psychological state of engagement, experienced in the moment, and also a predisposition to engage repeatedly with particular ideas, events, or objects over time. He reports that interest can help us think more clearly, understand more deeply, and remember more accurately and has the power to transform struggling performers and lift high achievers to a new plane. He explains further that:

Interest is at once a cognitive state and an affective state; what Silvia calls a “knowledge emotion.” The feelings that characterize interest are overwhelmingly positive: a sense of being energized and invigorated, captivated and enthralled. As



for its effects on cognition: interest effectively turbo-charges our thinking. When we're interested in what we're learning, we pay closer attention; we process the information more efficiently; we employ more effective learning strategies, such as engaging in critical thinking, making connections between old and new knowledge, and attending to deep structure instead of surface features. When we're interested in a task, we work harder and persist longer, bringing more of our self-regulatory skills into play.

In his discussion on how to arouse and keep students' interest alive, Paul (2013) reports that Harackiewicz (2010) and other researchers have found more success when they encourage students to generate their connections and discover for themselves the relevance of academic subject matter to their lives. This he calls a “value intervention,” because it helps students see the value of what they are learning. When students see the value of what they are being taught for their life their interest will not only be aroused it will be sustained.

When students' interest is aroused and sustained, it is most probable that their attitude will be positively affected. Writing on *Student Attitudes about Learning*, Weimer (2009) warns that it is important for us to remember that what students believe about learning and themselves as learners plays a key role in determining their success as learners. According to him, research evidence has shown that if a student believes that no matter what they do, they won't succeed in a course, even being in a course with a highly-rated effective teacher does not change the effects of those beliefs. She advises that because their beliefs matter so much, we must show students that their efforts do make a difference and explain why we propose they use certain strategies.

Demonstration of Learning in Language Arts

Fawkes (2015) underscores the importance of theoretical and practical learning when he quotes Benjamin Franklin “*Tell me and I forget. Teach me and I remember. Involve me and I learn.*” to strengthen the idea that theory and the practical application of theory are equally important. This is why specialists are advocating for the practice of demonstration of learning which refers to a wide variety of potential educational projects, presentations, or products through which students “demonstrate” what they have learned, usually as a way of determining whether and to what degree they have achieved expected learning standards or learning objectives for a course or learning experience.

Hidden Curriculum (2014) explains that in contrast to worksheets, quizzes, tests, and other more traditional approaches to assessment, a demonstration of learning may take a wide variety of forms in schools:

- Oral presentations, speeches, or spoken-word poems
- Video documentaries, multimedia presentations, audio recordings, or podcasts
- Works of art, illustration, music, drama, dance, or performance
- Print or online publications, including websites or blogs
- Essays, poems, short stories, or plays
- Galleries of print or digital photography
- Scientific experiments, studies, and reports
- Physical products such as models, sculptures, dioramas, musical instruments, or robots
- Portfolios of work samples and academic accomplishments that students collect over time
- Presentations or slideshows that provide a summary of the skills and knowledge students have learned



In his memorandum titled Proposal for Vocational Training in Use of English (language arts skills) submitted to the College Management towards the establishment of Entrepreneurship Centre, the following areas, Olajide (2015) identified the following:

- I. Writing
 - a. Script writing – stories – prose, play, or poetry for sale or performance
 - b. Printing and Publishing
 - c. Bookbinding
- II. Reading
 - a. Freelance broadcasting – News-casting, Reporting
 - b. Radio/T.V. program presentation – stories, social diary/comments, business promotion, etc
- III. Speaking/Singing
 - a. Master of Ceremonies – Alaga
 - b. Stand-up Comedy
 - c. Sports Commentary
 - d. Cultural songs – ijala, Iremoje, Ewi, Esa, Oriki Orile
 - e. Choral performance
 - f. Voice Training – Mimicry
 - g. Advertising /Jingles Production
- IV. Musical Instruments
 - a. All types of drums – drum set, gangan, iya-ilu, omele, bata, agogo, sekere, akuba, maracas
 - b. Modern instruments – guitar, trumpet, saxophone, flute, accordion, violin, keyboard, etc
 - c. Costuming
- V. Movements
 - a. Cultural Dance
 - b. Choreography
 - c. Acting - Solo, Duet, and Group performances
 - d. Music - Solo, Duet, Group performances
- VI. Listening
 - a. Hearing incapacitation
 - b. Inconsistent feedback

Objectives of the Study

*Perception is defined as an **impression**, attitude, or understanding based on what is observed or thought (Microsoft Encarta, 2009). In his paper on *Fostering Positive Attitudes and Perceptions about Classroom Tasks*, Marzano(1992) explains that proficient learners believe that the tasks they are asked to perform have value, that they have a fairly clear understanding of what the tasks require, and that they have the resources necessary to complete the tasks. He harps on the importance of task value, observing that the perceived value of tasks is probably the most important to the learner's success and that learners are most motivated when they believe the tasks they are involved in are relevant to their personal goals. He advises that to develop students' positive attitudes and perceptions about learning the teacher should first *help students to perceive classroom tasks as valuable* and then *help them to be clear about classroom tasks by describing how each task might look when completed or presenting models of completed tasks* will help students understand what they are trying to achieve. This is the focus of his study. How much of the values of the UoE curriculum are known to the students and how high is their perception of the vocational benefits of the course?*



Research Questions

The following seven questions are answered in the study:

- i. What is the students' entry-level awareness of the vocational benefits of polytechnic education?
- ii. What is the students' value rating of the UoE as a vocational curriculum?
- iii. What is the student's assessment rating of the UoE curriculum content?
- iv. What is the student's assessment rating of the UoE curriculum implementation process?
- v. What is the student's assessment rating of the skill acquisition end-product of the UoE curriculum?
- vi. What is the relationship between students' entry-level awareness of the vocational benefits of polytechnic education and their value rating of the UoE as a vocational curriculum?
- vii. Is there any significant difference in students' perception of the vocational benefits of UoE curriculum based on the school ownership, student's gender, course of study, and programme?

Method

Design

The study is ex post facto in nature. The variables already existed and nothing was done to manipulate the students' perceptions. It was merely captured through the instrument of a questionnaire constructed for the purpose.

Study Population, Sampling Procedure, and Sample

Polytechnic students in Nigeria constituted the study population. The samples were drawn purposively from 2 states in the southwest region giving, consideration to the proximity to researchers. Institutions were selected based on ownership – state, federal, and private. ND2 and HND2 students were selected for the study after they must have passed through 2 or 4 years of instructional processes in UoE respectively. In all, 600 study samples were selected from 6 institutions.

Instrument

UoE Vocational Benefits Questionnaire (UoE-VBQ) was constructed by the researchers. It contained 30 items in 5 sections. Respondents were requested to rate their perception of the various indices UoE curriculum, including the content, implementation, and product. Their entry-level awareness of the polytechnic education benefits and vocational content of the UoE curriculum were also included. Researchers relied on their years of experience as lecturers and the competence of the lead researcher to vouch for the validity of the instrument. The split-half reliability test yielded a coefficient of .83.

Procedure

Researchers visited the institutions, spoke with the Heads of relevant Departments, and met with the lecturers of the courses at the two levels. The course lecturers served as research assistants as they helped in the distribution and retrieval of the questionnaires. This made it possible to collect every copy of the questionnaires distributed.

Presentation and Analysis of Data

The respondents were required to rate their perception of each questionnaire item on a 4-point Likert scale: Strongly Agree, Agree, Partially Agree, and Disagree. The responses were given the values of 3, 2, 1, and 0 respectively. The values were reversed in items that had negative orientation. The mean values of each item, section, and whole study were calculated and interpreted as follows: 2.6-3.0 (Very High); 2.0-2.5 (High); 1.0-1.9 (Low); 0.0-0.9 (Very Low). The t. test was conducted to determine the significance of differences recorded in the responses of students by class levels (ND, HND) and school ownership (State, Federal, Private).



Table 1: Students' Awareness, Values, and Assessment Rating

	N	Mean	Std. Dev.	Min.	Max.
Students' entry-level awareness of the vocational benefits of polytechnic education	200	2.63	.52390	0.00	3.00
Students' value rating of the UoE as a vocational curriculum	200	1.63	.77938	0.00	3.00
Students' assessment rating of the UoE curriculum content	200	2.09	.86350	0.00	3.00
Students' assessment rating of the UoE curriculum implementation process	200	1.80	1.07652	0.00	3.00
Students' assessment rating of the skill acquisition end-product of the UoE curriculum	200	1.62	.77930	0.00	3.00

In answer to the first five research questions, Table 1 shows that students' entry-level awareness of the vocational benefits of polytechnic education is very high (Mean=2.63) and students' assessment rating of the UoE curriculum content is high (Mean=2.09). However, students' value rating of the UoE as a vocational curriculum; students' assessment rating of the UoE curriculum implementation process; and students' assessment rating of the skill acquisition end-product of the UoE curriculum are all low with mean values of 1.63; 1.80; and 1.62 respectively.

Table 2: Correlation Co-efficient

Variable	N	Sig(2-tailed)	Corr. Co-eff.
Students' entry-level awareness of the vocational benefits of polytechnic education	200	.585	-.039
Students' value rating of the UoE as a vocational curriculum			

To answer Research Question 6, the Pearson Correlation result in Table 2 shows that there is a negative correlation between students' entry-level awareness of the vocational benefits of polytechnic education and students' value rating of the UoE as a vocational curriculum with a coefficient of -.039

Table 3: One-Sample t.test

	N	Mean	S.D.	S.E.M	t.	df	Sig. (2tailed)	Mean Diff	95% Confidence Interval of Diff.	
									Lower	Upper
School type	200	1.89	.775	.054	7.115	199	.000	.390	.2819	.4981
Gender	200	1.45	..498	.035	-1.418	199	.158	-.050	-.1195	.0195
Program	200	1.52	..500	.035	.565	199	.573	.020	-.0498	0898
Course of study	200	2.43	1.127	.079	11.664	199	.000	.930	.7728	1.0872

Table 3 shows that the variables School Type (7.115) and Course of Study (11.664) are significant at a significance level of $p < 05$ while the variables Gender (-1.418) and Program (.565) are not significant at this level of significance. This provides the answer to Research Question Seven.



Discussion of Findings, Conclusions, and Recommendations

Very high students' entry-level awareness of the vocational benefits of polytechnic education and their high assessment rating of the UoE curriculum content is confirmed by their mostly strong agreement with statements that say that the polytechnic is an institution where students learn vocational skills and after polytechnic education, it is expected that graduates ought not to be a white-collar job seeker. They also agreed with statements that say the UoE curriculum contains many very useful language skills students can learn and benefit from and the UoE programme teaches us to use English for specific purposes. This confirms the UoE curriculum indeed captured the National Board for Technical Education (NBTE's) (1999) goals of the *UoE* course at various levels of polytechnic education, variously put as: 'to provide the student with the necessary language skills...' (p.4); 'to consolidate the student's competence in the use of English (p.10); and 'to further improve the student's level of proficiency and competence in language use' (p.15). From this finding, it can be concluded that the present content of the UoE curriculum is relevant and sufficient to meet the needs of the students wanting to study it for self-reliance.

The low value rating of the UoE as a vocational curriculum; students' assessment rating of the UoE curriculum implementation process; and students' assessment rating of the skill acquisition end-product of the UoE curriculum implied that from their experience, even though they believed that the UoE curriculum content is adequate for students' self-reliance, they did not feel that they have achieved that objective. This fact is laid bare in their strong agreement with the statement that says: Apart from boosting the student's GPA, UoE has no vocational value. They strongly disagreed that In the UoE classes, students are made to perform language skills individually or in groups; and students are made to submit individual/group projects. These responses are mostly prompted by the shortcomings in the curriculum implementation which is anything but practical. A properly implemented UoE curriculum, according to Olajide (2010) is practical and requires the students to submit a project at the end of the course as it is done in other courses.

The negative correlation between students' entry-level awareness of the vocational benefits of polytechnic education and students' value rating of the UoE as a vocational curriculum reinforced the students' disillusionment when it comes to the implementation of the UoE curriculum. Students who had come to the polytechnic with the expectation and hope of gaining mastery in the practice of language skills soon discovered that they were being taught again what they had learned in secondary school. Most of them agreed with the statement that in UoE, polytechnic students are taught again what they had learned in secondary school. This experience is what led to their ambivalent attitude to the study of UoE as reported by Olajide, Olajide, Fadare, & Adedeji (2014)

The significant difference noticed in students' perception of the vocational benefits of UoE curriculum based on School Type and Course of Study underscored the wide disparity that exists in the qualities of institutions based on ownership. When compared, federal institutions are better funded and equipped than state and private institutions so the expectation of a better handling of the UoE curriculum implementation is not misplaced. What to glean from here is that even though it could be said that some institutions are better funded and equipped, it does not show in the quality of instruction in UoE. This may not be far from the truth because when the chips are down, it is the competence of the lecturers in the language skills that will produce the required impact on student's achievement. Good equipment requires skillful instructors to produce maximum impact. This is why Olajide (2019) advocated for collaboration with language arts practitioners in the teaching of UoE. A recent study by Olajide, Olatipe, & Adedeji (2023) confirmed that UoE lecturers in polytechnics admitted that they cannot alone teach some vocational language skills but need the assistance of a practicing professional in the fields.

That Students' Gender and Program make no significant difference in the student's perception of the vocational benefits of UoE curriculum attests to the fact that both male and female students have high expectations from the study of UoE and that the course has very rich content at both the ND and



HND levels. As stated earlier in this paper, *UoE is taught* at all levels in polytechnic education and all four language skills – reading, writing, speaking, and listening – are taught apart from the grammar component. In recognition of the vocational significance, different skills are taught at different levels – prose writing and drama at the first and second levels of the national diploma stage respectively. At the two higher diploma levels students are respectively taught the skills of poetry and oral composition. Others are registers (varieties of language use), public speaking, small group (leadership), and dyadic communications (interviews). The implication is that after their national diploma course, polytechnic students are expected to have picked considerable interest and skill in story-telling/writing and playwriting/acting. Students who pass through the higher diploma training should be able to diversify to poetic composition, oral delivery skills, and public speaking on diverse channels, among others.

To satisfy the yearnings of polytechnic students, both male and female, at both the ND and HND levels, provisions should be made for skillful personnel and instructional material/equipment in the teaching of UoE for the vocational benefit of the students in the polytechnics.

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PERFORMANCE OF ENERGY-EFFICIENT COOPERATIVE SPECTRUM SENSING FOR DETECTING LICENSED USERS IN ASPECTRUM SHARING SYSTEM USING EIGENVALUE DETECTOR

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Abstract

Licensed User (LU) detection is a critical operation in Spectrum Sharing System (SSS) to prevent Licensed User (LU) from harmful interference. However, channel impairment such as multipath fading, shadowing, and path loss affect the sensing accuracy of SSS. Non-Cooperative SS (NCSS) used to solve this problem suffers from receiver uncertainty resulting in a high Probability of Missing (PM) that causes interference, while Cooperative SS (CSS) used to solve the problem of NCSS also suffers from large reporting overhead resulting in long sensing time, bandwidth inefficiency and energy inefficiency. Hence, this work proposes an Energy-Efficient CSS (EECSS) for signal detection in a CRN using cluster and Eigenvalue Detector (EVD). Secondary Users (SUs) 'L' numbers (4, 5, 6) are jointly used to carry out SS and each SU performs local sensing using EVD. The multiple copies of PU signals were received through 'P' (2, 3, 4) Secondary User (SU) antennas. The received signals are then used to form a square matrix to determine the ratio of maximum to minimum eigenvalue and used as test statistics to determine the idleness of the spectrum. SU selection is carried out based on the Signal Noise Ratio (SNR) of the received signal to determine the SUs that participate in the local sensing at that time. The 'L' number of SUs is used to form 'N' (3, 4, 5) clusters to reduce the reporting overhead between SUs. The local sensing results from individual SU are combined at the Cluster Head (CH) using the majority fusion rule to determine the sensing result at each cluster. Global sensing result is determined by combining the sensing results from individual clusters using the OR fusion rule. The model is simulated using MATLAB R2018a and evaluated using Probability of Detection (PD) and Sensing Time (ST). The results obtained showed that EECSS gives better performance with higher PD and lower ST values when compared with NCSS and conventional CSS. The EECSS technique proposed can be used for signal detection in wireless communication systems.

Keywords: *Eigenvalue Detector (EVD), Probability of Detection (PD), Sensing Time (ST), Secondary User (SU), Primary User (PU), and Cluster.*

1. INTRODUCTION

The tremendous increase in the usage of wireless communication services has led to an exponential increase in demand for frequency spectrum resulting in spectrum scarcity [1, 2, 3, 4]. The scarcity of spectrum is not only due to insufficient spectrum but also to underutilization of allocated spectrum [5]. To solve the problem of spectrum scarcity which is majorly due to underutilization of allocated spectrum, Spectrum Sharing System (SSS) was proposed. Cognitive Radio (CR) is a technique in which a transceiver intelligently detects communication channels which in use and not in use. This then instantly allows transmitting terminals to opportunistically make use of idle spectrum while avoiding busy ones [6, 7, 8]. The radio comprises two users namely: Primary User (PU) and Secondary User (SU). PU is the licensed user that owns the privileges to the assigned spectrum and SU is the unlicensed user that makes use of the frequency spectrum only when PU is not active [9]. CR is a technique that solves the problem of spectrum scarcity by exploiting the idle spectrum bands assigned to PU [10]. Spectrum Sensing (SS) which is the process by which SU scans through the spectrum to detect the presence of PU and identifies empty spectrum spaces is one of the important requirements of the CRNs [11, 12]. The difficulty in sensing PU is called the hidden PU problem

which is one of the challenges encountered during SS in CR-based systems [13, 14]. The sensing accuracy, which is the ability of SU to sense PU without interference, depends on fading channel between PU and SU. The Sensing of PU is affected by channel impairments such as path loss, multipath fading, and shadowing resulting in fluctuation of the received signals and causing poor reception of the signal [15].

SS is achieved using only one CR known as Non-Cooperative Spectrum Sensing (NCSS) or a group of CRs known as Cooperative Spectrum Sensing (CSS) [5]. NCSS suffers from receiver uncertainty which occurs when SU is outside the transmission range of the PU as a result of multipath propagation. CSS, on the other hand, solves the challenges of NCS and achieves a reliable detection that mitigates interference from SU to PU. In addition, CSS allows SUs to jointly carry out spectrum sensing to ameliorate the sensing credibility even at a very low PU signal strength. However, CSS suffers from large reporting overhead resulting in long sensing time and energy inefficiency. Several detection techniques such as Energy Detector (ED), Eigenvalue Detector (EVD), Cyclostationary Detector (CD), and Match Filter Detector (MFD) have been proposed in the literature to detect the presence of PU [16]. ED and EVD are blind detectors that do not require any prior information about the PU while CD and MFD is a non-blind detector that requires full information about the PU [17, 18]. Also, ED suffers from noise uncertainty which makes the detector have poor performance under low SNR. This is due to the noise variance which is not accurately known at the low Signal Noise Ratio (SNR) and the selection of threshold in ED depends on the noise variance which cannot be accurately estimated thereby resulting in unreliable detection. Therefore, in this work CSS with reduced reporting overhead resulting in low sensing time and energy efficiency is proposed using EVD and cluster.

2. LITERATURE REVIEW

2.1 Non-Cooperative Spectrum Sensing

Non-Cooperative Spectrum Sensing (NCSS) is a sensing method in which only one CR performs the sensing and makes decisions on its own. In this method, PU signals are detected independently by SU and decide on whether the spectrum is idle or occupied. In NCSS, individual SU works on its own and automatically configures itself according to PU detection. [19]. Single Antenna (SA) and Multiple Antenna (MA) are two antennas configuration used for NCSS. In SA, only one antenna is used at both PU and SU, while MA involves a single antenna at PU and multiple antennas at SU. Multiple antennae in NCSS perform relatively better than single antennae and this is due to an increase in PU signal strength in multiple antennae [20; 21, 22]. The efficiency of MA in NCSS is shown in terms of detection rate using a two-stage sensing method. In this scheme, SU has 'M' receiving antennas and each antenna receives 'L' samples of signals. PU transmits PU signal through the channel resulting in multiple copies due to obstructions in the channel. These multiple copies of signals are then received by multiple antennas of SU for sensing operation [21, 23]. NCSS suffers from receiver uncertainty that occurs when SU is outside the transmission range of license users resulting in harmful interference from SU to PU as shown in Fig. 1 [5].

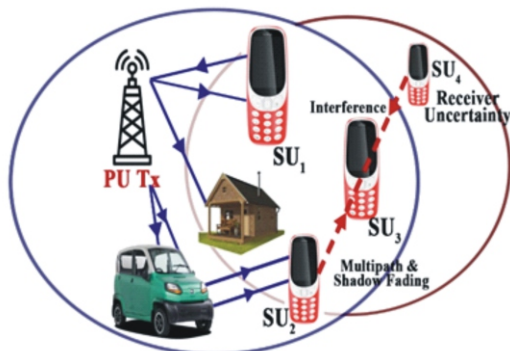


Fig. 1: Challenges of Non-Cooperative Spectrum Sensing [24]

2.1 Cooperative Spectrum Sensing

Cooperative Spectrum Sensing (CSS) is one of the sensing methods in which a group of SUs shares the sense information. Information from multiple SUs is incorporated together and analyzed for PU detection to increase the sensing capability of individual SU. The spectrum is continuously monitored by all the SUs to detect the free spectrum in the network and communicate with one another. When the free spectrum is available, SUs in the network send the sensed data to the Fusion Centre (FC) and the decision is made regarding the availability of the spectrum [24, 25]. The main idea of CSS is to enhance the detection rate by exploiting the spatial diversity in the observations of spatially located SUs. Through cooperation, CR users share their sensing information for making a combined decision more accurate than the individual decision. This provides a better scenario of the spectrum usage over the area where the CRs are located. CSS has been developed to solve the challenges of NCSS through spatial diversity since it is not possible for all spatially distributed SUs in a CR network to simultaneously experience fading that causes receiver uncertainty [19, 23]. Therefore, the combined effect of cooperative decision derived from the spatially collected observations overcomes the deficiency of individual observations at each SU and thereby improving the overall detection performance. CSS is an attractive and effective approach to address multipath fading and shadowing thereby mitigating the receiver uncertainty problem [21, 23]. It involves sharing of SUs observations between each other and communication exists between different SUs as shown in Fig. 2. Each SUs carried out its local sensing to determine the presence or absence of a PU signal. The observed information from individual CR is then shared among themselves to make a final decision based on the fusion rule [25, 28]. CSS reduce hidden node problem due to a higher number of receivers that provide more accurate transmissions in the specified area. An increase in the number of spectrum sensing nodes by cooperation enables the sensing to be more accurate and thereby providing an increase in detection rate. Signal detection is more accurate and reduces the number of false alarms by having multiple nodes performing the spectrum sensing [21].

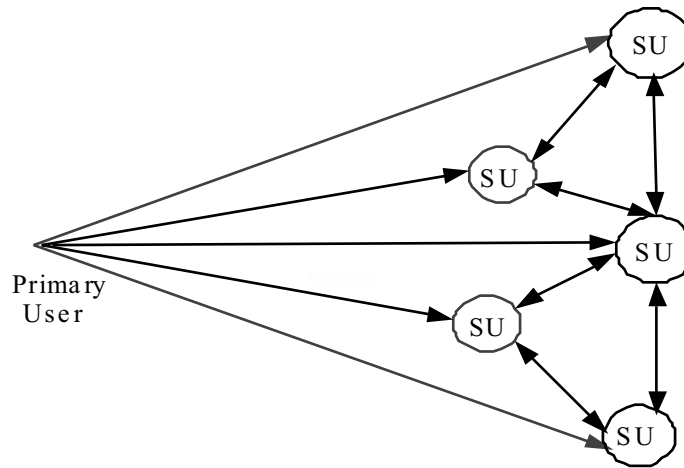


Fig. 2: Cooperative Spectrum Sensing [27]

2.3 Eigenvalue Detector

Eigenvalue Detector (EVD) is a non-coherent detector that is based on the maximum and minimum eigenvalues of the covariance matrix of the received signal. In EVD, the covariance matrix is first derived from the received signal. The maximum and minimum eigenvalues are then calculated from the covariance matrix. The ratio of maximum to minimum eigenvalue is compared with the set threshold to determine the presence or absence of the PU signal. Under H_0 hypothesis, the PU signal is present, otherwise, the PU signal is absent. Unlike ED, the threshold in EVD does not depend on the variance of the noise and thereby overcoming the problem of noise uncertainty. Also, EVD can detect a highly correlated signal, which is difficult to achieve in ED, thus making EVD have superior

performance compared to ED [30]. Under H_0 hypothesis, the received signal $R_i(n)$ is given by [29] as

$$R_i(n) = \sum_{j=1}^P \sum_{k=0}^N h_j(k)x_j(k) + w_j(k) \tag{1}$$

where: P is the number of PU signal
 x_j is the PU signals,
 $h_j(k)$ is the channel response from the PU signal,
 $w_j(k)$ is the noise sample.

The sample covariance matrix ' R_c ' is given by [30] as

$$R_c(N) = \frac{1}{N} X^q X^{+(q)} \tag{2}$$

where: N is the number of collected samples
 X^q is the square matrix
 $X^{+(q)}$ is the transpose of the matrix X^q

According to [30, 31], the characteristic equation of a square covariance matrix 'A' is given as

$$\det(A - \beta I) = 0 \tag{3}$$

where: β is the eigenvalue
 I is the identity matrix.

2 METHODOLOGY

Local spectrum sensing is carried out using Eigen Value Detector (EVD) and a Multiple antenna system is used at the SU to receive multiple copies of the PU signals. The ratio of maximum to minimum eigenvalues is obtained through the covariance matrix of the received signals and used as test statistics. The system model for the proposed technique is developed by incorporating "N" clusters and each cluster contains "L" SUs together with a Cluster Head (CH). The distance between SUs and CH in each cluster is determined using cluster radius. In this work, "L" SUs are used to carry out local spectrum sensing, and sensed decision from individual SU is sent to their respective CH in their respective cluster to make a global cluster decision. Also, the sensed decision from individual clusters is communicated among one another through CH to make the final decision. Extensive simulations using MATLAB R2018a are used to investigate the performance of the proposed technique.

3.1 Development of a Local Spectrum Sensing

The received signal 'Y'

$$Y = \sum_{i=1}^P \sum_{j=1}^Q X_i(j) + W_i(j) \tag{4}$$

where: P is the number of antennae
 Q is the number of branches received by individual antenna
 $X_i(j)$ is the PU signal
 $W_i(j)$ is the AWGN present on the PU link

$$Y = \begin{bmatrix} X_{1,1} & X_{1,2} \dots & X_{1,Q} \\ X_{2,1} & X_{2,2} \dots & X_{2,Q} \\ \vdots & \vdots & \vdots \\ X_{P,1} & X_{P,2} & X_{P,Q} \end{bmatrix} + \begin{bmatrix} W_{1,1} & W_{1,2} \dots & W_{1,Q} \\ W_{2,1} & W_{2,2} \dots & W_{2,Q} \\ \vdots & \vdots & \vdots \\ W_{P,1} & W_{P,2} & W_{P,Q} \end{bmatrix} \tag{5}$$

Using Equation (2), covariance ‘ Y_C ’ of the received signal for the proposed techniques is given as

$$Y_C = \frac{1}{P} (Y)Y^T \tag{6}$$

where:

P is the number of SU antenna

Y^T is the transpose of matrix Y

Using Equation (3), the maximum eigenvalue (β_{max}) and minimum eigenvalue (β_{min}) is obtained from Equation (6) as

$$\det(Y_C - \beta I) = 0 \tag{7}$$

Solving Equation (6) and substituting into Equation (7) gives

$$\det \begin{bmatrix} Y_{C1,1} - \beta & Y_{C1,2} \dots \dots \dots & Y_{C1,Q} \\ Y_{C2,1} & Y_{C2,2} - \beta \dots \dots & Y_{C2,Q} \\ \vdots & \vdots & \vdots \\ Y_{CP,1} & Y_{CP,2} & Y_{CP,Q} - \beta \end{bmatrix} = 0 \tag{8}$$

β with the highest value is the maximum eigenvalue and β with the lowest value is the minimum eigenvalue. Therefore, the test statistics ‘ T ’ is given as

$$T = \frac{\beta_{max}}{\beta_{min}} \tag{9}$$

The Probability of Detection at the local sensing is then expressed as

$$PD_{LEVD} = \Pr (T > 1) \tag{10}$$

3.2 Development of an Energy-Efficient Cooperative Network

The Energy Efficient Cooperative Network (EECN) is developed using clusters to reduce the reporting overhead between SUs that causes long sensing time and high-power consumption. SU selection is also carried out to opportunistically select SU that participates in local sensing at a particular time using the Signal-to-Noise Ratio (SNR) of the received signal at SU to reduce power consumption.

a. Formation of Cluster

In this work, ‘ N ’ clusters are considered, and each cluster contains ‘ L ’ SUs and a CH as shown in Fig. 3. The distance between an individual SU and a CH is determined using cluster radius ‘

$$R_C = \frac{\phi - 1}{\phi + 1} D_P \tag{11}$$

where: D_P is the distance between the PU and CH

$$\phi = 10^{\frac{0.1}{\delta}} \tag{12}$$

where: δ is the path loss exponent

in this work, the average values of path loss exponent for urban and suburban areas are given as 3.1 and 4.0, respectively. Solving Equation (12) using values of path loss exponent, cluster radius for the urban environment is obtained as

$$R_{C/urban} = 0.037D_P \tag{13}$$

While that of sub-urban is obtained as

$$R_{C/sub-urban} = 0.029D_P \tag{14}$$

Equations (13) and (14) are the distance between individual SU and CH for urban and suburban, respectively. At each cluster, the majority fusion rule is used to make decision on the presence and absence of PU at the CH due to its compromises between the spectrum management efficiency and PU protection. The global probability Q_{major} of this fusion is given by [5] as

$$Q_{major} = \sum_{K=R}^L \binom{L}{K} P_i^K (1 - P_i)^{L-K} \tag{15}$$

Using PD of local sensing and solving Equation (15) gives

$$PD_{CL,major} = 2^{K-1} (L + 2) (PD_{SU})^K (1 - PD_{SU})^{L-K} \tag{16}$$

where: PD_{SU} is the probability of detection for individual SU in a cluster

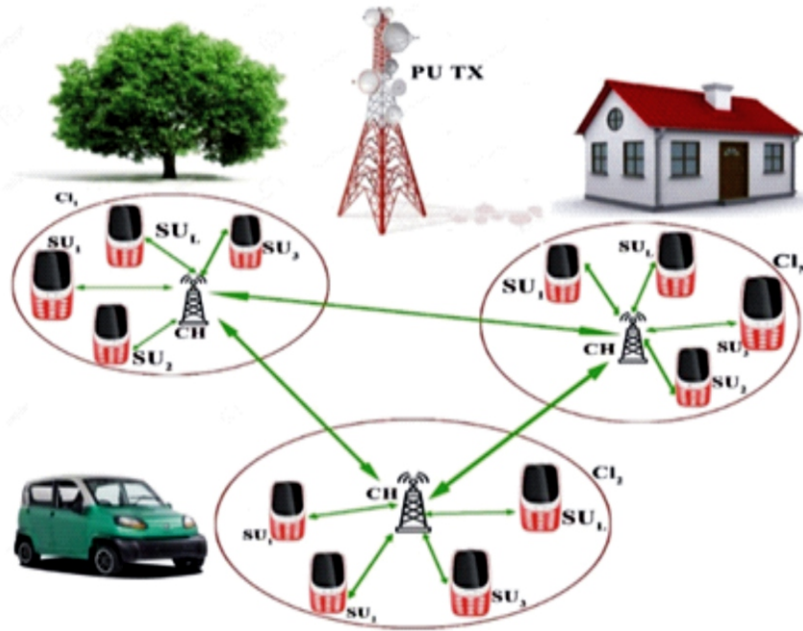


Fig. 3: Block Diagram of Energy Efficient Cooperative Spectrum Sensing

a. **Probability of Detection (PD)**

At the global decision, OR fusion rule is used due to its increase in PU protection.

If the total number of SUs is 'N' and the total number of SUs that decide that spectrum is used is 'R', the global probability Q_{OR} is given as

$$Q_{OR} = R - (1 - p_i)^N \quad (18)$$

where: p_i is the probability of detection or probability of a false alarm for the i^{th} SU
 In the OR rule, $R = 1$ since the spectrum is busy if at least one of the PUs decides that the spectrum is occupied. Therefore, equation (18) becomes

$$Q_{OR} = 1 - (1 - p_i)^N \quad (19)$$

Using Equation (19) and PD for the local sensing at each cluster, the global PD is given as

$$PD_{GL,OR} = 1 - (1 - PD_{CL,major})^L \quad (20)$$

Substituting Equation (16) into (20) gives

$$PD_{GL,OR} = 1 - (1 - 2^{K-1}(L + 2)(PD_{SU})^K(1 - PD_{SU})^{L-K})^L \quad (21)$$

RESULTS AND DISCUSSIONS

The values of PD obtained for both EECSS, NCSS and conventional CSS are presented in Figs 5 to 8 at different configurations. Fig. 5 shows the PD versus SNR for both EECSS and conventional CSS at P of 5, N of 6, and SU antenna of 4. The PD values obtained for the EECSS are 0.6229, 0.6962, 0.7345, and 0.7941 at SNRs of 4, 8, 12, and 16 dB, respectively, as against the conventional CSS with PD values of 0.5945, 0.6705, 0.7189 and 0.7667 at SNRs of 4, 8, 12 and 16 dB. NCSS showed poor performance with PD values of 0.1407, 0.1832, 0.2410, and 0.2761 at SNRs of 4, 8, 12, and 16 dB respectively. The poor performance of NCSS is due to receiver uncertainty that affects the sensing accuracy. Also, EECSS has higher PD values when compared with conventional CSS and this is due to a reduction in reporting overhead that in turn increases the detection rate. Fig 6 depicts the PD versus SNR for EECSS, conventional CSS, and NCSS at SU antenna of 3 with P of 5 and N of 6. At SNR of 4, 8, 12, and 16, PD values obtained for EECSS are 0.5143, 0.5731, 0.6054, and 0.6534, respectively, as against 0.4897, 0.5528, 0.5922, and 0.6316 for conventional CSS. NCSS showed poor performance with PD values of 0.1410, 0.1923, 0.2381, and 0.2864 at SNRs of 4, 8, 12, and 16 dB, respectively. Also, Fig 8 depicts the PD versus SNR at SU antenna of 2 with P of 5 and N of 6 for both EECSS, conventional CSS, and NCSS. EECSS showed a better performance when compared with conventional CSS and NCSS with PD values of 0.3819, 0.4242, 0.4471, and 0.4843 at SNRs of 4, 8, 12, and 16, respectively. The PD values obtained for conventional CSS are 0.3633, 0.4088, 0.4380, and 0.4666 at SNRs of 4, 8, 12, and 16 dB, respectively, as against 0.1189, 0.1599, 0.2019, and 0.2457 for NCSS. In all the configurations, NCSS showed poor performance with lower PD values when compared with EECSS and conventional CSS. The poor performance is due to hidden PU which occurs when SU is outside the coverage area of the PU signal. Also, in all the techniques, PD increases as the PU antenna increases and this is due to the fact the ratio of eigenvalue increases as the number of PU signals increases.

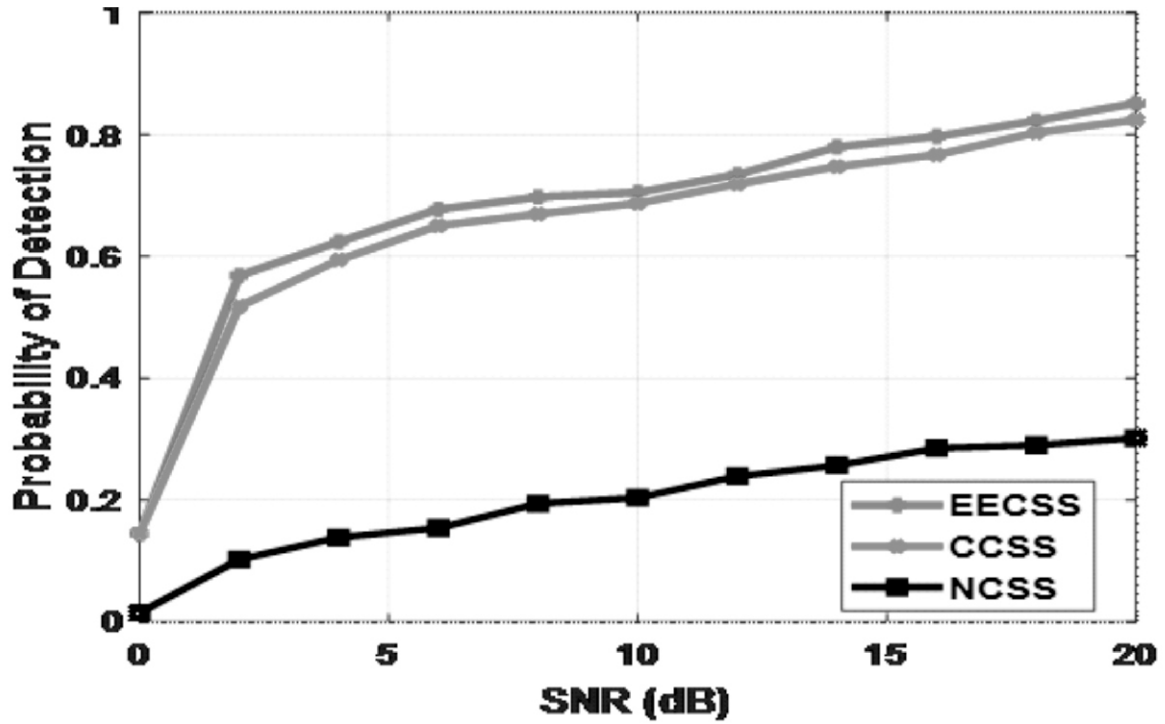


Fig. 5: Probability of Detection (PD) versus SNR for EECS, CCSS, and NCSS at SU antenna of four

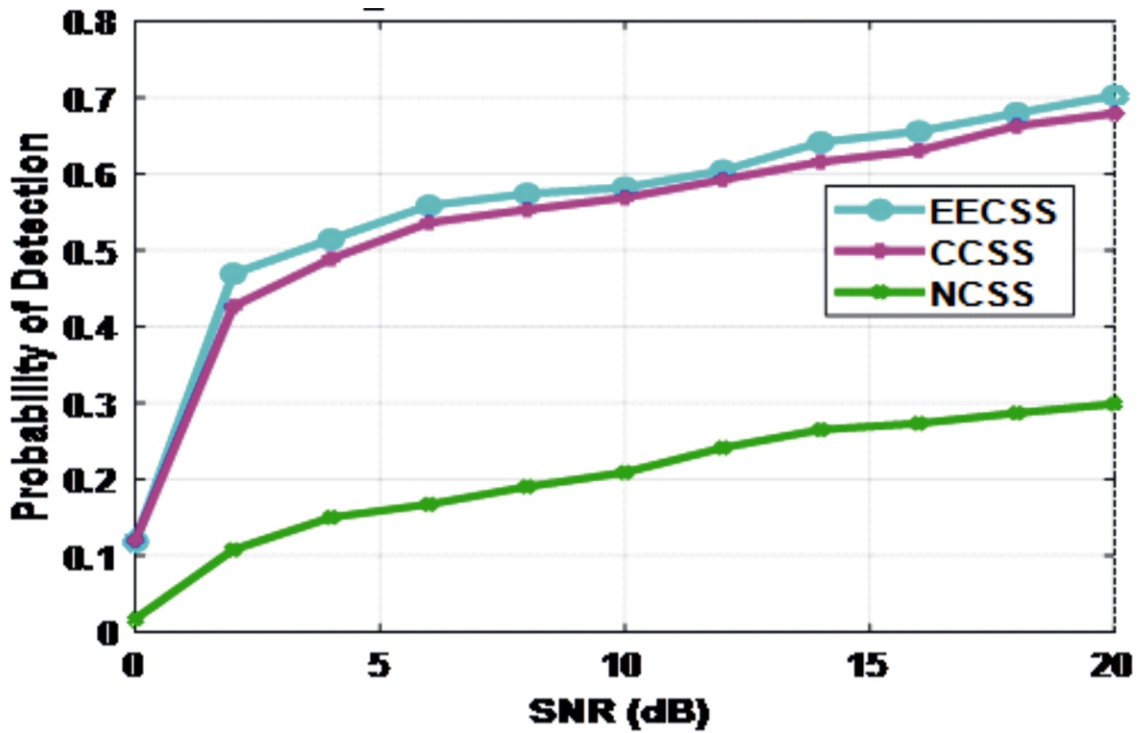


Fig. 6: Probability of Detection (PD) versus SNR for EECS, CCSS, and NCSS at SU antenna of three

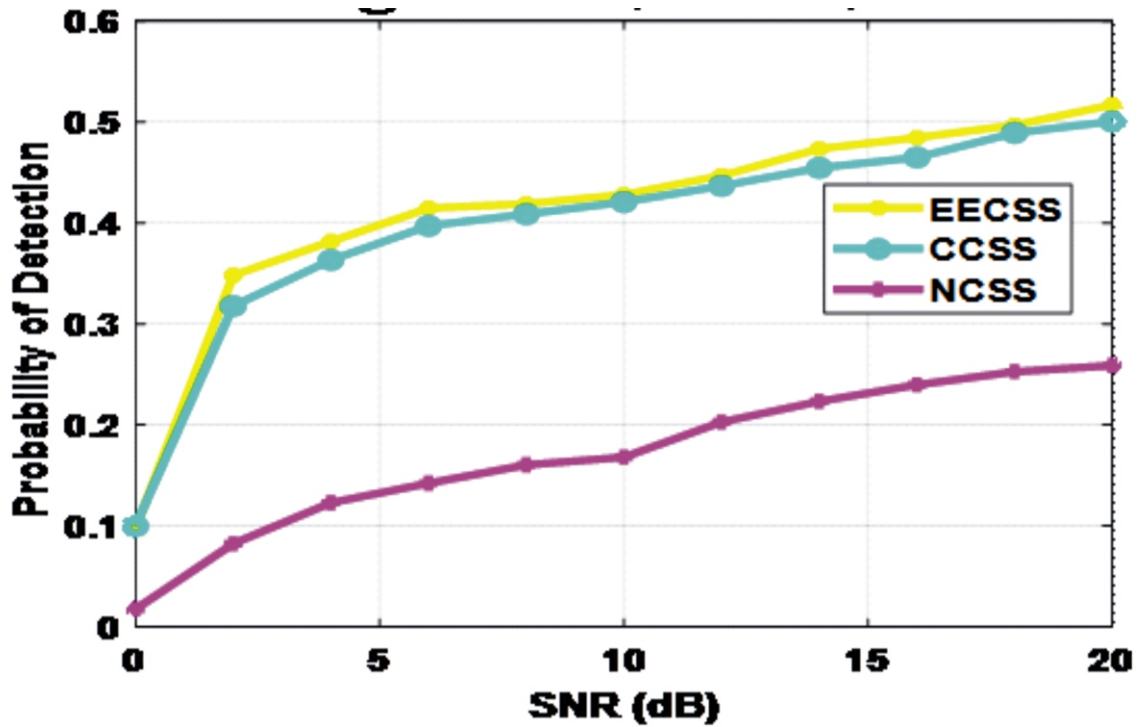


Fig. 7: Probability of Detection (PD) versus SNR for EECSS, CCSS, and NCSS at SU antenna of two

Figs. 8 to 10 depict the Processing Time (PT) versus SNR for EECSS and CCSS at different configurations. The values of PT obtained at P of 5, N of 6, and SU antenna of 4 for EECSS and CCSS are shown in Fig. 8. The PT values obtained for EECSS are 4.0907, 3.9621, 3.7732 and 3.4931 s at SNR of 4, 8, 12 and 16 dB, respectively, as against 7.5595, 7.2996, 6.9259 and 6.3435 s for CCSS. The results obtained showed that EECSS gives lower PT values when compared with CCSS and this is due to the cluster used thereby reducing the reporting overhead. Fig 9 is PT versus SNR for EECSS and CCSS at SU antenna of 3, P of 5, and N of 6. It is shown that at SNR of 4, 8, 12, and 16 dB, the PT obtained for EECSS are 5.4689, 5.2667, 5.0355, and 4.6513 s, respectively, as against 10.0841, 9.7384, 9.2431 and 8.4571 s, for CCSS. The results obtained show that PT decreases with an increase in SNR for both EECSS and CCSS. This implies that as PU signal strength increases, the rate at which SU detects the presence of licensed users increases. Fig 10 shows the PT versus SNR for the EECSS and CCSS at SU antenna of 2, P of 5, and N of 6. The results obtained show that at SNR of 4, 8, 12, and 16 dB, the PT obtained are 8.5893, 8.2428, 7.8808, and 7.2907 s, respectively, for the EECSS as against 15.777, 15.2441, 14.4510 and 13.2367 s for CCSS. The results obtained are justifiable in that the cluster and SU selection used in the EECSS reduces the reporting overhead in the implementation, thereby reducing the PT. Also, for both EECSS and CCSS, the PT values increase as the SU antenna decreases and this is due to the fact ST reduces as SU signal strength increases.

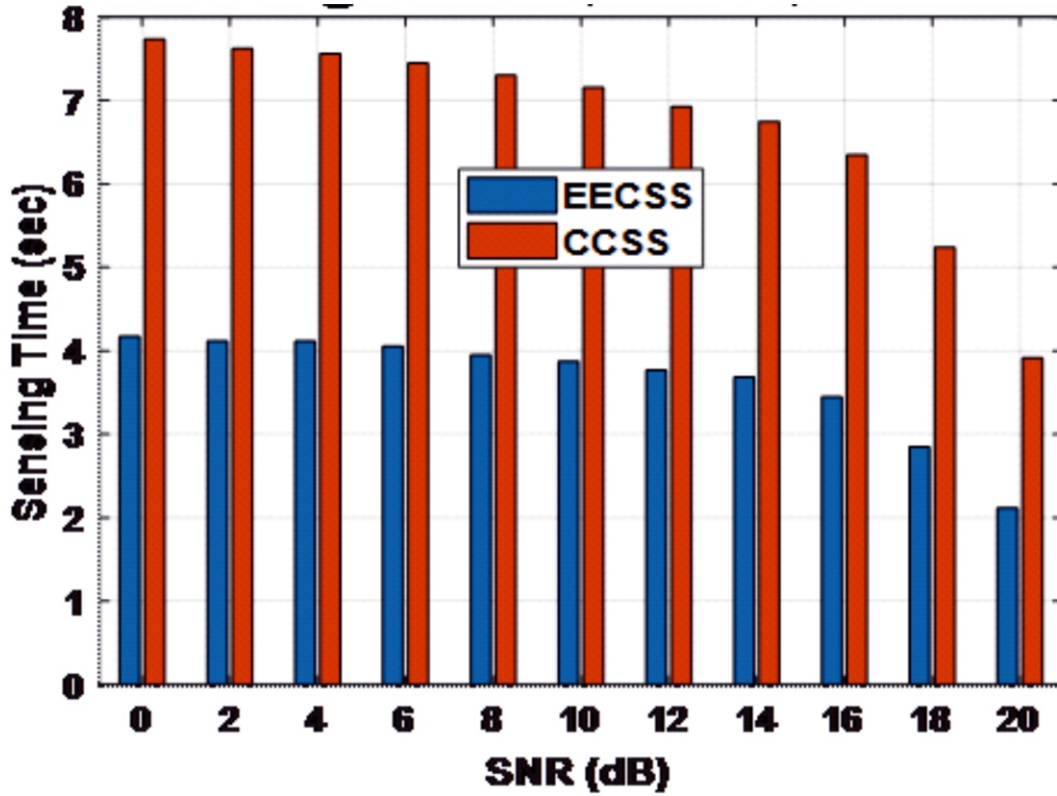


Fig. 8: Processing Time (PT) versus SNR for the EECSS and CCSS at the SU antenna of four

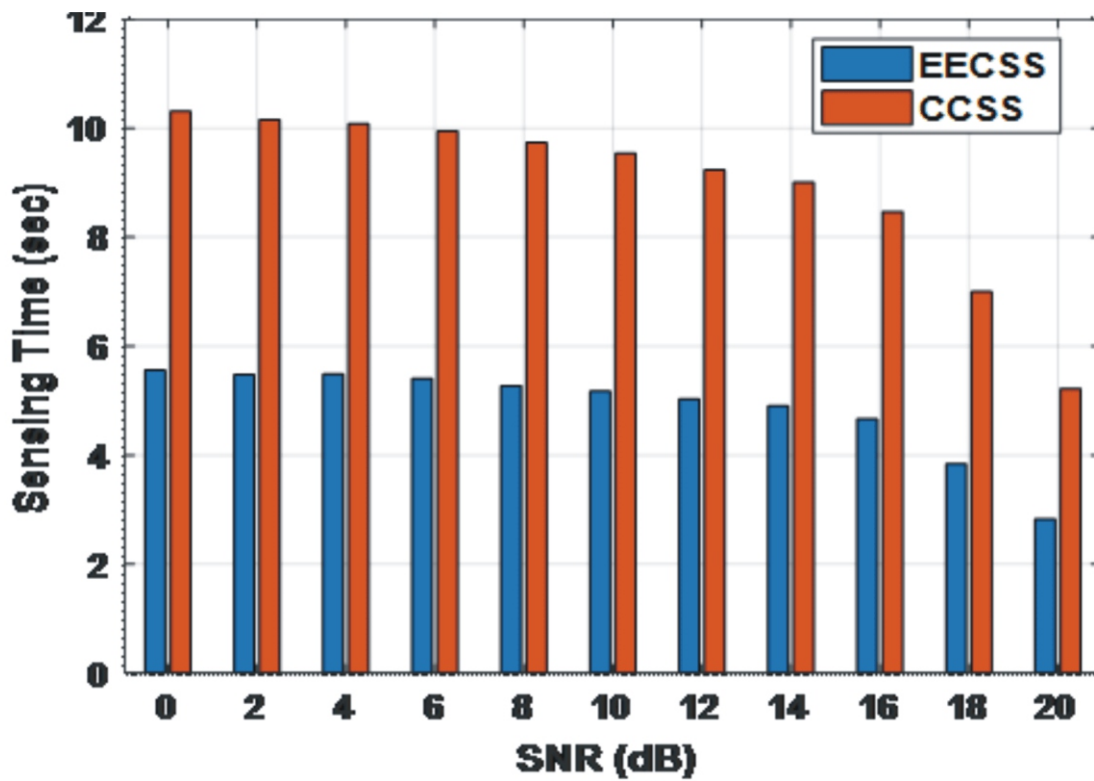


Fig. 9: Processing Time (PT) versus SNR for the EECSS and CCSS at the SU antenna of three

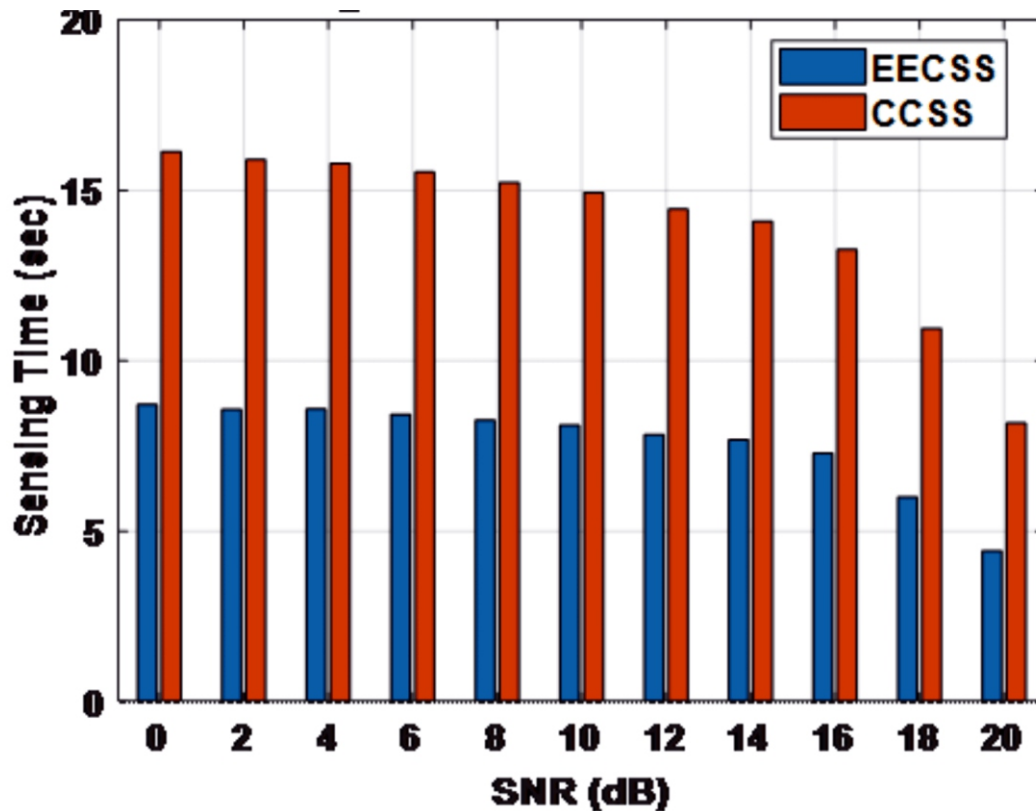


Fig. 10: Processing Time (PT) versus SNR for the EECSS and CCSS at the SU antenna of two

3 CONCLUSION

In this paper, an Energy Efficient Cooperative Spectrum Sensing (EECSS) technique for LU detection in SSS is proposed using Eigenvalue Detector (EVD) and cluster. The ratio of maximum eigenvalue to minimum eigenvalue at different antenna configurations is obtained and used as a test statistic to determine the presence of licensed users at each cluster. The local sensing results obtained at each cluster are combined using OR rule to determine the global sensing results. The technique has been simulated and evaluated using PD and PT. The results obtained show that the EECSS performs better than the CCSS due to higher PD and lower PT values. The proposed EECSS shows better performance with higher PD when compared with NCSS due to multiple SU that jointly carried out sensing operations. The better performance of the EECSS with higher PD and lower PT, when compared with CCSS, is due to cluster and SU selection used that reduce reporting overhead. Also, the results obtained depict the fact that PD increases as the number of clusters increases but PT decreases as the cluster increases. Therefore, the EECSS proposed has been shown to have a better performance by having a higher PD and lower PT than the conventional. The study shows the reporting overhead reduction and can be implemented in wireless communication systems for signal detection.

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-23-

FTIR, BACTERIAL, AND ANTIBIOTICS RESISTANCE PROFILE OF LEAF EXTRACTS AGAINST PATHOGENIC CLINICAL ISOLATES OF *Staphylococcus aureus* FROM THE HUMAN WOUND

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ABSTRACT

In many underdeveloped nations, plant material is still used as therapeutic medicines in primary health care. Thus, the focus of this research is on the discovery of medicinal plants as antibacterial agents that can be used to broaden the range of antibiotics available. Plant extracts of (*Ocimum gratissum*, *Moringa oleifera*, *Momordica charantia*, *Azadirachta indica*, and *Citrus auratifolia*) were screened for antibacterial activities against *Staphylococcus aureus* (SA) isolated from human wounds in two different years (2022 and 2023) at different seasonal weather. The leaves were extracted by hand-crushing while 0.1ml was used against SA. The zone of inhibition (ZOI) was recorded after 24 hours of incubation in millimeters (mm). The antibacterial effects of the leaf extracts increase during the rainy seasons (13-24mm) than in the dry season (10-16mm). All the leaf extracts have the highest ZOI (18mm-24mm) than the commercially sold antibiotics at the same concentrations. Antibiotics sensitivity test result shows 100%, 97%, and 93% resistant to SA. In the examined extracts, FTIR spectroscopy analyses revealed the presence of compounds that are responsible for the activities found by identifying their groups.

KEYWORDS: Resistance profile, Leaf extracts, Clinical isolates, sensitivity, and *Staphylococcus aureus*.

1. INTRODUCTION

In recent years, there has been an increase in antibiotic-resistant strains of clinically significant pathogens, which had resulted in the creation of new multidrug-resistant bacterial strains. Plants have been used in traditional healthcare delivery systems in Africa and around the world since civilization began [1]. African conventional medicine has recently gained attention and acceptability as a substitute healthcare delivery approach. Herbal medications have been used to treat and cure a variety of diseases and physiological abnormalities among Sub-Saharan Africans [2]. Throughout history, herbal treatments have been used to treat a variety of infectious disorders. In many underdeveloped nations, plant material is still used as therapeutic medicines in primary health care. Thus, the identification of medicinal plants as antibacterial drugs contributes to the broad range of antibiotics accessible [3].

In India, many portions of the neem tree have been employed in traditional Ayurvedic medicine. The leaves, seeds, and bark, for example, provide a broad spectrum of antibacterial effects against Gram-negative and Gram-positive microbes. The leaves, on the other hand, are of concern due to their therapeutic potential for wound healing. Neem leaf is beneficial in the treatment of chronic wounds, diabetic foot, and gangrene [4]. The availability of antibiotics over the counter has led to an increase in the antimicrobial resistance of pathogens to conventional drugs. Due to this increase in resistance, there is a need to research natural products which have therapeutic effects on which plants and their products. This study investigated the antibacterial activities of *Ocimum gratissum*, *Moringa oleifera*, *Momordica charantia*, *Azadirachta indica*, and *Citrus auratifolia* leaf extracts on *Staphylococcus aureus* isolated from a wound with infection.

2. MATERIALS AND METHODS

2.1 Study locale

The research was carried out within Ede, Osun State. Ede is a city with about 159,866 people living in it altogether. Ede is located between 4° 30' and 4° 3' east of the Greenwich Meridian and 7° 40' and 7° 40' north of the equator, respectively.

2.2 Study plan

This study was done to find out the inhibitory effects of *Ocimum gratissimum*, *Moringa oleifera*, *Momordica charantia*, *Azadirachta indica* and *Citrus auratifolia* extracts on *Staphylococcus aureus* isolated from infected wounds comparing with commercially sold antibiotics in-respect to weather seasons.

2.3 Collection of plant sample

Fresh leaves of five different plants namely Scent leaf (*Ocimum gratissimum*), Moringa leaf (*Moringa oleifera*), Balsam pear leaf (*Momordica charantia*), Neem leaf (*Azadirachta indica*) and Lime leaf (*Citrus auratifolia*) were plucked directly from the federal polytechnic Ede school pavilion surrounding and were collected into a sterile polythene bag. All the leaves were rinsed, weighed, and air-dried at room temperature.

2.4 Collection and Testing for the Viability of the Microorganism

The tested organism was collected from LAUTECH Hospital, Osogbo, Osun State from the microbiology department where identification and characterization of the tested microorganism was done. The stock cultured organism was subcultured onto an agar plate to check for the viability of the organism. A loopful colony of the inoculums was streaked using inoculating wire loop onto the agar plate aseptically and incubated at 37^oc for 24 hours.

2.5 Extraction Method

Direct hand extraction was used. The fresh leaves were weighed on an analytical weighing balance, rinsed, and air-dried at room temperature for 5 -10 minutes. The plants were extracted by crushing them with a sterile hand. The resultant extract was dispensed into plain covered bottles.

2.6 Testing for the anti-bacteria Potency of the leaf extracts

The viable organism of *Staphylococcus aureus* was swabbed on the solidified agar plate. A sterilized cork borer of an internal diameter of about 5mm was used to drill holes in the solidified media plates and 0.1mls of the plant extract was dispensed into it. The plate was incubated at 37^oc for 24 hours in an incubator and was observed after 24 hours. This process was repeated for all the leaf extracts used as mentioned above.

2.7 Determination of the anti-bacteria Potency from the leaf extract

The antibacterial efficacy of the leaf extracts was assessed by measuring the zone of inhibition with a laboratory meter and a rule rope. The inhibitory zone was measured in millimeters (mm)

2.8 Antibiotic susceptibility testing (AST)

The antibiotic sensitivity test for each strain of isolated bacteria was determined using Kirby-Bauer's disc diffusion method. McFarland matching standard was used to determine the concentration of isolates as explained below;

- i. Getting the test organisms ready for the sensitivity test
- ii. For 24 hours at 37^o C, 17 colonies of the multidrug-resistant sample were sub-cultured in sterile nutrient broth.

- iii. For ten minutes, Isolate broth cultures were centrifuged at 3000 rpm.
- iv. Using a spectrophotometer set to 600 nm, the sediments were diluted in sterile phosphate buffer saline (PBS). This was adjusted to a concentration of 10^8 CFU/ml with the McFarland matching standard (0.6 ml of 1% $\text{BaCl}_2 \cdot \text{H}_2\text{O}$ and 99.4 ml of 1% concentrated H_2SO_4).

Testing for antibiotic sensitivity, every aliquot was spread on Mueller Hinton agar medium.

- i. Antibiotic sensitivity discs {Gentamycin 10 μg , Tetracycline 30 μg , Ciprofloxacin 5 μg , Doxycycline 30 μg , Chloramphenicol 30 μg and Erythromycin 15 μg } were positioned on the medium's surface through sterile forceps.
- ii. The setup underwent a 24-hour aerobic incubation at 37°C.
- iii. The diameters of the inhibitory zones were measured using the meter rule in mm.

2.9 Interpretation of AST result

The results were interpreted using the Clinical and Laboratory Standards (CLSI) Institute's standards in terms of the test antibiotics' ZDI (zone diameter of inhibition) values (2011). According to the CLSI standards, bacteria were divided into three categories depending on how sensitive, intermediate, or resistant they were to a specific antibiotic.

3.0 Results

3.1 The antibacterial analysis of the leave extracts to clinical isolates of SA organism from the human wound.

The antibacterial analysis of the leave extracts of Scent leaf (*Ocimum gratissimum*), Moringa leaf (*Moringa oleifera*), Balsam pear leaf (*Momordica charantia*), Neem leaf (*Azadirachta indica*), and Lime leaf (*Citrus auratifolia*) against the pathogenic clinical isolate of *Staphylococcus aureus* (SA) was determined in two different years (2022 and 2023) and seasons to confirm if seasonal changes do affect the antiseptic activities of the plant extract. The zone of inhibitions was determined by measuring in millimeters (mm). All the Leaves extracts showed anti-bacteria response against pathogenic clinical isolate of SA although the level of reactions was different varying from 14mm to 24mm (Fig. 1). It can be observed that there were no significant differences between the two years but there are great significant differences between the seasonal values. The antibacterial effects of the leaf extracts increase during the rainy seasons (13-24mm) than in the dry season (10-16mm). The plant extract with the highest zone of inhibition (24mm) is Moringa oleifera.

3.2 Response of commercial antibiotics to clinical isolates of SA organism from human wound

When comparing the result of the commercially sold antibiotics (Gentamycin, Tetracycline, Ciprofloxacin, Doxycyclin, Chloramphenicol, and Erythromycin), the result shows that all the leaf extracts have high zone of inhibition (18mm-23mm) than the commercially sold antibiotics (0.9mm-19.2mm) except doxycyclin and chloramphenicol that had high ZOI of 18.7mm and 19.2mm respectively (figure 2).

3.3 Antibiotics sensitivity testing of commercially sold antibiotics to clinical isolates of SA organism from human wound

Table I to Table V shows the profile of antibiotics sensitivity testing results of the antibiotics to SA. 100% resistance to SA was recorded from tetracycline, ciprofloxacin, and gentamycin while 97% was recorded for both doxycycline and erythromycin while chloramphenicol has the lowest resistant percentage of 93%.

3.4 Spectrum range of FTIR results for the leaf extract

The FTIR peak values and functional groups for each leaf extract {Scent leaf (*Ocimum gratissum*), Moringa leaf (*Moringa oleifera*), Balsam pear leaf (*Momordica charantia*), Neem leaf (*Azadirachta indica*) and Lime leaf (*Citrus auratifolia*)} were represented in Table VI - X. These spectra reveal distinct variances between all functional groups. The presence of alcohols, phenols, alkanes, alkenes, aromatics, carboxylic acids, esters, ethers, and alkyl halides compounds was confirmed by FTIR analysis from five plant leaf extracts (Figures 4-8 and Table VI - X). The existence of alcohols, phenols, alkanes, alkenes, aromatics, carboxylic acids, esters, ethers, and alkyl halides was demonstrated by FTIR analysis of five aqueous leaf extracts. The spikes at $3448-3414\text{cm}^{-1}$ correlate to the frequency of hydrogen-bonded O-H stretching with phenols and alcohols functional groups. Peaks at $2972-2920\text{cm}^{-1}$ correspond to H-C-H asymmetric and symmetric stretching with alkane functional groups. Alkane groups are represented by the band at $2856-2852\text{cm}^{-1}$. Peaks at $1735-1631\text{cm}^{-1}$ belong to alkene groups and are ascribed to the C=C symmetric stretching frequency. The peaks at $1560-1026\text{cm}^{-1}$ are classified as aromatic rings and are assigned C=C asymmetric stretching.

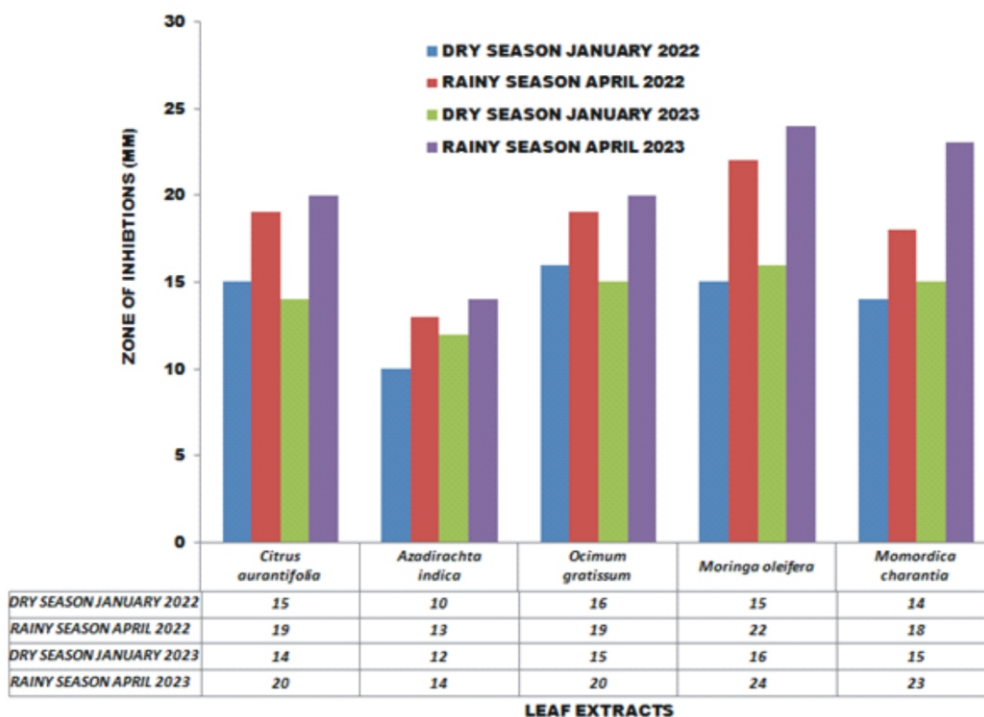


Figure 1: Comparative and seasonal effects of leaf extracts on the pathogenic clinical isolates of *Staphylococcus aureus*

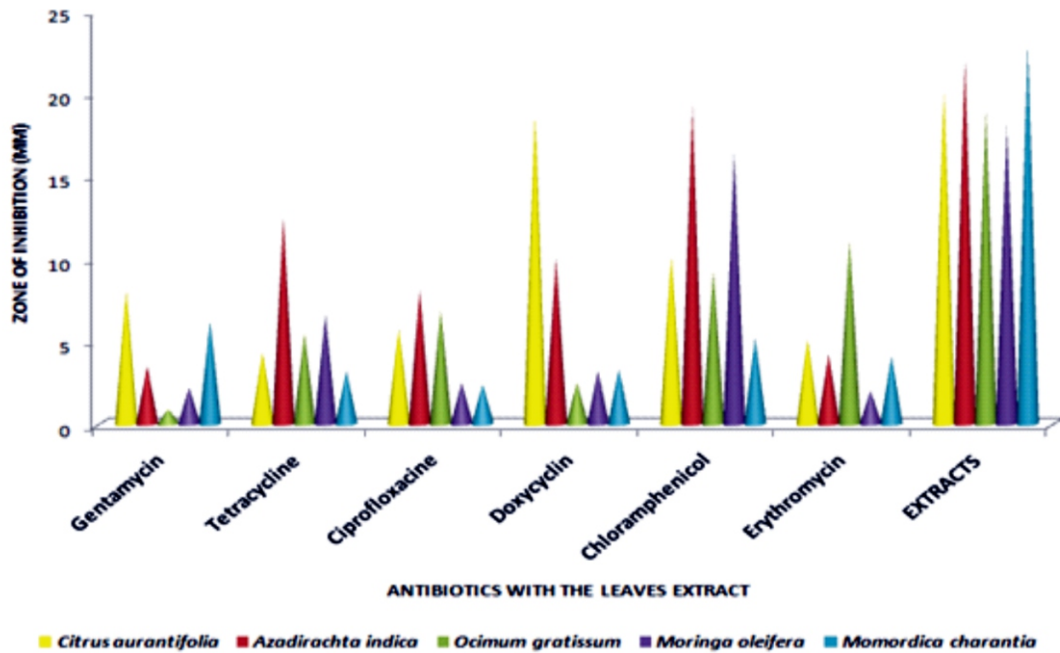


Figure 2: Antibiotics resistance of the leaf extracts against commercially sold Antibiotics

Table I: Antibiotics susceptibility testing of *Citrus aurantifolia* (Lime leaf) to commercially sold antibiotics

	DISC CONTENT (mg)	CLSI			VALUE	INTER- PRETATION
		S	I	R		
GENTAMICIN	10	=15	13-14	=12	8	R
TETRACYCLINE	30	=19	15-18	=14	4.3	R
CIPROFLOXACIN	5	=21	16-20	=15	5.7	R
DOXYCYCLINE	30	=19	15-18	=14	18.7	I
CHLORAMPHENICOL	30	=18	13-17	=12	10.1	R
ERYTHROMYCIN	15	=23	14-22	=13	5.1	R
PERCENTAGE RESISTANT						83%

KEY: S-Sensitivity; I-Intermediate; R-Resistant

Table II: Antibiotics susceptibility testing of *Azadirachta indica* (Neem leaf) to commercially sold antibiotics

	DISC CONTENT (mg)	CLSI			VALUE	INTER- PRETATION
		S	I	R		
GENTAMICIN	10	=15	13-14	=12	3.5	R
TETRACYCLINE	30	=19	15-18	=14	12.5	R
CIPROFLOXACIN	5	=21	16-20	=15	8.1	R
DOXYCYCLINE	30	=19	15-18	=14	10	R
CHLORAMPHENICOL	30	=18	13-17	=12	19.2	S
ERYTHROMYCIN	15	=23	14-22	=13	4.2	R
PERCENTAGE RESISTANT						83%

KEY: S-Sensitivity; R-Resistant



Table III: Antibiotics susceptibility testing of *Ocimum gratissum* (Scent leaf) to commercially sold antibiotics

	DISC CONTENT (mg)	CLSI			VALUE	INTER- PRETATION
		S	I	R		
GENTAMICIN	10	=15	13-14	=12	0.9	R
TETRACYCLINE	30	=19	15-18	=14	5.5	R
CIPROFLOXACIN	5	=21	16-20	=15	6.9	R
DOXYCYCLINE	30	=19	15-18	=14	2.5	R
CHLORAMPHENICOL	30	=18	13-17	=12	3.2	R
ERYTHROMYCIN	15	=23	14-22	=13	16.4	I
PERCENTAGE RESISTANT						83%

KEY: I-Intermediate; R-Resistant

Table IV: Antibiotics susceptibility testing of *Moringa oleifera* (Moringa leaf) to commercially sold antibiotics

	DISC CONTENT (mg)	CLSI			VALUE	INTER- PRETATION
		S	I	R		
GENTAMICIN	10	=15	13-14	=12	2.2	R
TETRACYCLINE	30	=19	15-18	=14	6.6	R
CIPROFLOXACIN	5	=21	16-20	=15	2.5	R
DOXYCYCLINE	30	=19	15-18	=14	3.2	R
CHLORAMPHENICOL	30	=18	13-17	=12	16.4	I
ERYTHROMYCIN	15	=23	14-22	=13	2	R
PERCENTAGE RESISTANT						83%

KEY: I-Intermediate; R-Resistant

Table V: Antibiotics susceptibility testing of *Momordica charantia* (Balsam pear leaf) to commercially sold antibiotics

	DISC CONTENT (mg)	CLSI			VALUE	INTER- PRETATION
		S	I	R		
GENTAMICIN	10	=15	13-14	=12	6.2	R
TETRACYCLINE	30	=19	15-18	=14	3.2	R
CIPROFLOXACIN	5	=21	16-20	=15	2.4	R
DOXYCYCLINE	30	=19	15-18	=14	3.3	R
CHLORAMPHENICOL	30	=18	13-17	=12	5.2	R
ERYTHROMYCIN	15	=23	14-22	=13	4.1	R
PERCENTAGE RESISTANT						100%

Y9 ò : I-Intermediate; R-Resistant

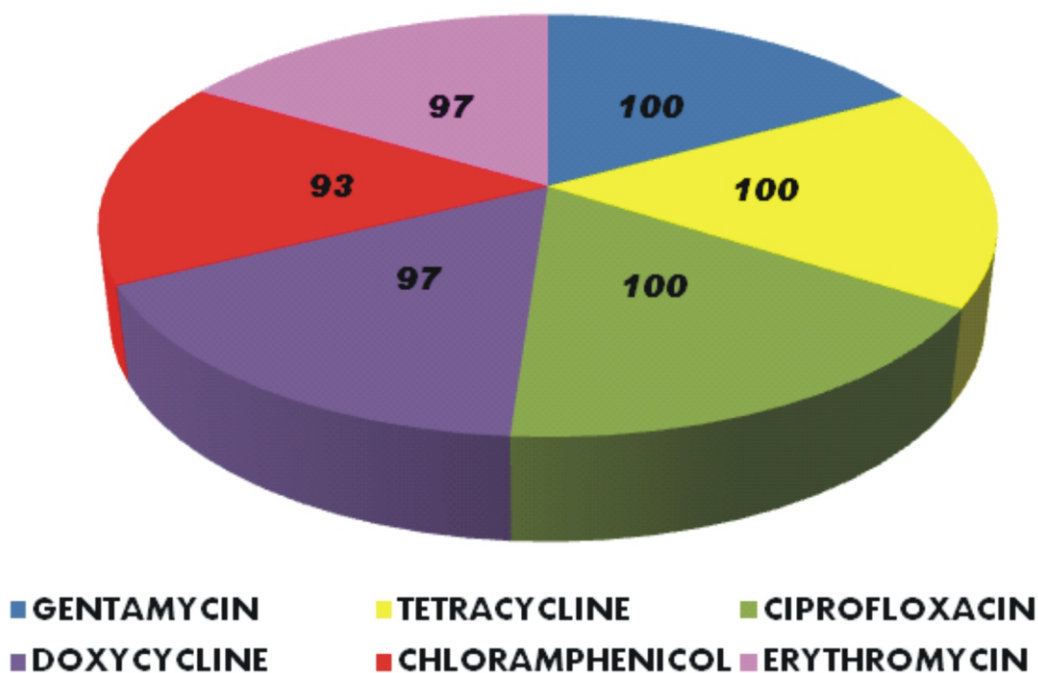


Figure 3: Percentage resistance of antibiotics to pathogenic clinical isolates of *Staphylococcus aureus*

Table VI: Spectrum range of FTIR results for Moringa (*Moringa oleifera*) leaf extract

S/N	PEAKS (cm ⁻¹)	INTENSITY RANGE	APPEARANCE	FUNCTIONAL GROUP	COMPOUND CLASS
1	441.71	89.2		UNKNOWN	
2	619.17	81.12	Strong	C-Br stretch	Halo compound
3	677.04	83.47	Strong	C-Br stretch	Halo compound
4	887.28	98.36	Strong	C=C bend	Alkene (Vihyidence)
5	985.66	98.55	Strong	C=C bend	Alkene (nonsubstituted)
6	1078.24	92.8	Strong	C-O stretch	Primary alcohol
7	1124.20	87.11	Strong	C-O stretch	Tertiary alcohol
8	1242	94.32	Strong	C-O stretch	Alkylaryl ether
9	1317.43	93.94	Strong	C-N stretch	Aromatic amine
10	1404.22	88.99	Strong	C-F stretch	Fluoro compound
11	1456.	93.71	Medium	C-H bend	Alkane
12	1633.76	63.1	Strong	C-C stretch	Carboxylic acid
13	2011.82	90.26	Strong	N=C=S stretch	Isothiocyanate
14	2341.66	98.51	Strong	O=C=O stretch	Carbon dioxide
15	2850.88	93.91	Weak	O-H stretch	Alcohol
16	2920.32	87.72	Strong	O-H stretch	Carboxylic acid
17	3439.19	34.98	Strong	O-H stretch	Alcohol

Table VII: Spectrum range of FTIR results for Neem (*Azadirachta indica*) Plant extract

S/N	PEAK VALUE(cm^{-1})	INTENSITY RANGE	APPEARANCE	FUNCTIONAL GROUP	COMPOUND CLASS
1	453.29	83.96			
2	522.73	83.84	Strong	C-I stretch	Halo Compound
3	584.45	82.75	Strong	C-Br stretch	Halo Compound
4	667.39	82.97	Strong	C-Br stretch	Halo Compound
5	779.27	85.13	Strong	C-H bend	1,2,4- trisubstituted
6	935.51	90.14	Strong	C=C bend	Alkene
7	1026.16	77.06	Strong	S=O stretch	Sulfoxide
8	1078.24	80.27	Strong	C-O stretch	Primary alcohol
9	1153.47	83.18	Strong	C-O stretch	Tertiary alcohol
10	1246.06	87.16	Medium	C-N stretch	Amine
11	1317.43	86.08	Strong	C-F stretch	Fluoro compound
12	1367.58	87.74	Medium	O-H bend	Phenol
13	1402.3	88.61	Strong	S=O stretch	Sulfate
14	1452.45	91.19	Medium	C-H bend	Alkane
15	1552.75	84.42	Strong	N-O stretch	Nitro compound
16	1631.83	72.96	Medium	C=N stretch	Imine/Oxime
17	1726.35	87.6	Strong	C=O stretch	α,β -unsaturated ester
18	2000.25	90		C=C=N stretch	Ketenimine
19	2372.52	97.45	Strong	O=C=O stretch	Carbon dioxide
20	2850.88	91.19	Medium	C-H stretch	Alkene(acid)
21	2924.18	85.02	Broad	O-H stretch	Alcohol
22	3427.62	66.95	Medium	N-H stretch	Aliphatic primary amine

Table VIII: Spectrum range of FTIR result for Balsam Pear (*Momordica charantia*) leaf extract

S/N	PEAK VALVE (cm ⁻¹)	INTENSITY RANGE	APPEARANCE	FUNCTIONAL GROUP	COMPOUND CLASS
1	565.16	75.95	Strong	C-Br stretch	Halo compound
2	619.17	74.32	Strong	C-I stretch	Halo compound
3	653.89	73.79	Strong	C-Br stretch	Halo compound
4	925.86	97.29	Strong	C=C bend	Alkene
5	1026.16	89.36	Strong	C-O stretch	Primary alcohol
6	1053.17	89.03	Strong	C-O stretch	Ester
7	1078.24	89.01	Medium	C-N stretch	Amine
8	1153.47	93.74	Strong	S=O stretch	Sulfone
9	1300.07	91.88	Medium	O-H bend	Phenol
10	1346.36	90.35	Strong	S=O stretch	Sulfonate
11	1408.08	66.88	Medium	O-H bend	Alcohol
12	1556.61	52.46	Strong	N-O stretch	Nitro compound
13	1631.83	57.11	Strong	C=C stretch	Alkene
14	2019.54	90.34	Strong	N=C=S stretch	Isothiocyanate
15	2933.83	82.8	Strong	N-H stretch	Amine salt
16	2972.40	80.89	Strong	O-H stretch	Carboxylic acid
17	3439.19	26.14	Strong	O-H stretch	Alcohol

Table IX: Spectrum range of FTIR result for Scent leaf (*Ocimum gratissum*) extract

S/N	PEAK VALVE (cm ⁻¹)	INTENSITY RANGE	APPEARANCE	FUNCTIONAL GROUP	COMPOUND CLASS
1	418.57	88.26		Unknown	
2	515.01	86.1	Strong	C-Br stretch	Halo compound
3	580.59	85.67	Strong	C-Br stretch	Halo compound
4	669.32	85.9	Strong	C-Br stretch	Halo compound
5	785.05	87.87	Medium	C=C bend	Alkene
6	931.65	94.32	Strong	C=C bend	Alkene
7	1024.24	82.09	Strong	C-F stretch	Fluoro compound
8	1078.24	85.01	Strong	C-O stretch	Primary alcohol
9	1153.47	86.44	Strong	C-O stretch	Tertiary alcohol
10	1246.06	89.24	Strong	C-O stretch	Alkyl aryl ether
11	3121.28	83.31	Medium	O-H bend	Phenol
12	1395.55	90.04	Medium	O-H bend	Carboxylic acid
13	1396.51	90.88	Medium	O-H bend	Alcohol
14	1458.23	93.79	Medium	C-H bend	Alkane
15	1545.03	85.55	Strong	N-O stretch	Nitro compound
16	1618.33	66.53	Strong	C-C stretch	α,β -unsaturated ester
17	1647.26	67.95	Medium	C-N stretch	Imine/oxime
18	1735.99	88.36	Strong	C=O stretch	Ester
19	2000.25	90		C=C=N stretch	Ketenimine
20	2364.81	94.72	Strong	O=C=O stretch	Carbon dioxide
21	2856.67	93.6	Medium	C-H stretch	Alkene
22	2928.04	88.69	Strong	C-H stretch	Imine salt
23	3439.19	61.96	Strong	O-H stretch	Alcohol

Table X: Spectrum range of FTIR result for Lime (*Citrus aurantifolia*) leaf extract

S/N	PEAK VALVE (cm ⁻¹)	INTENSITY RANGE	APPEARANCE	FUNCTIONAL GROUP	COMPOUND CLASS
1	453.29	83.96		Unknown	
2	522.73	83.84			Benzene derivative
3	584.45	82.75	Strong	C- Br stretch	Halo compound
4	667.39	82.97	Strong	C =C bend	Alkene
5	779.27	85.13	Strong	C-H bend	1,2, 4 trisubstituted
6	935.51	90.14	Strong	C-H band	1,2, 4 trisubstituted
7	1026.16	77.06	Strong	S= O stretch	Sulfoxide
8	1078.24	80.27	Strong	C-O stretch	Primary alcohol
9	1153.47	83.18	Strong	C-O stretch	Tertiary alcohol
10	1246.06	87.16	Strong	C-O stretch	Alkylaryl ester
11	1317.43	86.06	Medium	O-H bend	Phenol
12	1367.58	87.74	Strong	S=O stretch	Sulfonyl chloride
13	1402.30	88.61	Medium	O -H bend	Alcohol
14	1452.45	91.19	Medium	C-H bend	Alkane
15	1552.75	84.42	Strong	N-O stretch	Nitro compound
16	1631.83	72.96	Medium	C=C stretch	Cyclic alkene
17	1726.35	87.60	Weak	C-H bend	Aromatic compound
18	2000.25	90		C=C=N stretch	Ketenimine
19	2372.52	97.45	Strong	O=C=O stretch	Carbon dioxide
20	2850.88	91.19	Medium	C-H stretch	Alkane
21	2924.18	85.02	Weak	O-H stretch	Alcohol
22	3427.62	66.95	Strong	O-H stretch	Alcohol

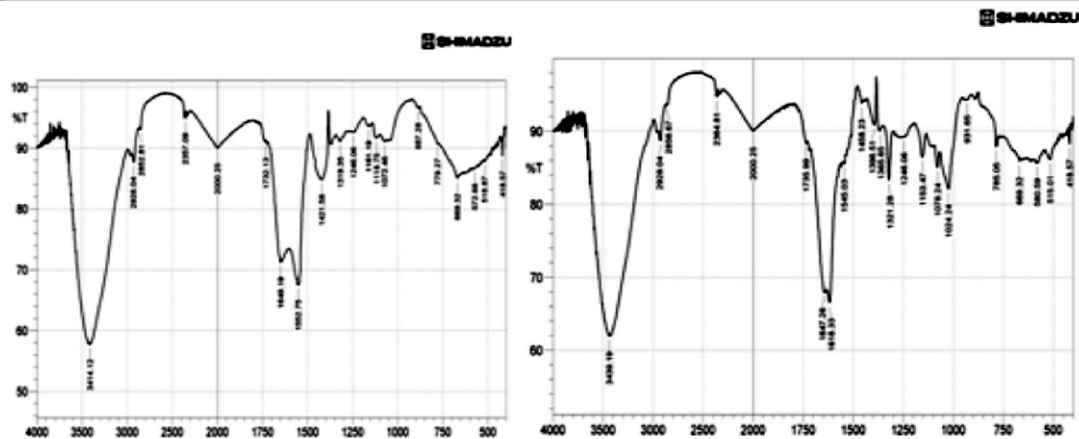


Figure 4: FTIR spectrum *Azadirachta indica* leaf extracts

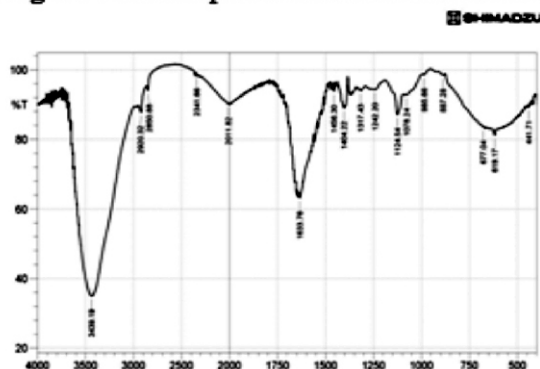


Figure 5: FTIR spectrum *Ocimum gratissimum* leaf extract

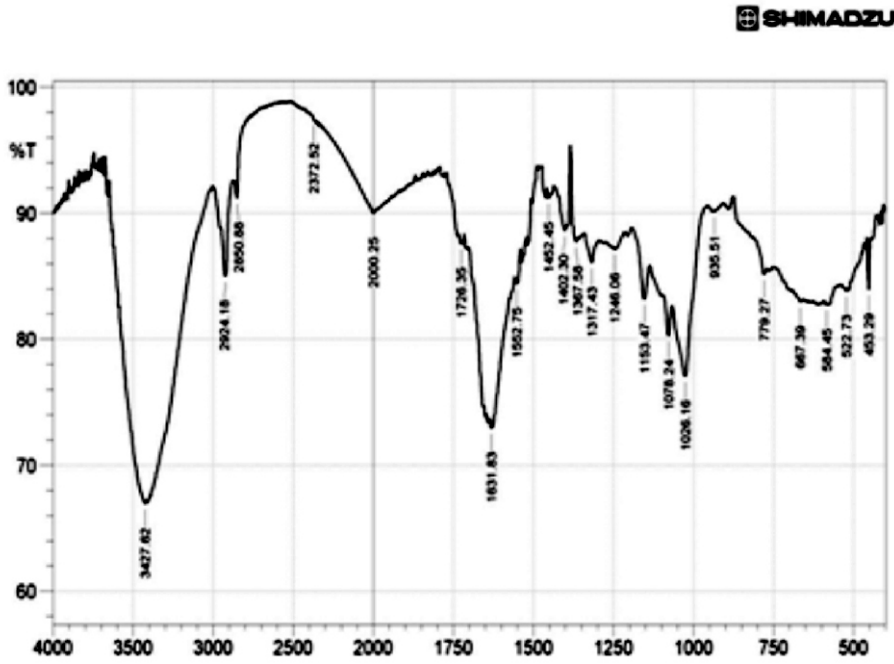


Figure 6: FTIR spectrum *Moringa oleifera* leaf extract
Figure 7: FTIR spectrum *Citrus aurantifolia* leaf extract

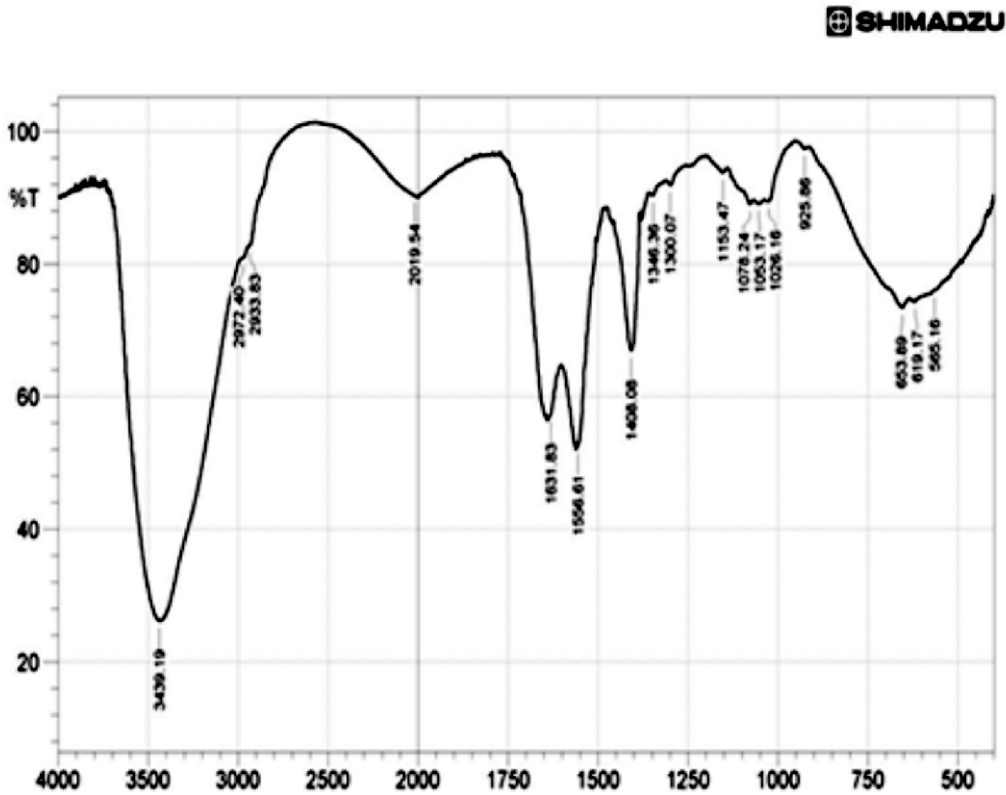


Figure 8: FTIR spectrum *Momordica charantia* leaf extract

3.0 Discussion

The result of this research agreed with the work of [6] which revealed that *S. aureus* is the most predominant bacteria in infected wounds. Annual Changes do not have any effect on the antibacterial activities of all the leaf extracts as seen in Figure 1 but the antibacterial activities of the leaf extracts were affected due to changes in weather seasons. The result from 2022 when compared with 2023 was not significantly different. For *Ocimum gratissimum* in 2022, it has 16mm while in 2023 has 15mm *Moringa oleifera* has 15mm and 16mm, *Momordica charantia* 14mm and 15mm, *Azadirachta indica* 10mm and 12mm and *Citrus auratifolia* 15mm and 14mm respectively. When comparing the seasonal effects, the antibacterial activities of the leaves were very high during the rainy season than in the dry season which could be the result of the fact that the leaves were fresh and had access to complete nutrient supply than in the dried season. All the leaf extracts show higher antibacterial effects when compared to commercially sold antibiotics Figure 2. The zone of inhibition from all the leaf extracts ranges from 18mm to 23mm while that of commercially sold antibiotics ranges from 0.9mm to 19.2mm. The highest zone of inhibition was recorded from chloramphenicol (19.2mm) and doxycycline (18.7mm). Of all the antibiotics used gentamycin has the lowest zone of inhibition 0.9mm [19].

The resistance profile of each leaves to commercially sold antibiotics was described in Table I-V. Three out of the antibiotics used showed 100% resistance to *Staphylococcus aureus* (figure 3) which are Tetracycline, Ciprofloxacin, and Gentamycin followed by Doxycycline and erythromycin which are 97% resistant to *Staphylococcus aureus* while Chloramphenicol is 93% resistant to *Staphylococcus aureus*. *Moringa olifera* possesses some Phyto-constituents including alcohol, isothiocyanate, aromatic amine, etc. A significant proportion of pharmaceutical products in use are designed in all the tested plants. Babacanet *et al.*, 2022 also reported similar result. Balsam pear possesses some phytoconstituents such as alcohol, amine salt, isothiocyanate, phenol, etc. Amoxicillin is also a good antibiotic in treating pathogenic *staphylococcus aureus* which is (a 12.5mm zone). Scent leaves contain alcohol, amine, ketenimine, phenol, alpha-unsaturated ester, etc.

Table VI-X describes the spectrum range of FTIR results for each leaf extract. The peak value in the infrared radiation area was used to determine the functional group of the active components. The leaves extract of *scent leaf (Ocimum gratissimum)*, *Moringa leaf (Moringa oleifera)*, *Balsam pear leaf (Momordica charantia)*, *Neem leaf (Azadirachta indica)*, and *Lime leaf (Citrus auratifolia)* were separated based on it speak ratio. FTIR analysis confirmed the presence of alcohols, phenols, alkanes, alkenes, aromatics, carboxylic acids, esters, ethers, and alkyl halides compounds which show major peaks; IR absorption spectra of the five extracts were studied and recorded in the 500-4000 cm^{-1} region (Figures 4-8); and these spectra show that there were clear differences between all the functional groups at, 3448-3414, 2972-2920, 2856-2852, 2372-2357, 2019-2000, 1735-1631, 1560-1026, 935-580 and 523-502 respectively (Figures 4-8; Table VI-X). The five extracts' IR absorption spectra were studied and recorded in the 500-4000 cm^{-1} region (Figures 4-8), and these spectra demonstrate that there were distinct differences between all of the functional groups. The obtained results are summarized as follows: FTIR analysis confirmed the presence of alcohols, phenols, alkanes, alkenes, aromatics, carboxylic acids, esters, ethers, and alkyl halides compounds, which show major peaks [Mariswamy *et al.*, 2012]. The peaks at 3448–3414 cm^{-1} correspond to the hydrogen-bonded O–H stretch frequency with functional groups for phenols and alcohols. The peaks at 2972-2920 cm^{-1} are attributed to asymmetric and symmetric stretching of the H-C-H molecule and contain functional groups for alkanes. The alkane groups are represented by the band at 2856–2852 cm^{-1} . The alkenes groups correspond to the peaks at 1735-1631 cm^{-1} , which are assigned to the C=C symmetric stretching frequency. The C=C asymmetric Stretching assigned to the peaks at 1560-1026 cm^{-1} represents aromatic rings. The H-C-H bent and alkanes groups are associated with the band between 1405 and 1400 cm^{-1} . The peaks at 1107 and 1101 cm^{-1} are associated with the C-O stretch and represent functional groups such as carboxylic acids, esters, and ethers. The signal at 831

to 820 cm^{-1} , which corresponds to alkyl halide groups, is attributed to C-Cl stretch. The peaks at 523 and 502 are assigned to C-Br stretching and, in contrast to [19], corresponding to the functional groups of alkyl halides, respectively (Table 5 and Figures 5–11).

4.0 CONCLUSION

Uncovering and exploring the unexploited dietary and therapeutic wealth of leaves, roots, and herbs ruins an effective choice in incapacitating unmanageable infection/disease-causing microorganisms as an antibacterial conflict to synthetic drugs and medication continues to be a dreadful and worrisome challenge in the medical field. In this study, antibacterial activity and antibiotics sensitivity testing constituents of neem leaves, lime leaves, scent leaves, balsam pear leaves, and moringa leaves extracts were evaluated in two different years and the results revealed that all the tested leaves had the highest activities against *Staphylococcus aureus* which is a gram-positive bacteria. Balsam pear leaf (*Momordica charantia*) and Neem leaf (*Azadirachta indica*) extracts had more appreciable activities SA when compared with other leaf extracts tested.

It can be concluded that the extracts from *Ocimum gratissimum*, *Moringa oleifera*, *Momordica charantia*, *Azadirachta indica*, and *Citrus auratifolia* were very effective in treating *S. aureus* and related disease conditions than some commercially sold antibiotics. I suggest that more research should be done to understand the mechanism of the organism's antibacterial susceptibility as this will increase the likelihood of developing novel products that can successfully attack germs that appear to be drug resistant.

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AN EMPIRICAL NETWORK PERFORMANCE MONITORING SYSTEM APPLICATIONS SOFTWARE ASSESSMENT

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ABSTRACT

When it comes to computer networks, speed and efficiency are essential for both the Network Administrator and clients. These factors determine network performance and gauge the effectiveness of the Network Administrator. To ensure optimal network performance, the Network Administrator requires tools that focus on solving performance issues. Network Performance Monitoring Systems (NPMS) is a solution that provides essential tools for maintaining the network, meeting client demands, and enhancing network security. NPMS is a network monitoring system that manages CPU memory usage, hard disk usage, I/O devices, and other network devices.

Keywords: Network utilization, CPU memory usage, Hard disk usage, monitoring systems, and clients.

1. INTRODUCTION

1.1. Background of the Study

The importance of networking cannot be overstated in the world of computing, telecommunication, and other technology fields. Therefore, it is crucial to keep an eye on the network to make the most of the resources it offers. A network performance monitoring system (NPMS) is a tool used by engineers to diagnose network issues. It is a client/server multi-threaded network diagnostic tool that gathers data about the network's status and availability. By providing network engineers with real-time and historical reports, NPMS enables them to troubleshoot network performance proactively. This tool also allows network administrators to capture, view and analyze network activities, and build network statistics such as network utilization, CPU usage, physical disk, and more.

The Network Performance Monitor is a real-time network monitor that can track network latency, traffic, and other network statistics. It continuously tracks packets crossing a network, thus providing an accurate picture of the network activity at any moment or a historical record of network activity over some time. In addition, the network administrator can use the NPMS to report client names, log-on time, log-out time, etc.



NPMS provides an essential ingredient in making large systems performance-aware and bandwidth adaptive. Performance issues are a significant concern when monitoring a network because when several computers are connected, complex interactions with unforeseen consequences are common. This complexity often leads to poor performance. Identifying bottlenecks that might cause network slowdowns, such as CPU utilization, memory usage, and allocation, is crucial to maintaining a high-performance network.

1.2. Statement of the Problem

As enterprise networks continue to grow in size, scope, and strategic importance, Network Administrators are facing numerous challenges in maintaining the performance and availability of their network. However, as customers deploy new network applications and services, measurements of network performance must recognize different levels of performance based on the different types of network traffic. Given these, the Network Managers often spend too much time trying to identify the source of performance problems and the need for performance troubleshooting tools that can identify performance problems before they seriously impact users and quickly identify the network devices that caused the performance problems once they have occurred. Furthermore, the network managers have the tool they need to identify performance problems, locate performance bottlenecks, diagnose latency, and identify performance trends in the network. Network Performance Monitoring Systems (NPMS) will enable the network manager to perform path and hop performance analysis, thus simplifying the identification of network devices that are contributing to the network performance problems.

1.3. Purpose of the Study

The primary objective of this study is to create a program that can track network activities, including session duration, source IP, network response time, and system performance.

The main goals are as follows:

1. Secure the network against unauthorized access to sensitive data to prevent network congestion.
2. Optimize network resources to avoid overloading issues.
3. Monitor all information and data flowing in and out of the network.
4. Utilize effective monitoring tools to maintain a smooth networking environment.

2. LITERATURE REVIEW

In the Windows NT environment, there is a vast array of performance data available, with many performance counters traceable through standard monitoring tools. However, this abundance of data can lead to overwhelming management problems for analysts if a process is not implemented to quickly identify performance issues and address bottlenecks. Windows NT provides a wealth of data

on system interfaces and application performance, but it is crucial to avoid data overload. Key matrices can provide an overview of system performance for analysts. Despite changes in technology, the basics of analyzing system data have remained the same for over 30 years. If a server is not 100% busy, there may be a problem with the I/O and memory subsystems that require investigation. However, NT servers may run out of memory before any other resource due to changes in the CPU.

The network managed by the Simple Network Management Protocol (SNMP) consists of three essential components:

(a) **ManagedDevices:** A managed network contains a network node that has an SNMP agent. This node is known as a managed device, which is responsible for collecting and storing management information. This information is then made accessible to Network Management Systems (NMSs) via SNMP. Managed devices, which are also called network elements, can be routers, access servers, switches, bridges, hubs, computer hosts, or printers.

(b) **An Agent:** The agent is a software module for managing networks that are installed in a device that is being managed. It knows management information and converts it into a format that can be understood by SNMP.

(c) **Network Management Systems (NMSs):** Applications that monitor and control managed devices are executed by NMSs. These systems provide the necessary processing and memory resources for effective network management. It is essential to have at least one NMS on any managed network.

3. RESEARCH METHODOLOGY AND FRAMEWORK

This research is focused on gathering non-numerical data through quantitative research methods and experimental validation. The target for assessment is a publicly accessible Network Administrator, and several Network Administrators were interviewed regarding the monitoring of network performance. End users were also asked relevant questions, and Windows NT performance monitoring tools were studied. The system was modeled using Unified Modeling Language (UML) and implemented using Visual Basic. The GFI LAN guard Network Security Scanner (LNSS) is a helpful tool for network administrators to perform a security audit quickly and easily. LNSS functions as a port scanner and creates reports that can be used to fix security flaws on the network. Unlike other scanners, LNSS provides information in a manageable way and includes hyperlinks to security sites for further information on vulnerabilities.

The LNSS has several features and they include:

- **LANS** is a LAN guard scripting tool that enables script creators to write complex security checks. It features a script editor with syntax highlighting capabilities and a debugger.
- **Scheduled scans**—You can schedule LNS to scan and send an email listing any differences it finds from the previous scan.
- **Hot Fix Checker for Windows Machine**—When you scan a machine, the system will now look for any hotfixes installed on it. This process no longer solely relies on checking registry keys, but it will also examine version-specific information on key files.
- **Ability to Patch Windows Machines that are missing Hot Fixes** – When LNS detects that a machine is without Service Packs, it can now automatically send and install the necessary hot fixes without requiring any user input. The installation can either happen immediately or be scheduled for a later time.



· Configuration Manager – With the LAN guard Network Scanner (LNS), you can now configure and customize your scanning preferences to your liking and save it to an initialization file. This eliminates the need to manually change the settings every time you want to switch between scan types. By saving and quickly reloading your configuration files, you can perform multiple scans in less time.

When conducting a network scan with the LANguard Network Scanner, the entire range entered from the main LNSS window is scanned. The scanner will detect which computers are active and only scan those responsible for it. This is achieved through the use of NetBIOS probes, Internet Control Message Protocol (ICMP) Ping, and SNMP queries.

4. SYSTEM DESCRIPTION AND LANGUAGE USED

As a network administrator, it's crucial to be able to capture, view, and analyze the activities that occur on a network when users utilize workstations. The Network Performance Monitoring System is a multithreaded diagnostic tool that helps with this task. Network statistics like network utilization percentage, CPU usage, memory usage, physical disk (percent disk time), and physical disk (average queue length) are needed to understand the overall status of the network.

The NPMS system also helps locate traffic bottlenecks within a network. It continuously tracks packets crossing a network, providing an accurate picture of a period to establish a normal performance profile. The Unified Modeling Language (UML) was used to model the NPMS system in the next selection of the project. UML is an exciting tool in the world of system development today.

4.1 Use Case

The use case diagram describes the system's behavior from the user's perspective. In the case of the network performance monitoring system (NPMS), its use case is as follows:

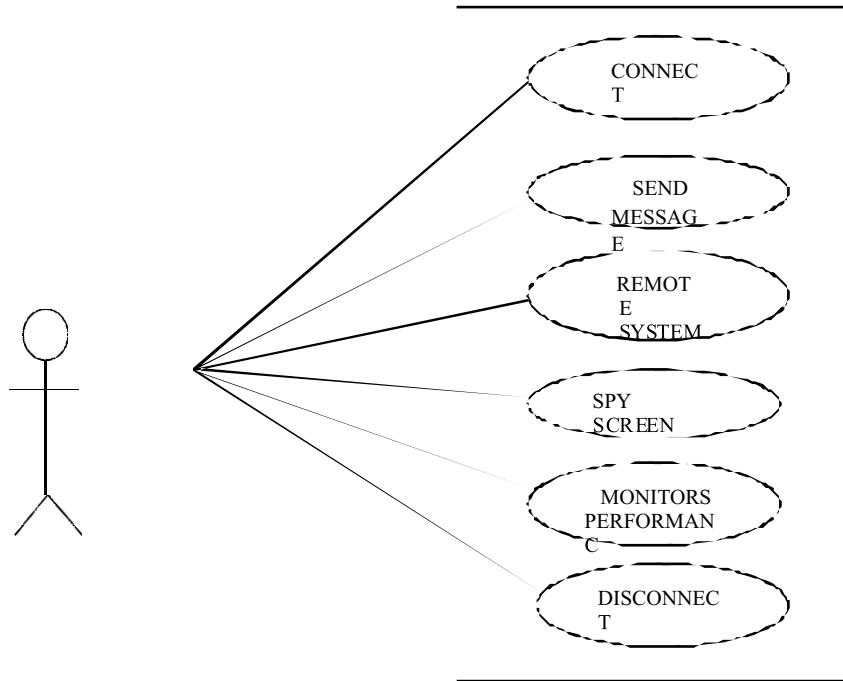


Fig. 1: Use Case Diagram

4.2 The Network Administrator

The only person who interacts with the system (NPMS) is the Network Administrator.

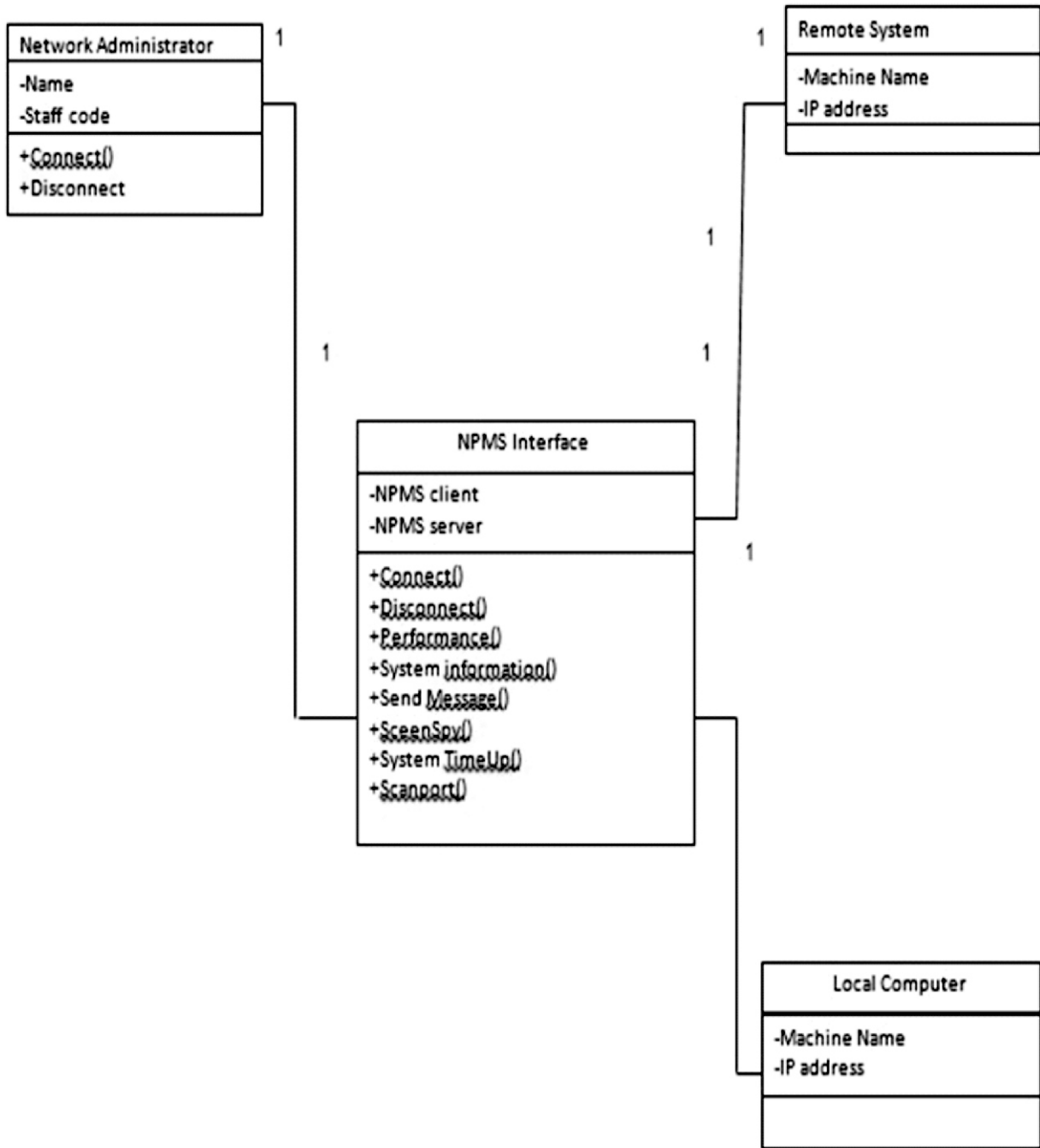


Fig 2: Network Actor Interaction

4.3 Class Diagram

The class diagram is useful for analyzing requirements and serves as a representation for developers to work on. It models each object present in the system.

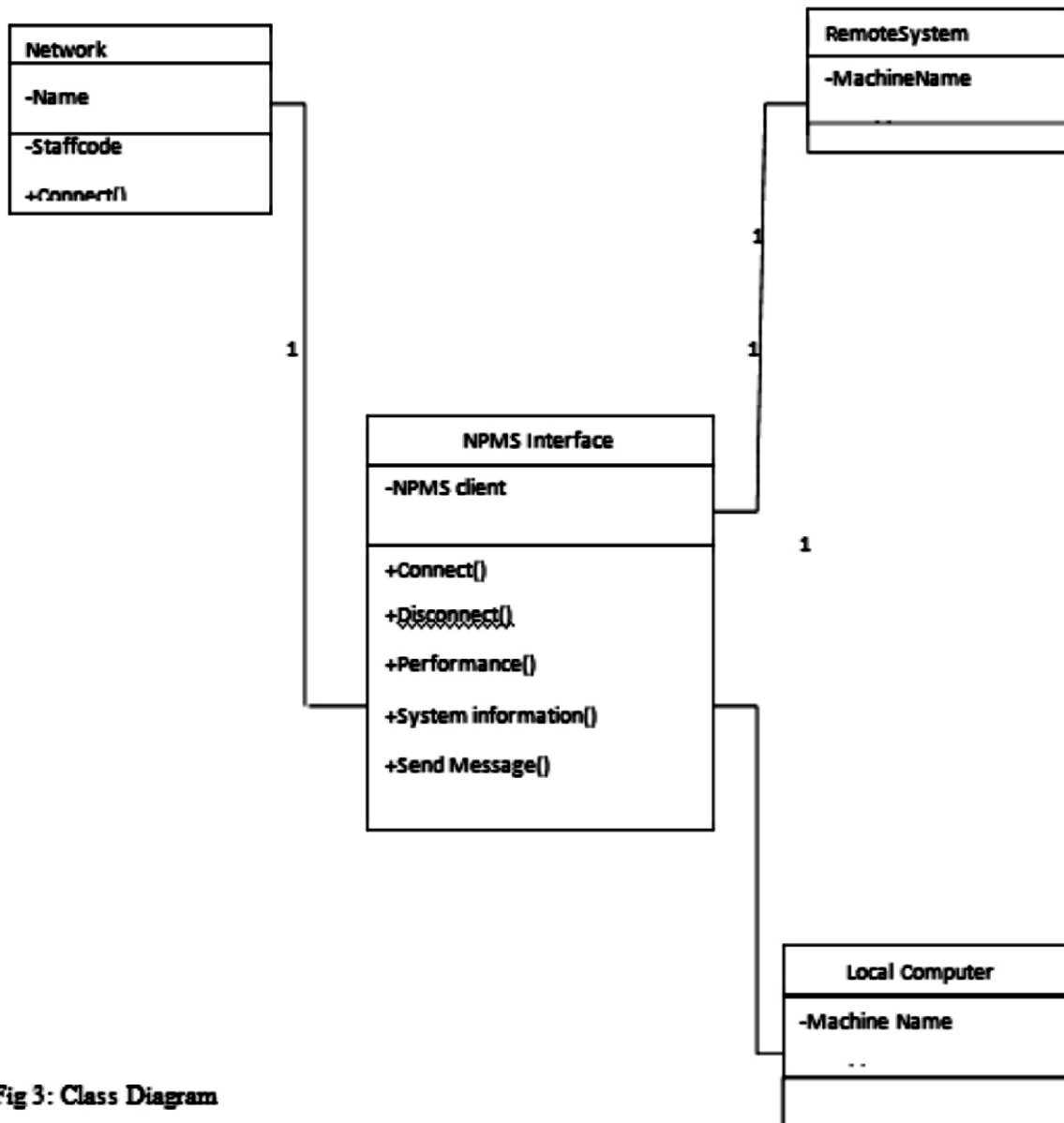


Fig 3: Class Diagram

In the NPMS system, the network administrator is responsible for connecting and disconnecting the machine before and after network monitoring. It's important to note that the monitoring computer (NPMS) can only connect to one remote computer at a time, and the network administrator interacts with just one NPMS.

a. Sequence Diagram

The sequence diagram depicts the chronological behavior of the system's object interaction. NPMS Server is the software installed on the network workstation that offers information regarding a workstation to solve server issues. On the other hand, NPMS Client is the front-end software that requests services from the NPMS Server situated at the back end.

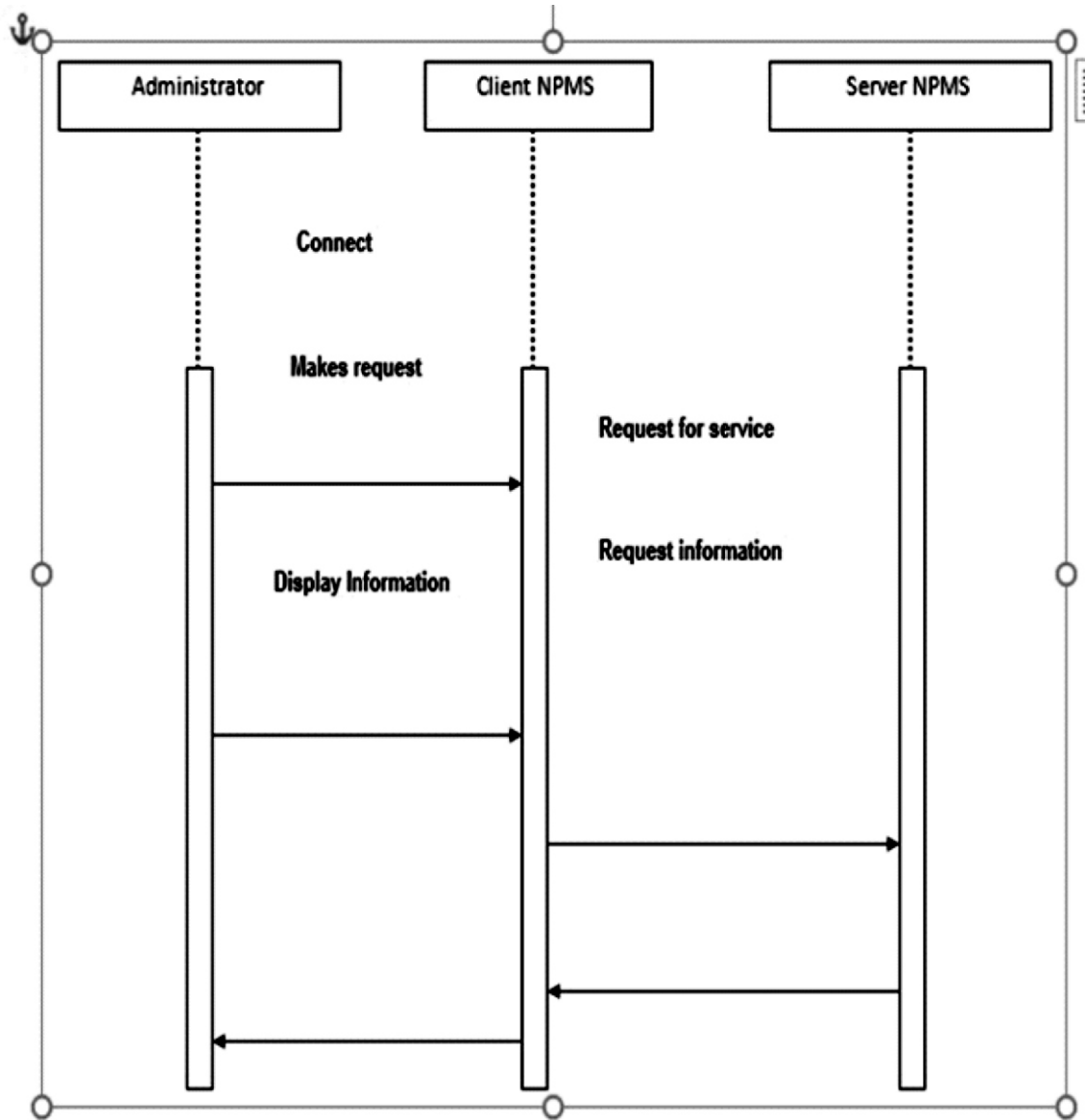


Fig 4: Sequence Diagram

a. ActivityDiagram

An activity diagram is a tool for illustrating activities, decision points, and branches. It depicts the flow of events that occur during an operation and is commonly utilized to model the sequence of events within the objects of a system.

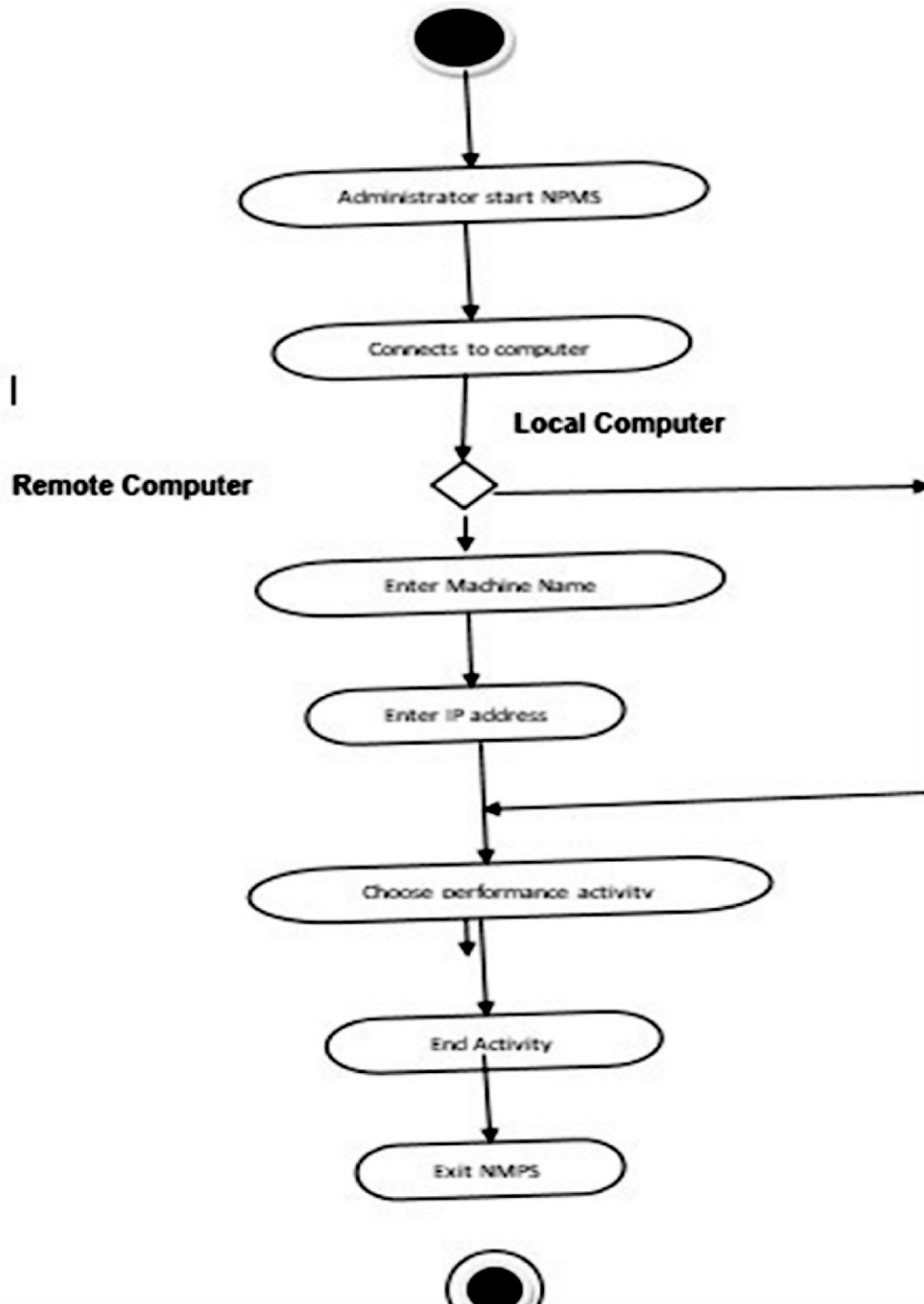


Fig 5: Activity Diagram



4. IMPLEMENTATION

NPM 1.0 is a tool for diagnosing networks, which operates on both client and server sides. It is compatible with Windows QX and other Windows NT platforms. The tool gathers data on the network's status and availability, as well as information on the workstations and local computers it is running on. It uses the latest network research development tools, including socket programming (Winsock in Visual Basic), ActiveX controls, and Windows API functions. The server program should be installed on all remote computers, while the client program should be installed on the monitoring computer.

The two software are designed to identify one another and establish a connection between the computers simultaneously.

1. Server Program: NPMS server
2. Client Program: NMPS client

NPMS server – This software is installed on the network workstation and supplies requested information to the server program. It automatically starts running at Windows startup and sends packets of data to the server program upon request, using integrated socket programming control called Winsock in Visual Basic 6.0.

NPMS client – The front-end software for NPMS requests services from the back-end NPMS server. Developed in a Visual Basic environment, the main interface is called "Network Performance Monitoring System Version 1.0". This dynamic utility includes the following tools:

- * Connectivity
- * Screen Spy
- * Remote Control
- * Performance Monitor
- * Chatting (Message Sending)
- * System Information

5. DISCUSSION

The research findings suggest that the tools used to assess vulnerabilities in Network Performance Monitoring Systems (NPMS) may not strictly adhere to the common vulnerabilities and exposures standard for speed and efficiency. Additionally, there are significant differences in the number of identified vulnerabilities between NPMS and Online Web Application Security. The study shows that proprietary tools like Screen Spy, Performance Monitor, and Nets Parker tend to be more reliable and exhaustive in probing for NPMS vulnerabilities.

It's important to note, however, that subsequent versions of these tools may address the limitations of the older versions. The study also found that some vulnerabilities, such as CSRF, were missed due to the scanners' ineffective functionality. Patil and Gosavi (2015) also discovered that different types of vulnerabilities require different detection methods.

The relevance of these findings is that Network Performance Monitoring Systems Vulnerability Scanners tend to identify more industrial standard results of NMPS application vulnerabilities. However, given the significant number of scanners available, this research is not exhaustive in



NPMS. The case study platform was developed using Internet Control Message Protocol and SNMP queries, and future research on platforms developed with other programming languages, such as XML, PHP, and Java, may be beneficial.

6. CONCLUSION

The Network Performance Monitoring System (NPMS) assists in network utilization, trend analysis, and network capacity planning. This planning involves assessing the current usage of server and network resources and tracking their utilization over time to predict future usage and necessary hardware upgrades. Capacity planning can be performed on a single computer or the entire network. However, further research is required to thoroughly compare open-source and proprietary tools for efficiency, effectiveness, and reliability. Additionally, the platform used for developing the NPMS test should be evaluated to determine any specific capabilities or limitations of open or closed-source tools on NPMS application platforms.

7. CONTRIBUTION TO KNOWLEDGE

NPMS is a crucial tool that aids in the creation of upcoming Network Services. It offers network performance measurement for various network protocols. The capacity to gauge network response time, ascertain device accessibility, scrutinize response time patterns, and provide real-time and historical performance reports are essential needs in modern enterprise networks.

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PREVALENCE OF *CAPRA HIRCUS* L. (GOAT) ECTOPARASITE IN MAJOR LIVESTOCK MARKETS OF ZARIA, KADUNA STATE.

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ABSTRACT

Although large numbers of ruminants are slaughtered per annum, the production of quality skins remains very low. Skin diseases account for considerable economic losses, particularly to the skins and hides export due to various defects, 65% of which occur in the pre-slaughter slabs. This work was conducted to seek information on the prevalence of ectoparasites in selected markets with their associated risk factors of age, sex, and breed to know the prevalence rate. A total of 239 *Capra hircus* (goat) were examined for ectoparasites infestation with associated risk factors of age, sex, and breed. Clinical examination was done by visual inspection, physical examination of the skin, palpation of skin, and hair samples were collected from the infested part of the goat in 70% methanol solution and subjected to identification tests. Results showed that ticks and lice prevalence were 0(0%) Two species of mites encountered were *Demodex caprae* and *Sarcoptes scabiei* var *caprae* prevalence ranging from 9.6% - 17.9% at the age range of less than 2 years and the lowest of 0% at age range of 2-5 years for both male and female. However, West African Dwarf (WAD) recorded the highest with 20(8.4%), and the lowest was recorded by Red Sokoto (RS) with 6(6.7%). The study concluded that though the prevalence was a little lower in the selected the rate could still be brought lower to promote the production of quality skins. The study, therefore, recommended that routine and strategic control measures should be employed to reduce downgrade, skin rejection, and mortality of livestock.

Keywords: Hides and skin quality, Ectoparasite infestation, livestock mortality

1. INTRODUCTION:

Ruminants represent an important segment of the Nigeria livestock system . The national ruminant population of Nigeria is the second largest in Africa after Ethiopia and is estimated to be 13.9 million cattle, 22.1 million sheep, and 34.5 million goats (Lawal-Adebowale, 2012). Although large numbers of ruminants are slaughtered per annum, the production of quality skins remains very low . Skin diseases are accountable for considerable economic losses, particularly to the skins and hides export due to various defects, 65% of which occur in the pre-slaughter slabs . This causes often rejection because of poor quality (Bekele, 2012). Goat rearing is one of the most important aspects of agriculture which has contributed immensely toward the growth and development of the national economy of Nigeria . It contributes significantly to the provision of domestic meat, estimated at over 162,000 tonnes per annum . Goats play important roles in the livelihood of farmers as they provide a vast range of products such as meat, milk, skin, hairs, horns, bones, and manure . These products are sources of raw materials for other industries like tannery, milk production, and many more .

There are many breeds of goat, but only three are major Nigerian breeds namely, West Africa Dwarf (WAD), Sahelian, and Red Sokoto Goat (RSG) . Each breed has a different climatic adaptation, WAD is found in the Southern region while RSG and Sahelian are mostly domiciled in the Northern part of Nigeria . Infestation by ectoparasites could lead to skin damage in the form of downgrading, rejection, irritation, creating an opening for the development of secondary infection, cases of vector-borne diseases, weight loss, loss of blood or anemia and in severe cases death with the consequent



socio-economic implications. Ectoparasites infesting livestock animals are majorly lice, ticks, mites, and so on (Teklay, 2019). They contributed greatly to the loss of livestock farmers by reducing the quantity and quality of livestock animals. They are also responsible for causing diseases in livestock animals; some of these diseases are zoonotic. Zoonotic diseases are diseases that can be easily transmitted from animal to man and vice versa, thereby posing a threat to livestock farmers. Lice can be generally classified into two namely; sucking and biting lice. Sucking lice are more harmful because they live on blood and pierce the skin to obtain it. They are blue or dark gray and have pointed heads and sucking mouth parts. The heads are usually longer than broad. Biting lice live on the surface of the skin and feed on scales, bits of hair, and other debris on the skin's surface. They are yellow or reddish brown and have short, broad, rounded heads, which are usually broader than long. Sucking lice pierce the skin to obtain blood for food. In doing so, they cause intense irritation. Biting lice do not pierce the skin. They move about on the skin surface much more than the sucking lice and irritate the infested animals with their constant movements. They live on particles of hair, dried skin, dried scum, and other bits of skin debris. Because sucking lice consume blood, they are considered more harmful than biting lice. The damage done by both biting and sucking lice is confined largely to that done by wool or mohair. The attempts made by the infested animals to relieve the irritation caused by lice result in injury to the fleece. The wool or mohair becomes soiled, matted, and broken by the rubbing, scratching, and biting done by the infested animals. The value and utility of both are reduced, and the loss sustained by the producer is considerable, examples are *Lignonathus stenopsis*, *L. pedalis*, and *Bovicola caprae*. Ticks are divided into hard (Ixodidae) and soft ticks (Argasidae). Ticks contribute innumerable to the damage of livestock animals. They are vectors of some diseases like theileriosis, ehrlichiosis and many more, examples are *Amblyomma variegatum*, *Ixodes scapularis*, *Ixodes ricinus* Mites are also obligate parasites. Mites are classified as Sarcoptes, Demodex, Psoroptes, and Chiroptes with their unique body morphology and characteristics. Many works have been done in the area of disease transmission of ectoparasites like theileriosis, ehrlichiosis, anaplasmosis, cowdriosis, and rickettsial, e.t.c but little or no work on the prevalence of ectoparasites in goat in Zaria Community and its environs. This work is to provide information on the prevalence of ectoparasites in the three major livestock markets of Zaria, namely Tundun-Wada, Giwa, and Dogarawa livestock markets with their associated risk factors of age, sex, and breed to know if the prevalence is low or high in the study area.

Therefore, this study sought to answer these research questions;

1. What is the prevalence of goat Ectoparasites in relation to age in the three selected markets?
2. What is the prevalence of Ectoparasites of goats in relation to breed in the three selected markets?
3. What is the prevalence of Ectoparasites in relation to sex in the three markets surveyed?
4. What is the Ectoparasites of goat that is identified in the three market study areas?

2. MATERIALS AND METHODS:

Study Area and Animal: Kaduna State is one of the most popular States in the country in northwest geopolitical zones. It is well known for its housing of many federal government institutions, ministries, departments, agencies, and parastatals. The climate is tropical in Kaduna. When compared with winter, the summers have much more rainfall. The climate here is classified as Aw by the Köppen-Geiger system. The average annual temperature in Kaduna is 25.2 °C | 77.4 °F. About 998 mm | 39.3 inches of precipitation falls annually (latitude.com, 2021). It is cited on the latitude of 10° 30' 59.99" N and longitude of 7° 25' 59.99" E (latitude.com, 2021). The survey was conducted in three (3) Local Government Areas in Kaduna State namely, Sabon-Gari, Zaria, and Giwa local government of Kaduna State. Three major livestock markets were selected purposively. The markets have their different market days in the week. Giwa market is located in Giwa local government area (LGA), Dogarawa slaughter slab is located in Sabon-Gari LGA and Tudun-Wada is located in Zaria LGA. The markets were visited on their different market days.

Ectoparasites Identification: The body of the goats was visibly examined for hair loss, keratinization, and attached ectoparasites like ticks, mites, and lice. Hair samples were collected from different parts of the animal body into a methanol container by hair scrapping using a scalpel blade. The sample was immediately transported to the Laboratory of the Department of Parasitological and Entomology in the Faculty of Veterinary Medicine, Ahmadu Bello University (ABU) Zaria for proper identification using morphological characteristics described by Wall and Shearer (2001) after viewing under the microscope of magnification x40. Every goat encountered was tagged to avoid sampling the goat more than once. The hair samples were digested using 30% potassium hydroxide after boiling under a furnace for 10 -15 minutes. The samples were filtered using filter paper and the filtrate was added to methanol to view under the microscope .

3. RESULTS AND DISCUSSION:

Table 1 shows the prevalence of goat ectoparasites in three livestock markets surveyed in relation to their age risk factors, both ticks and lice infestation score 0% prevalence in all the surveyed three livestock markets. Mite infestation was higher in Giwa with 9.6% in less than 2 years and lower at Dogarawa with 0% in all the age ranges (Table 1)

Table 1: Prevalence of Goat Ectoparasites in Relation to Age

Age	G (%)	TICKS& LICE		No. G D	MITES No. (%)		TOTAL	
		T	D		T	D		
<2 years								
Positive	0(0)	0(0)	0(0)	0(0)	23(9.6)	14(4.2)	0(0)	37(15.5)
Negative	33402699				10(4.2)	26(10.9)	26(10.9)	62(25.9)
(%)	(13.8)	(16.7)	(10.9)	(41.4)				
2-5 years								
Positive	0(0)	0(0)	0(0)	0(0)	0(0)	7(2.9)	0(0)	7(2.9)
Negative	25342988				25(10.5)	27(11.3)	29(12.1)	81(33.9)
(%)	(10.5)	(14.2)	(12.1)	(36.8)				
>5years								
Positive	0(0)	0(0)	0(0)	0(0)	3(1.3)	3(1.3)	0(0)	6(2.5)
Negative	19201352				16(6.7)	17(7.1)	13(5.4)	46(19.24)
(%)	(7.9)	(8.4)	(5.4)	(21.7)				

Key- G: Giwa market, T: Tudun-Wada Market, D: Dogarawa Market, No.: Number, %: Percentage

Table 2 shows the prevalence of ectoparasites in the three surveyed livestock markets in relation to the breed. West African Dwarf scored 8.7% in Giwa which was the highest followed by 6.7% in red Sokoto at Giwa and the lowest was 0% in Dogarawa among all the three breeds considered for this survey (Table 2).

Table 2: Prevalence of Ectoparasites of goats in relation to breed

BREED	TICKS& LICE No. (%)		No. D	MITES No. (%)		TOTAL
	G	T		T	D	
MARADI/RED						
SOKOTO	0(0)	0(0)	0(0)	6(6.7)	10(4.18)	0(0)
Positive (%)	506444158			16(6.7)		
Negative (%)	(20.9)	(26.8)	(18.4)	44(18.4)	54(22.6)	44(18.4)
				142(59.4)		
WEST AFRICAN DWARF GOAT						
Positive (%)	0(0)	0(0)	0(0)	2014034		
Negative (%)	27302481			(8.4)	(5.9)	(14.2)
	(11.3)	(12.6)	(10.0)	7(2.9)	16(6.7)	24(10.0)
	(33.9)			47(19.6)		

Key- G: Giwamarket; T: Tudun-Wada Market, D: Dogarawa Market, No.: Number, %: Percentage

Table 3 shows the ectoparasites prevalence in relation to sex in three livestock markets surveyed. Tudunwada recorded the highest prevalence for males than females which were 17.9% and 12.1% respectively. Giwa market scored 15.5% for males and 4.6% for females (Table 3).

Table 3: Ectoparasites prevalence in relation to sex

SEX	TICKS& LICE No. (%)			MITES No. (%)		TOTAL
	G	T	D	T	D	
Male						
Positive	0(0)	0(0)	0(0)	37(15.5)	43(17.9)	0(0)
Negative	0(0)			80(33.5)		
	63(26.4)	51(21.3)	46(19.2)	26(10.9)	8(3.3)	46(19.2)
	160(66.9)			80(33.5)		
Female						
Positive	0(0)	0(0)	0(0)	11(4.6)	29(12.1)	0(0)
Negative	0(0)			40(16.7)		
	14(5.9)	43(17.9)	22(9.2)	3(1.3)	14(5.9)	22(9.2)
	79(33.1)			39(16.3)		

Key- G: Giwa market, T: Tudun-Wada Market, D: Dogarawa, MarketNo.: Number, %: Percentage

Table 4 shows the major mite species identified during the survey. Mite species were the only ectoparasites identified throughout the survey period.

Table 4: Mite Species identified

MITES	MARKETS		
	G	T	D
<i>Demodex caprae</i>	65%	70%	0%
<i>Sarcoptes scabiei</i> var <i>caprae</i>	35%	30%	0%

Key- G: Giwa market, T: Tudun-Wada Market, D: Dogarawa Market

$$\text{Prevalence (P)} = \frac{\text{TOTAL NUMBER OF GOATS TESTED POSITIVE}}{\text{TOTAL NUMBER OF GOATS EXAMINED}} \times 100$$

$$\text{Prevalence (P)} = \frac{50}{239} \times 100$$

$$P = 20.92\%$$

$$P = 21\%$$

The overall prevalence rate of ectoparasites of goats at Zaria is 21% which is lower compared to the prevalence recorded in similar work at Anambra state where 70.4% was recorded however, the overall prevalence of 21% recorded in this study is higher than that of Kagira and Kanyari (2001) who reported a prevalence of 10.0% in sheep and goats in Gwagwalada area of FCT Abuja, Nigeria, the 13.1% reported by George *et al.* (1992) in Zaria, Kaduna State, North Western Nigeria. 18.52% reported by Ugochukwu and Apeh (1985) and 8.7% reported by Ohaeri and Ugwu (2013) were also lower than the recorded prevalence rate in this survey. The prevalence of 21% recorded is lower than 45.95% reported by Ugochukwu and Apeh (1985) in Nsukka, Enugu State, South Eastern Nigeria, 55.1% reported by Ohaeri and Ugwu (2013) in Michael Okpara University of Agriculture, Umuidike, animal husbandry farm at Umuahia, Abia State, South Eastern Nigeria and 68.1% reported by Obi *et al.* (2014) in Uli, Anambra State, South Eastern Nigeria. Likewise, 47.0% reported by Onojafe (2008) in Ethiopie West Local Government Area of Delta State, South Southern Nigeria, and 69.8% reported by Obi *et al.* (2014).

The lower prevalence rate could be a result of the presence of Ahmadu Bello University veterinary service in Zaria. This gives farmers proximity to cheap and timely treatment of their livestock. The tick prevalence in all surveyed markets was zero percent (0%), this could be attributed to the time of the season in which the survey was carried out. The survey was done from October to December which is considered to be the beginning and the mid of the dry season. This work is contrary to the works of Osman (1997), Onojafe (2008), Mbuh *et al.* (2008), Mulugeta *et al.* (2010), Ohaeri and Ugwu (2013) and Yishak *et al.* (2015) where ticks prevalence was prominent. Ticks are more prevalent during the rainy season ranging from April to September but have a record of low prevalence during the dry season (Table 1, 2, & 3). The overall prevalence of 21% of mites infestation in Zaria is higher than the 15.4% posited in Anambra and Ethiopia. 21% mange prevalence recorded might be as a result of Ahmadu Bello University veterinary services availability and the level of awareness among the livestock farmers in the area the highest of which was recorded in West Africa Dwarf (WAD) than Red Sokoto (RS) breed (Table 3), this may be due to adaptation of red Sokoto goat because they are indigenous breed to the Sudan savannah than rainforest breed of West Africa Dwarf (WAD) (Lawal-Adebowale, 2012). There was no record of the Sahelian goat breed in the location of the study.

The associated risk factors indicated the highest mites prevalence rate in age less than 2 years, (Table 1) this agree with the work of where age 1-5 years had a highest 54% prevalence rate than other age groups, this was attributed to the ability of the animal high activeness, struggling, thriving to survive, low immunity and vulnerability of this young goats that predispose them. Hansen (2011) reported that the young goat's hematological parameters make them susceptible to ectoparasites infestation. Age 2-5 years scored second in the prevalence rate, this could be due to peri-parturient immunity because immunity decreases during pregnancy or in lactating mothers (Hansen, 2011)

The male goat had the highest prevalence rate than their female counterparts (Table 3) this could be a result of using one male goat to carter for the reproduction of a large flock of female goats and their ability to cover a long distance in free range system, this agrees with the finding of Mandefrot (2018) in Angacha where male goats and sheep had the highest prevalence than the female goats and sheep. The common mite species encountered during the survey were *Demodex caprae* and *Sarcoptes scabiei var caprae*. These are mites of goats; this result indicates that there is no case of co-habitation of the goats with other animals if not other mites peculiar to other animals would have an equal chance of being encountered (Table 4).

1. CONCLUSION AND RECOMMENDATION:

The prevalence rate of ticks and lice was 0% and overall mite prevalence was 21% in this survey. The less than 2 years goat had the highest mite prevalence rate while the West African Dwarf (WAD) breed scored the highest mite prevalence rate. In risk-associated factors for sex; the male had the highest prevalence rate, *Demodex caprae* and *Sarcoptes scabiei var caprae*. More veterinary attention should be given to the location to eliminate the existence of skin infestation that lead to downgrade or rejection of the skin from livestock animals. Intensive care methods of livestock farming reduced the chances of infestation among livestock animals. Similar work like this could be conducted during the rainy season in the same locations as compared to the existing works.

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INTERNATIONAL PUBLIC SECTOR ACCOUNTING STANDARDS (IPSAS) ADOPTION AND FINANCIAL REPORTING QUALITY OF NIGERIA PUBLIC SECTOR ENTITIES

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Abstract

The study assessed the extent to which IPSAS engenders financial reporting quality in Nigeria. The study's population consisted of 426 employees of Federal Government agencies in FCT, Abuja, and a sample size of 206 employees. A total of 206 copies of the questionnaire were distributed but 200 validly returned copies of the questionnaire were used. The data for this study were analyzed using regression model. The result shows that IPSAS has a considerable positive effect on the transparency of the Nigerian public sector's financial reports. Furthermore, the adoption of IPSAS has a negative minor influence on the reliability of financial reports in the Nigerian public sector. Finally, it is discovered that IPSAS implementation has a considerable beneficial influence on the value relevance of financial reports. It is recommended that Nigeria's federal government should continue with the IPSAS adoption. The increased transparency in public financial reports would make stakeholders trust the government's financial disclosures. This will go a long way in helping government institutions earn the confidence of stakeholders who intend to invest and partner with the government towards achieving the medium-term economic growth plans of the government.

Keywords: IPSAS, transparency, reliability, accountability, value relevance, and financial reporting quality.

Introduction

There has been increased concern regarding the prudential use of borrowed funds and the management of public debt in Nigeria. The country's debt profile is also growing at an exponential rate without a concomitant report that gives detail on how these funds were expended. This represents a lack of transparency and accountability by the government; which is what International Public Sector Accounting Standards (IPSAS) was supposed to address in the first place. Globally, leaders owe it to their constituents to figure out how to be financially responsible and transparent to execute their statutory obligations and maintain their confidence. In response to the financial rascality of public office holders that supervise government entities, the International Federation of Accountants Committee (IFAC) established the International Public Sector Accounting Standards Board (IPSASB) to establish the International Public Sector Accounting Standard (IPSAS) (IPSASB 2019). The standard encourages financial reporting excellence, thorough disclosure, account synchronization, and consistency, setting the stage for more transparency and faithful representation (Ijeoma & Oghoghomeh, 2014). It was also argued that IPSAS enhances accountability, lowers graft, and increases the effectiveness and efficiency with which inhabitants of nations or entities that have adopted it are served (Erin, Okoye, Modebe & Ogundele, 2016). As a result, IFAC and IPSASB, in particular, have advised all countries around the world to adopt international standards capable of directing the government's disclosure and accountability toward the citizenry (IFAC, 2018). IPSAS adoption provides the opportunity to properly manage public finances, with numerous benefits. As observed by Shehu and Adamu (2014), these advantages include tighter fiscal control, the provision of quality financial statements, government accountability, strict monitoring, adherence to effective

performance measurement, and the avoidance of decisions that have an inverse effect on productivity. On the other hand, fiscal irresponsibility and unreliable data, acute corruptions are simply the product of deficiency in the availability of IPSAS, all of which are horrific to the sustainability of the Nigerian economy. (Zhuquan & Javed, 2018).

The major essence of IPSAS was to improve the quality of financial reporting by public sector entities and to ensure equitable resource distribution, as well as encourage government stewardship to their citizens and electorates (IPSAS, 2019). IPSAS Adoption by developing nations was also to improve the understandability, relevance, and reliability of financial information provided by government entities. To achieve shared prosperity and long-term reductions in corruption and maladministration, good governance that falls within the arm bit of a universally acceptable accounting framework such as IPSAS is essential. Public accountability and competent governance result in enhanced public service delivery, competition, and growth, including collaboration with public service groups. Globalization, the ease of managing global trade, and the execution of intergovernmental continued development are the essence of global IPSAS adoption. Comparability, dependability, and relevance of financial information, on the other hand, are significant barriers to IPSAS adoption (Beredugo, 2021). Given this development, this study revolves around the efficacy of IPSAS implementation on the financial reporting quality of public sector entities in Nigeria.

Statement of the Problem

It is in the public domain that the Nigerian government is presently drenched in sovereign debt issues. There has also been increased concern regarding the prudential use of borrowed funds and the management of public debt. The country's debt profile is also growing at an exponential rate without any report that gives detail on how these funds were expended. This represents a lack of transparency and accountability by the government; which IPSAS has set out to address. In other circumstances, the IPSAS financial reporting structure is expected to be an effective tool for addressing the government's financial information provision problem, but the public sector remains skeptical of full IPSAS implementation. Financial reports from government organizations in the Nigerian Public Sector continued to indicate a lack of transparency and incorrect application of accounting laws. As observed in FAAC's (2020) study, many states that have adopted IPSAS are not fully complying with the disclosure rules.

It is also crucial to note that, despite the importance of IPSAS implementation, the country was unable to meet the 2016 deadline, despite repeated attempts by the authority at the center since the IPSAS adoption roadmap was drawn up in 2010. The influence of IPSAS implementation on the level of financial reporting quality in Nigeria is also undetermined. This has prompted academics and other stakeholders to question whether the implementation of IPSAS has enhanced the quality of public accounting information in Nigeria, and that is the gap this study is set out to fill.

Objectives of the Study

The primary goal of this research is to investigate the effect of international public sector accounting standard adoption on the quality of financial reporting in the Nigerian public sector. Among the specific goals are to:

1. Examine the effect of IPSAS adoption on transparent financial reports in the Nigerian public sector.
2. Evaluate the effect of IPSAS adoption on the accountability of financial reports in the Nigerian public sector.
3. Determine the effect of IPSAS adoption on the reliability of financial reports in the Nigerian public sector.
4. Ascertain the effect of IPSAS adoption on the value relevance of financial reports in the Nigerian public sector.

Conceptual Review

International Public Sector Accounting Standard

Governance concerns are addressed with the highest openness and rectitude in developed countries, allowing individuals to actively participate in policy and decision-making (Tanjeh, 2016). The main advantages of IPSAS are probity, clarity, and personal accountability (Maciucăi & Seucea, 2013). Huges (2013), posits that the implementation of IPSAS allows citizens to engage in policy and decision-making in their countries by providing access to and monitoring public organizations' financial arrangements. While Ezebuoro (2015), stated that IPSAS is an important aspect of a country's institutional architecture as a competent government accounting standard. In the majority of African countries, particularly Nigeria, it is used as a standard for examination and leadership accounting (Balogun, 2017).

In the opinion of Bastani, Abolhalaj, Jelodar, and Ramezani (2012), IPSAS provides economic fact dependability, enhances public trust, and encourages new business. Based on the preceding assumptions, IPSAS inspires the following: morally acceptable prudence, succinctness, and monitoring and oversight in management; increased civic participation in policy and decision-making; a policy framework for democratic implementation; a key performance indicator for assessing and improving government accounting practices; informed evaluation of public - sector priority setting; and enhanced credence and transparency of financial reports. Babatunde (2017), observed that IPSAS provides the full accounting database needed to promote transparency in government. This is because it is based on an accrual basis, and accrual-based accounting reporting is of higher quality than cash-based financial reporting. The primary goal of IPSAS is to enhance the accuracy of financial reports for general purposes financial reports (GPFs) that are used by public entities to think critically and allocate wealth equitably.

In the words of Balarabe and Aliyu (2015), IPSAS compliance ensures that accounting data for public entities provide an accurate and fair depiction of their financial status and demonstrates transparency and trust in the conduct of monetary policy. The Public sector entities are mandated to implement accrual-based financial reporting that would ensure that economic transactions are recognized even before they are settled (Godson, Mory & Lapointe, 2012). They argue that it is necessary for intelligent decisions, in addition to responsibility and transparency. The primary benefits of government accrual accounting are faster data accessibility, and forward-looking information, including the ability to offer solutions continuously. The standard-based accrual accounting also conforms to other government financial disciplines such as planning and treasury services.

Financial Reporting Quality in the Nigerian Public Sector

Financial accounting information must be demanded by users and expected to influence their decisions to be relevant. The word "honest depiction" refers to the accounting data that accurately represents the underlying economic activity that happened during the period under consideration (Roje, Vasicek & Vasicek, 2010). Where accounting measurement and recognition as well as rules and regulations are similar to themselves in different economic jurisdictions and from one period to another, accounting data is said to be comparable. Another major characteristic of financial accounting quality includes but is not limited to understandability, comparability, relevance, reliability, and timeliness. The qualitative characteristics simply propel easy comprehension of government financial report that is traceable to the books of account and meet the needs of all financial recipients on timely bases. Consistent cost and pricing information; asset and liability stewardship; faster data access; forward-thinking expertise, including the ability to provide continuing solutions; financial similarity with the organization, which improves training and comprehension are the qualities of the financial report in the public sector. Standard-based accrual accounting is consistent with other government financial disciplines such as planning and cash management.

Transparency and Accountability

Transparency is the quality of being easily seen through, while transparency in a business or governance context refers to being open and honest. As part of corporate governance best practices, this requires disclosure of all relevant information so that others can make informed decisions. It implies openness, communication, and accountability. Transparency is practiced in companies, organizations, administrations, and communities. Good governance is concerned with the assessment of government performance relative to the attainment of its stated goals. The word 'Governance' was derived from the Latin word 'Gubernare', meaning 'to rule or steer'. This word was used to refer exclusively to the exercise of power and responsibility for accountability in the running of kingdoms, regions, and towns (Popoola, 2020). It is a measure of the level of transparency, integrity, effectiveness, and efficiency in the application of scarce resources to satisfy the desires and aspirations of the citizens. There are eight major characteristics of good governance; include accountability, transparency, effectiveness and efficiency, participation, consensus, responsiveness, equity and inclusiveness, and following the rule of law (Angahar, 2020).

Accountability refers to the process of holding persons or organizations responsible for performance as objectively as possible (Angahar, 2020). When an individual is elected or appointed to superintend over the affairs of an office, such a person becomes an agent or trustee and acts on behalf of those who either elected or appointed him. This agency relationship creates a social contract between the agent and the principal with obligations on the agent to be answerable for his actions and inactions. It is only proper that public entities that utilize public resources should have an obligation to account for the way these resources are allocated and used and the results these spending have achieved.

In the words of Akpa (2014) cited in Angahar (2020), public accountability in a democracy has three components namely; Financial accountability, Administrative accountability, and Political accountability. First, Financial accountability places an obligation on all public office holders entrusted with public funds to account for the allocation, custody, and use of such resources in line with the established policies, rules, and regulations. Second, administrative accountability seeks to check the degree to which the administrative structure of governance functions well. Third, Political accountability arises when a politician makes choices on behalf of the people and the people can reward or sanction politicians.

Value Relevance Determinants

Value relevance is the ability of earnings to predict future dividends, future cash flows, future earnings, or future book values (Francis and Schipper, 1999). Value relevance is observed as a favorable characteristic of accounting information as it is intended to address relevance and reliability, the primary criteria for standard setters to choose among accounting alternatives (Barth, Beaver & Landsman, 2001). Earnings response is affected by risk, growth, and interest rate which are referred to as economic determinants of earning response. The economic determinant of accounting amount is not a major concern because investors are concerned about whether it contains information useful for market participants, but risk, growth, and interest rate are major economic determinants of earnings response. If the investor is risk averse, a higher risk for expected future return will have a lower value than a low-risk sequence of future returns all things being equal. In a similar development, earnings response will be higher in firms that have the opportunity for growth potential in certain investments that are expected to give above the normal rate of return. In the case of interest rate, the risk-free interest rate of return in addition to the risk premium constitutes the discount rate, which is used to discount the revisions in expectations of future earnings innovations. Any increase in the interest rate would then cause an increase in the discount rate and therefore lower discounted value of earnings innovations all things being equal. According to International Financial Reporting Standard; IFRS (2007), the major objective of a financial statement is to provide financial information about the financial position, performance, and changes in the financial position of an entity that is, useful to a wide range of users in making economic decisions. The provision of financial information is concerned with the disclosure in the financial statement; it is paramount to

discuss the concept of disclosure about value relevance. To be effective, financial reporting must contain information that is both relevant and credible. Financial reporting standards guide how accounting information should be recorded, reported, and interpreted. Levitt (1996), in identifying what high-quality accounting standard delivers, stated that educated investors need relevant useful information to make their investment decisions. Differences in the quality of accounting standards, specifically, play a role in differences in the value relevance of accounting numbers Babalyan (2001); Bartov, Goldberg & Kim (2002).

Value relevance also refers to the ability of information shown in financial statements to capture and summarize a company's worth and predict future earnings Gjerde, Knivsfla & Sættem (2005). Gjerde et al (2005) posits that value relevance can be assessed using statistical correlations between financial statement information and stock market valuations. The metadata studies on value relevance utilizing event studies explore capital market reactions to financial information, with a primary focus on earnings as the primary output of financial reporting. Share price reactions to earnings announcements suggest that the reported earnings numbers provide fresh information to market participants, causing them to revise their projections regarding firms' future revenues. Considering economic efficiency and no other evidence affecting price movements, earnings announcements are seen as valuable for investment decisions and have informativeness, which then refers to market participants' reactions to reported earnings. The literature on earnings response coefficient and earnings coefficient on unexpected-earnings/abnormal-returns relationship has provided a deeper understanding of the return-earnings relationship by demonstrating how this relationship varies across time and firms, as well as key conceptual improvement to expedite the configuration of the more potent evaluations.

To assess the quality of the accounting standards SEC (2000) emphasizes that accounting standards must result in a consistent application, and provide for transparency and full disclosure. The aim is that the standards produce relevant and reliable information that is useful for investors to make well-informed decisions. Accounting standards that fulfill such quality measures create high-quality accounting information specifically information regarding a firm's earnings. Bell and Carcello (2000) provide evidence that accounting earnings in enhancing common-law accounting countries' accounting standards are substantially more timely and conservative than code law countries, particularly in incorporating losses.

Theoretical Framework

Institutional theory

Freeman and Reed (1983), posit that institutional theory explains that organizational behavior is conditioned by the expectations stemming from the institutional environment. Institutional theory is concerned with examining and explaining how institutionalized norms and pressures affect social changes among organizations. This theory is slowly but steadily emerging as a useful theoretical framework concerning the environmental implications of an organization's operations and behaviours. The institutional framework emphasizes the importance of regulatory, normative, and cognitive factors that affect firms' decisions to adopt a specific organizational practice. Institutions function within and around a social framework of tolerable guidelines that coordinates economic behavior (Acho, 2014). The fulcrum of institutional theory affirms that organizations respond to pressures from their environments and inculcate socially acceptable procedures that conform to dominant norms and traditions. This is linked to IPSAS as it prescribed a social and legal framework that enables public institutions to react and address the demand for quality financial reports from government institutions.

Empirical Review

Tawaih (2021) investigated how worldwide public accounting standards aid or impede misconduct in emerging economies. Between 2005 and 2017, he applied the System Generalizable Method of Moments on a sample size of 77 emerging economies. He discovered that IPSAS is inversely and substantially connected with corruption, meaning that adopting IPSAS aids in the prevention of corruption in emerging regions. After adjusting for IPSAS history and the deployment of other



standards, the results remain constant. However, subsequent studies found that the inverse effect of IPSAS on corruption is more acute in nations that have accrual-based IPSAS in place.

Izuekee, Onah, Ugwuibe, Okwueze, Agu, Ugwu & Ezeibe (2020) carried out a study on whether the application of global public sector accounting standards (IPSAS) in Nigeria since its introduction in 2014 has resulted in increased public sector reporting qualities. Following a qualitative survey of agencies in five states in southern Nigeria, the data were reviewed using the comparative discussion procedure. They discovered that the level of IPSAS implementation in Nigeria has resulted in a lack of openness and responsibility within the public service. They additionally observed that the major conditions for complete IPSAS implementation are governmental will, accrual accounting regulations, and internet access, all of which were lacking at our study site.

The role of foreign public sector accounting standards in reducing corruption among Enugu State public officials was explored by Ezejiofor, Okolocha, and Ofurum (2020). They surveyed all employees of the Enugu State Ministry of Finance. The researchers used frequency counts and mean scores to analyze the study's findings. The hypothesis was tested at 5% significance using SPSS version 20.0's t-test statistical tool. Findings revealed that implementing worldwide governmental accounting standards reduces crime.

Olola (2019) investigated the impact of IPSAS on financial reporting in Ondo State, Nigeria. This was limited to the state ministries in Ondo State. The survey design was used; while a Multivariate technique was used to investigate the impact of IPSAS on government accountability. The findings revealed that IPSAS has a significant and positive impact on the effective administration of public resources in Nigeria.

Aduwo (2019) investigated the effect of International Public Sector Accounting Rules on Nigerian fiscal responsibility. The study examined how global public financial management criteria affect the optimized utilization of government funds in Nigerian public sectors, as well as how international public sector accounting standards aid in the effective completion of tasks in the Nigerian public sector. The study included participants from Ondo State's 18 Local Governments' internal audit, accounting, and finance sectors. The survey design was used to gather data from the agency-chosen respondents and the research instrument was a questionnaire structured on a five-point Likert scale. The findings revealed that there is a significant effect of IPSAS adoption on the fiscal responsibility of the State government.

METHODOLOGY

The descriptive research methodology was used in this study and data were gathered from government agencies employees in Nigeria's FCT, Abuja. The population of the study comprised 426 staff that are proficient in Accounting and financial reporting, while the sample size of 206 was arrived at using the Yamane (1964) sample size determination technique. The sample size informed the distribution of 206 copies of the questionnaire, while the duly returned and valid number of questionnaires that were used for the study was 200 copies. This represents a 97.1 percent response rate. The questions were structured in simple English for easy comprehension and the respondents indicate the frequency of their various opinions under Strongly Agree (SA) =5, Agree (A) =4, Undecided (UD) =3, Disagree (DA) =2 Strongly Disagree (SD) =1.

Models specification

Adopted model is given in a functional model:

- Transparency = f(IPSAS Adoption) Model 1
- Accountability = f(IPSAS Adoption) Model 2
- Reliability = f(IPSAS Adoption) Model 3
- Relevance = f(IPSAS Adoption) Model 4

The model is specified in a linear estimation form;

- $TRP = \beta_0 + \beta_1 IPSAS + \mu$ **Model 1**
- $ACCT = \beta_0 + \beta_1 IPSAS + \mu$ **Model 2**
- $RLIA = \beta_0 + \beta_1 IPSAS + \mu$ **Model 3**
- $REV = \beta_0 + \beta_1 IPSAS + \mu$ **Model 4**

Where;

TRP= Availability and accessibility of financial information

ACCT=Accountability

RLIA= Presentation of financial information

REV= Reported expenditure and full disclosure of debt and liability

IPSAS= IPSAS adoption

Stochastic Error Term/ Disturbance Factor= μ

Shift Parameters= b_1 ,

Constant Parameter= β_0

Analysis of Data

The analysis of the data shows as follows:

Table 1: Descriptive statistics

	IPSAS	TRP	ACCT	RLIA	REV
Mean	4.82000	4.745000	4.31000	4.56500	4.69000 5.00000
Maxi	5.000000	5.000000	5.000000	5.000000	0 2.00000
Min	4.000000	1.000000	2.000000	2.000000	0 0.54349
Std. Dev.	0.385150	1.199830	0.835100	0.669340	0
Skewness	-1.678000	-1.78400	-1.36900	-1.76400	-1.94100
Kurtosis	0.825000	2.10700	1.62700	3.59400	4.91800 85.5496
Jarque-Bera	58.00739	1035.638	1035.638	245.8962	9 0.00000
Probability	0.000000	0.000000	0.000000	0.000000	0
Observations	200	200	200	200	200

Source: E view output in appendix

Table 1 above presents the descriptive statistics of all the variables. The number of observations for the study is 200. The result reveals that the IPSAS adoption response reflects a mean of 4.82000 with a standard deviation of 0.385150. IPSAS also revealed a maximum value of 5.0000 and a minimum value of 4.0000. Response for transparent (TRP) financial representation reveals a mean of 4.745000 with a deviation of 1.199380. TRP further reveals maximum and minimum values of 5.000 and 1.0000 respectively. The response for reliability (RLIA) of the financial report has a mean of 4.56500 with a deviation of 0.6693. Accountability shows a mean of 4.31000 with a deviation of 0.835100. Furthermore, RLIA records a maximum and minimum values of 5.0000 and 2.0000. More so, the response for relevance (REV) of financial report results reveals maximum and minimum values of 5.0000 and 1.00000. REV also revealed mean and standard deviation of 4.69000 and 0.543490. The mean for IPSAS and RLIA specified that the respondent agrees that public organizations have adopted IPSAS and that the financial reports of public organizations are reliable. For TRP, the mean shows that the respondent strongly agrees that the financial reports of public organizations are transparent. While the respondent disagrees that public organizations' financial reports are value relevant.

To ensure that the fluctuations that have occurred in the responses do not distort the outcome of the regression result of the study, the skewness test is used as a further data normality test. The skewness test reveals values for all the variables within -2.5 to +2.5 which are within the accepted skewness range except data for TRP. Furthermore, the study variables revealed the respective Jarque-Bera

probability values of less than (<) 0.05; this further proves that the set of data is not stationary thus further data diagnostic test is required before the final regression analysis.

The following before and posttests are performed to guarantee that the results are robust.

Table 2: Validity test

TEST	TEST STAT	MODEL TRP		MODEL RLIA	
		(Prob)	ACCT (Prob.)	(Prob)	MODEL REV (Prob)
Independence of residuals	Durbin Watson	2.12 (DW)	1.891 (DW)	2.383 (DW)	2.027 (DW)
	Ramsey Reset test	0.207 (tau-P)	0.3220 (tau-P)	0.5775 (tau-P)	0.2244 (tau-P)
Serial autocorrelation	Breusch-Godfrey SLLM test	0.382 (Prob)	0.2924 (Prob)	0.0062 (Prob)	0.7918 (Prob)

Source: E view output in appendix ii

The result for the four models (TRP & IPSAS; ACCT & IPSAS; RLIA & IPSAS; REV & IPSAS) reveals Durbin Watson statistics of 2.12, 1.891, 2.383 & 2.027. This indicates that the set of data for the model variables has residuals that cannot influence the outcome of the linear regression. As posited by Field (2009), a Durbin-Watson statistic within the range of 1 to 3 is appropriate for a linear model. This is the case with the study result. The Ramsey reset test (post) with probability values of 0.2070; 0.3220 0.5775 & 0.2244 further prove that there is no need to include the residuals to reset the linear model since the observations are free from auto correlation.

TABLE 3: Regression model analysis

Dependent Variable	Parameter	B	Fisher Stat.	F. Prob	Sig.
TRP	Const	3.670102	67.23510	0.00007	0.0000
	IPSAS (Coef)	0.27019			
ACCT	Const	3.417001	14.01000	0.00000	0.0000
	IPSAS (Coef)	0.325010			
RLIA	Const	3.001019	14.01000	0.00000	0.0000
	IPSAS (Coef)	0.39602			
REV	Const	2.335011	14.76122	0.00000	0.0000
	IPSAS (Coef)	0.525011			

Source: E view output in appendix

Table 3 presents the regression result between IPSAS and financial report quality proxies. From the model summary table above, the following information can be distilled.

TRP, ACCT, RLIA & REV show that when IPSAS is held stationary; there will be a variation in TRP, ACCT, RLIA, and REV by 3.670102, 3.417001, 3.001019, and 2.335011 units respectively. This simply implies that there is likely an increase in TRP, ACCT, RLIA, and REV without the introduction of IPSAS. A unit increase in IPSAS will lead to an increase in TRP by 27.0%. A unit

variation in IPSAS will also lead to an increase in ACCT, RLIA, and REV by 32.5%, 39.6%, and 52.5% respectively.

H_{o1}: *The adoption of IPSAS has had no discernible effect on the accuracy of financial reporting in the Nigerian public sector.* Since the calculated probability value for IPSAS (0.0000) against TRP response is less than the accepted probability value of 0.05. The null hypothesis is rejected and the alternative is accepted.

H_{o2}: *The implementation of IPSAS had no significant influence on the transparency of accounting results in Nigeria's public sector.* Our result shows that the calculated probability value is less than the accepted probability value of 0.05. This indicates that the *implementation of IPSAS has a significant influence on the transparency of accounting results.*

H_{o3}: *The adoption of IPSAS has had little impact on the reliability of financial reports in Nigeria's public sector.* Since the calculated probability value for IPSAS (0.000) against the Reliability response is less than the accepted probability value of 0.05. The null hypothesis is rejected and the alternative is accepted thus; IPSAS adoption has a significant effect on the reliability of financial reports in the Nigerian public sector.

H_{o4}: *The use of IPSAS has had no significant impact on the value relevance of financial reports in the Nigerian public sector.* Because the computed probability value for IPSAS versus REV answer (0.0000) is less than the allowed probability value of 0.05. As a result of the null hypothesis being rejected then the alternative is accepted.

DISCUSSION OF FINDINGS

The study relied on primary data collected from FCT residents. It specifically revolves around IPSAS adoption and financial reporting quality in the Nigerian public sector, with the following results; it was discovered from our study that IPSAS adoption has a considerable effect on transparency financial reporting in the Nigerian public sector. The outcome was consistent with our apriori expectations, indicating that the more IPSAS implementation, the greater the transparency of financial reporting in the Nigerian public sector. Tawaih (2021) also found that IPSAS has a detrimental influence on corruption, particularly in nations that have completely implemented accrual-based IPSAS.

CONCLUSION AND RECOMMENDATIONS

Although the implementation of IPSAS was delayed in Nigeria, our findings from this study revealed that its adoption has affected transparency, accountability, reliability, and value relevance of public sector reports positively. This shows that deployment and successful integration of IPSAS can provide authenticity to financial numbers and instill trust in citizens and financiers on financial reports of the public sector entities.

Based on the above development, we recommend that:

1. Education and sensitization of all relevant parties (financial analysts, and other users) of government financial statements are critical for IPSAS adoption policy to be properly implemented and applied in practice,
2. Professionals must learn to minimize any negative influence on the dependability and accountability of financial reporting in Nigeria's public sector. It is expected that increased transparency in public financial reporting would instill greater trust in budgetary integrity and stop budget padding.
3. The Federal government should continue to encourage greater compliance with IPSAS requirements as a means of enhancing the value relevance of financial reports of public sector entities. This will go a long way in helping government institutions earn the confidence of stakeholders who intend to invest and partner with the government towards achieving the medium-term economic growth plans of the government.



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ESTIMATION OF MUNICIPAL SOLID WASTE AVAILABLE FOR POWER GENERATION IN COCA-COLA, ILESA, OSUN STATE

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ABSTRACT

Municipal solid waste generation is a day-by-day activity by individuals, groups of people, and industries. The rate at which waste is generated varies due to some factors such as population growth and urbanization to mention a few. In knowing the amount of waste available for power generation in a day, waste collection and analysis were organized at the Coca-Cola community, Ilesa, Osun State, for eight consecutive weeks, in which the characteristics of the waste gathered in terms of contents were obtained by manual sorting through the use of hand picking with gloves, shovel, and garden hand fork. 15% of the initial total waste collected was partially good and considered for reuse and recycling. The remaining contents of the waste collected were sorted into twelve waste fractions, in which only eight under biomass and non-biomass combustible wastes were capable of generating energy by Biochemical and Thermochemical methods of waste conversion. It was recorded that 87.3% of the remaining waste streams after recycling, which is equivalent to 2.06 tons/day were available for energy (electricity and heat) generation in this area. This total waste in a ratio of 3.5:1 of biomass to non-biomass combustible wastes, was presumed to take care of 10% of power demanded in the community.

Keywords: Solid waste, Waste management, Combustible waste, Biomass, Electricity.

1. INTRODUCTION

Waste is no more a threat in the world today but a source of wealth and energy. This opportunity has not been harnessed by Nigerians. Nigeria as a country can benefit positively from the waste generated instead of receiving its adverse effects. Waste can be solid, liquid, or gas, but more emphasis is laid on solid waste, that is Municipal Solid Waste (MSW) because they appear to be more reusable than other forms of waste. Waste generated and dumped or buried in Nigeria at large, with a population approximately of 200 million and a land area of 923,768 km² (356,669 sq mi) which is in the 32nd position of landed property in the whole world, (*Index, (2018), World Population, (2019)*) is every day on the increase due to population growth, urbanization, economic development, low level of salvage and recycle, low public attitude towards conservation of natural resources, and lack of legislation to regulate the use of specific materials in production of some goods and materials to reduce the generation of certain type of wastes (World Bank, (2018); Ques10, (2022)). More than 32 million tons of solid waste was said to generate annually in Nigeria with less than 30% of it properly disposed of (Bakare, (2020)).

According to Olubanjo (2019), 70% of Nigeria's cities lack adequate capacity to manage waste, and because of this some plots and acres of land in all cities have become dumping sites that accommodating all wastes and have made our environment unhygienic due to environmental pollution, and also generate greenhouse gas which creates a greenhouse effect causing global warming and climate change. Poor solid waste disposal posed a great health risk to the lives of people, animals, and even plants, which resulted in disease outbreaks, and farmlands infertility that causes food scarcity which led to food price inflation. Nigeria needs Solid waste management characterized by efficient collection methods, sufficient coverage, and proper waste disposal which includes recycling, reusing, composting, burning, and land filled. This waste if properly handle can

be used to boost the economy of a country through one of the economic key areas which are power (electricity). Nigeria will become one of the greatest countries in the world, the day it gets its power problem solved. The quick and ultimate solution to power and all other problems in Nigeria is to positively change our way of life, our ideas, and our thinking to get new and better solutions. The power problem in Nigeria can be solved or reduced if the power generation can be diversified by investing in new and efficient power generation technology, which involves exploring alternative energy sources such as solar, wind, and (now) waste; and if waste management can be properly harnessed at all level of governments. Nigeria is among the lowest power generation counties in the world and far lower than most other African countries (PwC, (2016)).

In 2019, the power supply in Nigeria was an average of 4.0 GW, which was insufficient and estimated to be one-third of the country's minimum demand (USAID, (2020)) this Power shortage harms the overall economy, which both Nigerian consumers and businesses are suffering (PwC, (2016)). To improve the people's standard of living and also to make Nigeria an industrialized country like China, U.S.A, and Japan, the power generated must be raised to about 200,000MW to take care of 200 million population, following Thumb's Rule (PwC, (2016)). The power available from different sources in the country can be augmented by power generated from solid waste by conversion, and this will enable Nigerians to have access to adequate and regular power supply. It is quite unfortunate that Vision 2020 strategic objectives, in which Nigeria is to attain sustainable, adequate, qualitative, reliable, and affordable power supply are not achievable.

This vision can be achieved before 2025 if the Nigeria government and citizens can positively invest in waste energy as an alternative renewable source of energy. Many advanced countries such as the U.S.A, China, the UK, and Sweden are benefitting from waste to wealth and waste to energy (electricity) where millions of tons of waste burn every year to generate a billion Kilowatt-Hours of electricity and heat energy (EIA, (2016); *Amila (2017)*). Nigeria can generate electricity from waste to boost the already power generated from hydro and gas, by converting waste to electricity through Biochemical and Thermochemical methods of conversion (Salman, (2018)). Biochemical conversion converts waste to biogas to produce Methane used as fuel in a heat engine, while Thermochemical conversion converts waste into heat by burning, and gives pressurized steam or gas from water or air to operate a steam/gas engine or turbine to generate electricity (Energypedia (2016); Ovoenergy (2020); Bioenergy (2020)). This paper focused on how to determine the amount of solid waste that can be collected to generate electricity which can be used to improve the economic strength of our country Nigeria from each of its localities as in the case of Coca-Cola, Ilesa, and Osun State. It also shows means of collecting waste from every nook and cranny of the country, sorting out the waste unto different categories. For the reasons of a power failure and much more waste generated in this area, research was carried out to know how much waste disposed of in the community can lead to energy generation in terms of heat and electricity. This also will reduce waste deposited around the community that causes environmental deterioration and problems.

2. METHODOLOGY

2.1 Study Area

The research was carried out at Coca-Cola in Ilesa, Osun State. Ilesa is a city located in Osun State, southwest of Nigeria, and with many smaller surrounding cities. The town which is of geographic coordinates of Latitude 7.62°N, Longitude 4.73°E with Elevation of 462m comprises two local government areas: Ilesa West and Ilesa East Local Government areas. Coca-Cola is located at Ilesa West local government area along Ijebu-jesa road, and accommodated six hundred and twenty-seven houses including five guest houses, one hotel, three private Nurseries and primary schools, one private secondary school, and many religious houses.

2.2. Demographic Characteristics

The population of Ilesa municipality is 305,480 according to the 2007 census, (Osun, (2014)). Coca-cola community population density is three thousand eight hundred according to the house census carried out for the research. The sex distribution of males and females was 1,785 (47%) and 2,015 (53%) respectively. The community population comprises 25% children, 47% youths, and 28%



adults. Certain percentages of the adults and youths were into different job careers, such as civil services, contract, labor, farming, trading, entrepreneur, and artisan.

2.3 Field Research Approach

The research is a quantitative method which was approached through extensive literature search, personal observation, construction and positioning of seven large waste cabins in seven strategic places in the community, positioning of small trash containers for those houses with multi residents for easy collection of their waste, and provision of three trash bags/nylons of different colors for each building. Considering the time and resources available it was not possible to carry out the collection of waste in every house and also, not all houses deposited their waste to the general disposal sites available in the area, some houses have dumps in their back yard, where they buried or burnt their waste, why some discarded their waste at any available space in their vicinity. Therefore, an awareness crusade was made in the community to encourage residents in assisting in waste collection. All trash bags collected every two days were gathered together with waste in cabins for sorting, classification, and quantification of waste for energy conversion.

2.4 Method of Sorting, Quantity, and Characteristics of Municipal Solid Waste

The waste contents of the solid waste collected in this area were studied. The collections were done from February 9, 2020, to March 4, 2020. The collections were taken twice a week (Tuesday and Saturday) for eight consecutive weeks. All the waste, in the large waste cabins, small trash containers, and trash bags, were gathered together and manually hand sorted into different components and into different containers, and weighed. In the entire period of characterization, the waste streams were sorted into twelve waste fractions, as shown in Table 1, and were classified into Biomass waste, Non-Biomass Combustible waste, and Non Combustible waste, Table 2 according to EIA, (2016) waste classifications.

For finding the rate of waste generated in this community, the amount of waste generated by individuals per day was carried out by close monitoring of six households with all levels of human stages including infants (babies) and old ages. The waste of these households was gathered every night after supper, and divided by the total number of occupants for three days.

2.5 Quantity and Percentage of MSW for Energy

Out of the twelve waste fractions obtained as shown in Table 1, eight were characterized for energy potential, due to their decomposability, combustibility, and heat capability properties. These are waste under biomass waste and non-biomass combustible waste, Tab. 3.

3. RESULT AND DISCUSSION

3.1 Classification and Quantity of Waste Contents Disposal at the Community

Analyzing of physical characterization of municipal solid waste gathered in this area every week for two months was shown in Tab. 1. All the waste every two days were first collected and later sorted out by hand-picking with gloves and shovels into twelve streams in which like waste were grouped. The paper products contain any paper materials such as newspapers, magazines, paper carton boxes, notebooks, textbooks, etc. Also, the plastic/polythene products involve nylon, plastic plates, spoons, bowls, buckets, pampers, etc. while the other under waste stream referred to wastes that cannot be categorized into any notable group, this waste such as sand and other smaller un-identified particles. These waste streams were classified into the group Biomass waste which includes food waste, vegetative materials, paper, rubber, etc., Non-Biomass Combustible waste which includes plastics, and other synthetic materials made from petroleum and Non Combustible waste which include glass, metal, and ceramics materials as shown in Table 2.

Table 1, Weight of waste collection in Weeks

Waste Components	Weeks with the weight of waste gathered in								Total wt (kg)	Wt %
	Kilogram (Kg)									
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th		
Food waste	125	129	135	115	133	127	125	129	1018	17.28
Vegetative Materials	50	50	47	44	51	49	55	52	398	6.76
Plastic/Polythene Products	137	142	135	131	138	132	144	140	1099	18.66
Paper Products	93	95	89	92	89	86	90	92	726	12.33
Leather Materials	45	47	49	51	48	50	47	49	386	6.55
Rubber	67	64	62	64	66	57	58	62	500	8.49
Textile	51	52	55	49	50	48	51	50	406	6.89
Wood/Wood Products	79	83	74	68	75	70	81	79	609	10.34
Glass	23	21	18	16	19	13	17	19	146	2.48
Ceramics	23	25	20	16	20	16	24	25	169	2.87
Metal Materials	60	49	47	45	51	48	47	44	389	6.60
Other	06	05	06	04	06	03	07	07	44	0.75
Grand Total	759	762	737	695	746	697	746	748	5890	100.0

Table 2, Content of waste materials collected

Biomass waste (Black bag)	Non-Biomass waste (Blue bag)	Combustible	Non-combustible waste (White bag)
Food waste	Plastics/polythene Products		Glass materials
Vegetative material			Metal Products
Paper products			Ceramics
Textile (Rag) Materials			Others
Wood/Wood products			
Leather			
Rubber			

Table 1 reflected the mass of each waste in kilogram (kg) collected each week and throughout the collection (2 months) with their weight percentage. It also shows the total mass of waste collected each week and throughout the collection. This help to determine the expected waste in this region from their population density. In the first week of waste collation, the total waste collected weighed 759 kg which plastic/polythene waste, food waste, and paper waste were of majority with 137 kg, 125 kg, and 93 kg in mass, while glass waste and ceramic waste were of the lower waste gathered with 23kg in mass. The total waste collected each week for the period of collection varied from week to week. This can be a result of changes in income and consumption. **15% of total waste gathered initially were good and useful and were considered for re-use and recycling** because of their high quality, and this goes for the waste-to-wealth concept which can create wealth in terms of money, job, raw material for other goods and lower or less level use of old products.

The total waste collected in this environment for the project as shown in the Tab. 1 is far away from the actual waste generated, this is due to some houses' backyard spaces and proximity spaces around the nooks and crannies of the community in which people were so used to, and most of these wastes were dumped, buried and burnt in these available spaces.

In determining the waste generated per day, a population of fifty-six (56) people of six households in the community were under surveillance through observation and close monitoring to know the amount of waste likely generated by individuals. For days One, Two, and Three, 41,910g, 40,624g, and 40,112g of waste were gathered, making the average waste per individual per day to be 730g. It is presumed that each person in the community produced an average waste of 0.73kg per day.

This individual waste per day determined in the community was within the speculation of The United Nations, 'World Population Prospect' projection for Nigeria that, in 2025 waste generating rate capacity would have increased to 0.85kg/cap/day from 0.65kg/cap/day in 2012 with population of 182.2 million to 233.5 million (Arogundade, (2018)) and, also by Chinedu et al, (2018), which estimated Nigeria waste rate generation at 0.65- 0.95kg/capital/day with average of 42 million tonnes of waste generated annually. The individual waste generated multiplied by the population density gives the expected waste generated in the community and this is accountable to 2.37 tons of waste generated in the community in a day and 2.06 tons of waste generated for energy generation after Re-use, recycling, and non-combustible wastes had been removed, as shown in Tab.3.

3.2 Physical characterization of waste at Coca-cola

Table 3, Weight of waste collection in Weeks

Waste Components	Weeks with the weight of waste gathered in kilogram (kg)								Total wt (kg)	Wt %	Wt/Day (Ton)
	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th			
Food waste	125	129	135	115	133	127	125	129	1018	17.28	0.41
Vegetative Materials	50	50	47	44	51	49	55	52	398	6.76	0.16
Plastic/Polythene Products	137	142	135	131	138	132	144	140	1099	18.66	0.44
Paper Products	93	95	89	92	89	86	90	92	726	12.33	0.29
Leather Materials	45	47	49	51	48	50	47	49	386	6.55	0.15
Rubber	67	64	62	64	66	57	58	62	500	8.49	0.20
Textile	51	52	55	49	50	48	51	50	406	6.89	0.17
Wood/Wood Products	79	83	74	68	75	70	81	79	609	10.34	0.24
Grand Total	647	662	646	614	650	619	651	653	5142	87.3	2.06

From Table 3, the weight of waste generated in a day in tons was shown for all power generation waste streams. Plastic and polythene products were of the highest waste of 0.44ton each followed by food waste of 0.41ton. The highest wastes on this list were of the products of food and drinks, that is food waste and plastic/polythene waste, which were common and also of the basic needs of the people across all classes and genders. From the table about 87.3% of solid waste was available for energy production through Biochemical and Thermochemical conversions, this shows that there is enough and sufficient waste for energy production from waste generated in the community.

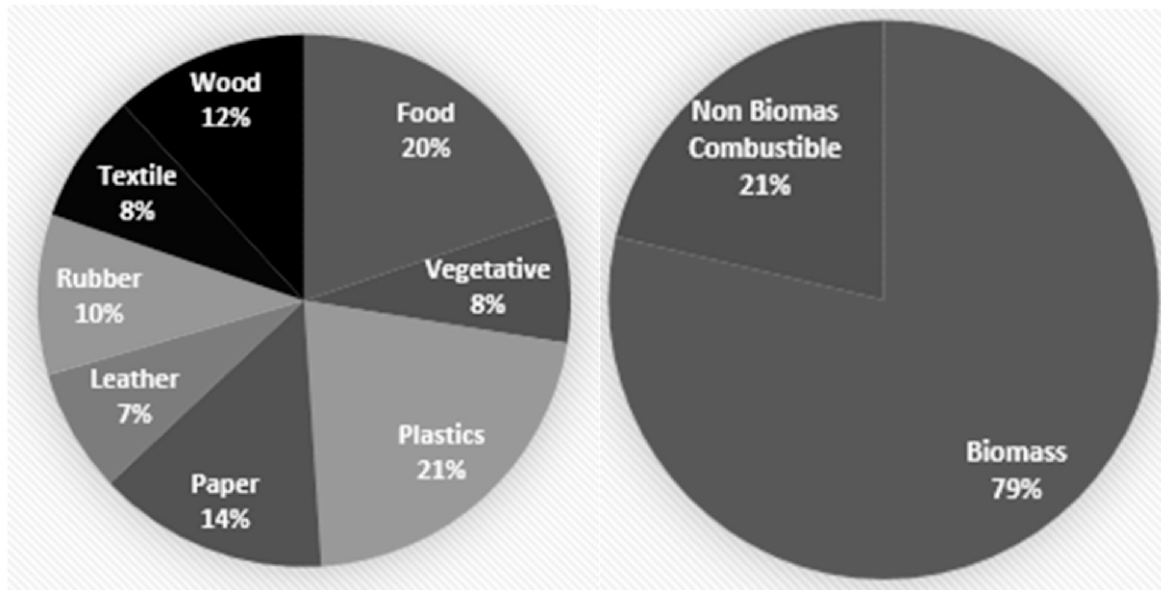


Chart 1, Percentages of Municipal solid waste contents for power generation

Chart 2, Percentages of Biomass and Non Biomass Combustible Waste for power generation

Chart 1, shows the percentage of each waste content from waste available for power generation while chart 2, shows the percentages of Biomass and Non-Biomass Combustible waste in a ratio of 3.5:1 in availability for power generation. According to Kumar et al., (2010); Gupta, (2013); Daura, (2016), and Ibikunle et al., (2019); through equations and by calculation, if this energy potential waste (2.06 tons) was subjected to burning experimentation by being processed and analyzed, it should be able to give a low heating value of 21 MJ/Kg, Energy Potential of 12MWh (which is equivalent to 2.3 tons of wood, 1.5 tons of coal, 1,330 liters of petrol and 1,211 liters of diesel oil, (DeepResource, (2012)), and Electrical Power Potential of 151Kw. If this power is compared with the power supply to the Coca-Cola area for 24 hours stable electricity supply by Ibadan Electricity Distribution Company (IBEDC), which is 1.5MW (agent, Isokun Unit, Ilesa). This implies, that a waste-to-energy program using Coca-Cola municipal solid waste would provide approximately 10% of the power demand in the community.

2. CONCLUSION AND RECOMMENDATION

4.1 Conclusion

Waste is produced and could be gotten rid of by human activities, and one such activity is by conversion of waste to heat and electricity, which is construed as waste-to-power. The waste reviewed at the Coca-cola community in Ilesa, Osun State showed that the community was assumed to generate a waste quantity of 1012.51 tons/year and about 2.77 tons/day with a waste rate generation of 0.73kg/cap/day. Due to waste management processes and the good quality of some waste, 15% of the waste was good for Re-used and recycling, which left 2.36 tons of waste per day from which 2.06 tons was available for power generation by biochemical and thermo- chemical conversions. It can be concluded that about 87% of the remaining waste after reuse and recycling will be available for power generation while 13% remains will end up in landfills.



4.2 Recommendations

There should be efficient and effective means of waste collection established between waste generation and disposal for easy waste management processes; corporate waste management has to be developed at all levels of government. The government in each locality should provide sanitary dumping site(s) in their areas for easy disposal and easy quantification of waste generated. The government, NGOs, Waste Industry, and all others involved in waste management should organize public campaigns to enlighten the general public about the advantages and opportunities in waste business and recycling.

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A KNOWLEDGE-BASED DOCUMENT PREPARATION FOR SUPPORTING A SYSTEM USING ARTIFICIAL INTELLIGENCE

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ABSTRACT

A knowledge-based way of preparing documents tools in an organization within an activity such as document preparation that is supported by a knowledge-based system. Software called REGENT (Report Generation Tool) works in an environment that generates documents from reusable document pieces during the planning, execution, and monitoring of the document preparation process in a firm or organizational environment. The documents are built from stored document pieces by using artificial intelligence methods. A system architecture was developed to enable the document generation process to take place within a widened office automation standard. The report preparation process knowledge is captured in the form of representing a knowledge-based scheme. An artificial intelligence problem-solving strategy was developed to take care of reasoning steps when document pieces were being configured. The REGENT environment is normally working when preparing a recurrent report type such as annual reports preparation.

Keywords: knowledge-based approach, artificial intelligence, document preparation, office automation, document analysis, document standardization.

1. BACKGROUND TO THE STUDY

Artificial Intelligence (AI) is an area of computer science that emphasizes the creation of intelligent machines that works and reacts like humans. Some of the activities with the introduction of artificial intelligence in a computer are speech recognition, planning, learning, and problem-solving. However, there is a need to explore the possibilities of incorporating knowledge-based advantages in our offices today. The reason is to support the recurring document preparation activities in cooperative and system settings, such as facilitating the update of yearly reports. The design of such an office automation tool is not required to take into account the document processing tools and also how the tool can be integrated with the existing information system software and hardware as well as the existing office procedures that exist in an organization. These include an interface with database systems to facilitate the storage and retrieval of data in addition to document pieces.

This research work talked about the requirements of such a knowledge-based system environment which includes integration of various technologies associated with the document preparation application, improving the office work and then the office procedures including the reuse of past paper captured in a document piece and also supporting the communication among system components. In a situation where the recurring nature of reports were observed, a knowledge-based approach is used for automating the preparation of such documents. More so, the reports are highly structured and their structure follows predictable patterns. However, the reports can be classified based on the common features, allowing different or the same subject matter to be expressed in many versions in application areas.

The contents of the report in addition to the report structure also form the report generation process.

The approach here considers the document preparation process as an artificial intelligence design task. More importantly, a conceptual model was developed to identify the report components, using appropriate artificial intelligence in a problem-solving methodology which was proposed to guide the process and composing reports from report pieces. Some rules and regulations are enforced through application domains, which are to be connected to during the process of document generation. Also, rules and procedures govern an organization in knowledge-based document preparation.

1.1 Research Aim and Objectives

This research work aims to develop the conceptual model including its relationship to the presentation model and also to capture the content information within an organizational setting.

1.2 Objectives

The main focus of this work is to come up with a better understanding of the specific application relations of the objects in addition to the standard norm descriptions. Also, to focus on applications and standards that are widely used and have been widely deployed within the knowledge base, stored in general and terminal topic definition, being utilized when deciding on the task plan and then carried out at the time the report is joined together from document pieces.

2. LITERATURE REVIEW

2.1 Concept Of Document Standardization

The two standardized and internationally accepted document norms, the standard generalized markup language (SGML) and the office (OPEN) Document architecture (ODA) and interchange format (ODIF) employ the logical structure model. The norm defines a document class that guides the construction of syntactically correct reports of this document class. ODA and SGML norms do not employ semantics knowledge, except for the ODA layout objects. The document norms only include structural rules; as such they neglect the organization they are modeling including the office procedures. These are the two models, the conceptual and presentation. The presentation model is corresponding to the document's appearance; thus, it encompasses the logical and layout model.

However, the prepared approach to document modeling does not depend on a specific presentation model; it can be a conceptual model that expresses the information requirement of the reports preparation process within an office setting in a high-level format. All reports belong to a class document while the report structures are represented as frames. The process which recursively combines report components is called the document structuring process. More so, the conceptual model relates report components to organizational procedures.

The conceptual model views a document as composed of report pieces called topics. Topics correspond to items listed in the report outline. Note that topics are not the same as logical objects because logical objects are part of the presentation model and can take different presentation forms such as text or image.

However, the objects are activated by rules during the document generation and structuring process. These rules have two main roles;

1. Function as production rules when generating a new version of the report.
2. Used to maintain the integrity of the report when modifying report structures.

Moreover, the information that is important to authors is viewed in four ways;

- i. Content – the subject matter of the report
- ii. Structure – refers to the organization of the material
- iii. Format – pertains to the appearance of the report
- iv. Meta information – the auxiliary information that is not generally part of what the reader of

the report saw, but it is essential to the development of the report structure.

2.2 Report Model: Strategy in solving problems.

A knowledge-based tool can offer support while designing report context and structure and there is a need to select a problem-solving method and problem-solving process, specifically as a design task, where a report is designed from report pieces. The design task involved deciding on what information to include as well as organizing this information in a structured document which would ensure effective communication of report content to readers. These systems offer predefined templates that can be modified by users. They do not offer any guidance as to how to adapt these templates when modeling new requirements.

In an ideal situation, a report generation tool should provide help in building the report structure corresponding to user requirements in a specific situation by supporting the adaptation of predefined templates. These tools can be enhanced to offer support for the adaptation and modification of predefined templates only if they are equipped with semantic knowledge that can guide the process. This level of sophistication can be achieved if the report preparation tool is equipped with semantic report structuring capabilities captured in a suitable knowledge representation scheme along with the adaption of a suitable problem-solving strategy. However, the letter specifies the way and manages the system carried out the reasoning by assuring the role of a user when adapting stored document pieces to the new organization. This requires the tool to be useful, and capable of constructing a report which identifies, integrates, instantly supports, and sequencing the report.

Finally, the combination of classification and constructive approach is suitable in complex application domains where classification categories can be identified and the interactions can be specified. The approach is applied to such domains as medical diagnostics and intelligent model-building decision support systems and others. Figure 1 shows the report model of the ontological structure of a document model.

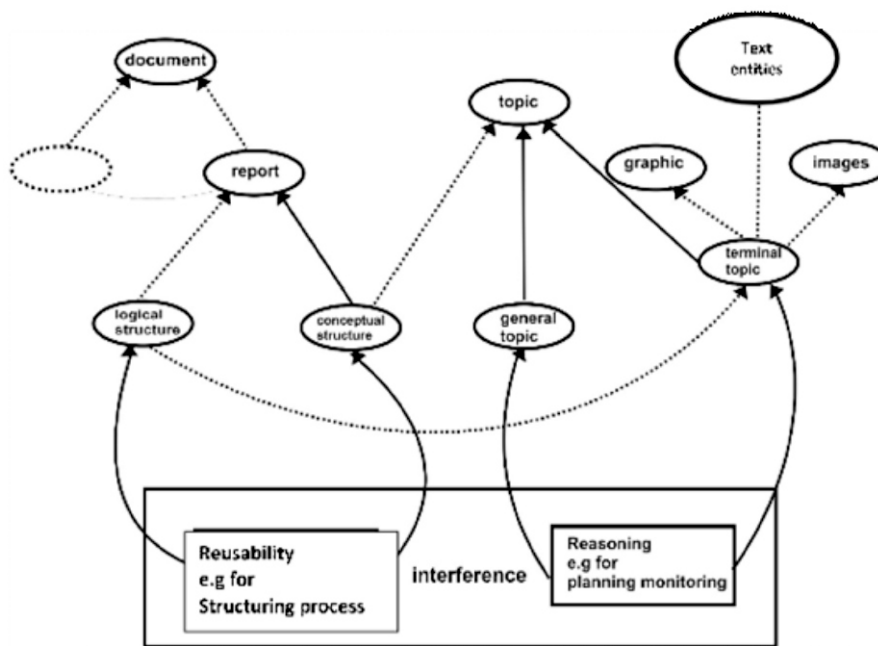


Fig. 1. The report model: ontological structure
 -----> is a
> Value class

3. METHODOLOGY

3.1. System Architecture

The system architecture of REGENT is about the situation of office automation support. This architecture is composed of three components;

- i. The flexible task management (FTM) component carries out the exchange of data, procedure activation, and message interpretation among the system components.
- ii. The knowledge management system KMS captures the static knowledge needed during the process of document structuring and construction.
- iii. The flexible Task Processing (FTP) components utilize the static knowledge stored in KMS and configured a plan to achieve the goal. This component captures the dynamic aspects of the document construction process, which involves the planning, execution, and monitoring of the task.

The report model describes the interaction between various knowledge sources which include databases, users, and networks.

3.2 The Knowledge-Based Component

The RBC is made up of two parts namely the knowledge management system which is a static system component that stores knowledge to document pieces and related rules whereas the FTP component manages the dynamic part of the report configuration process. However, the KMS captures and represents the knowledge about the descriptive and procedural parts of the task environment. This information is necessary to adequately model the application of domain knowledge in an organizational setting. Moreover, the FTP component manages the dynamics of report configuration and is composed of three types that are responsible for document structuring, task planning, and task execution and monitoring.

The sub-components are;

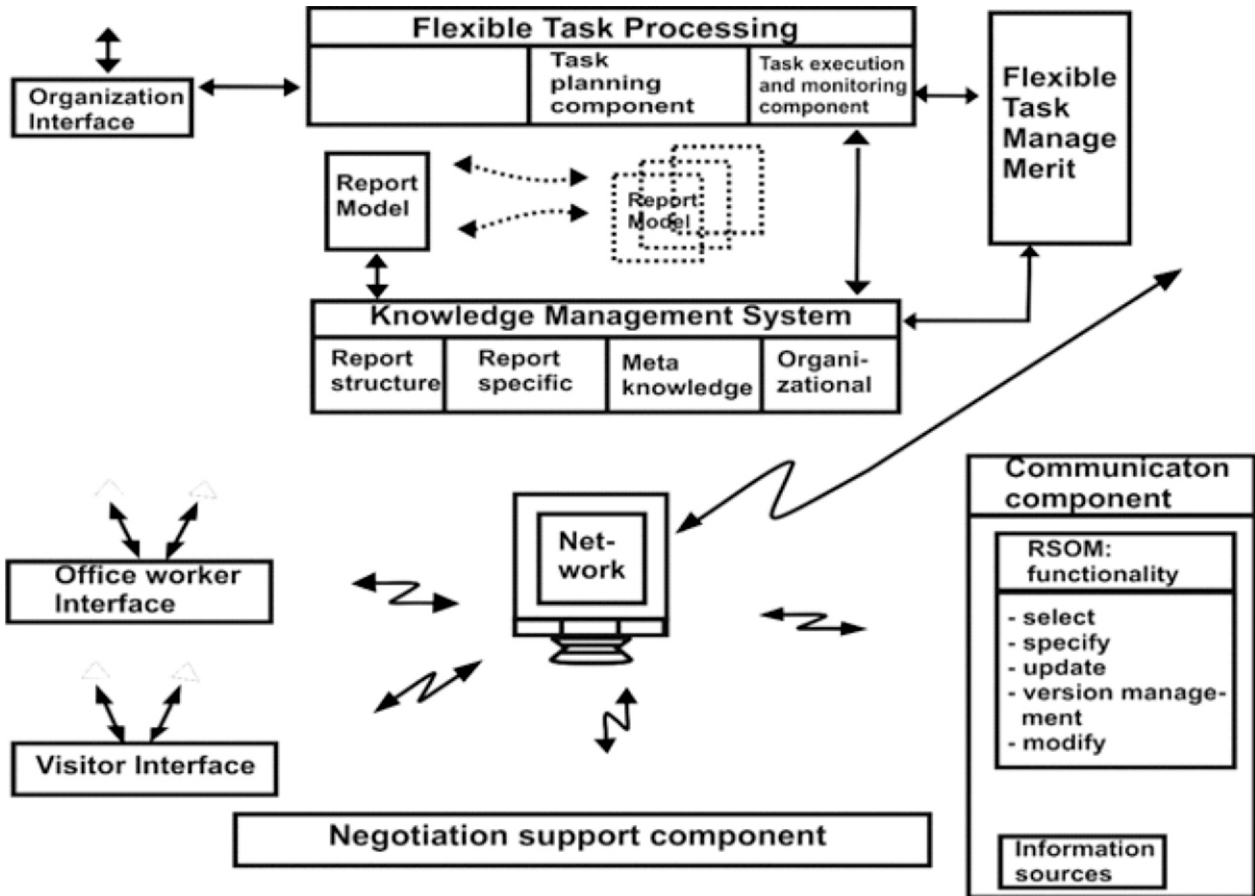
1. The document structuring component provides the specification language that allows the user to describe the document that is of interest by using the knowledge about report types and features, the system takes over the document structure and presents to the user the likely document structure including the relevant topics and their organizations.
2. The task planning component carries out the tasks involved in two steps, firstly the task selection component interprets the findings of the document structuring step and identifies the required activities. Secondly, the configuration component schedules the identified activities by taking into account the dependencies among the activities, then forming a plan fragment.
3. Task Execution and Monitoring Components control the execution tasks. The plan execution requires all the activities of all the involved components. The execution control components receive as input the partially initiated plan. At this point, supplementary information that would facilitate monitoring and coordination is also considered here.

3.3. Database Component

Database management system (DBMS) plays an important role in supporting the office application. It has the potential to facilitate the management of structured document pieces and also the management of multimedia objects and hypertext documents. The main focus here is to achieve an integrated interface using object-oriented techniques. Also, within the context of document processing with a database component that supports the request produced by the knowledge base component when joined together with the model structure.

In addition, the DBMS supports the requests invoked by the users and arranges programs together with data maintenance tasks with communication components that support the internal

communication among the system components, which needs the required specific, object-oriented model (RSOM), user interface model, and the interconnection model. The interconnection model supports various interconnection types including blackboard and message passing. The blackboard architecture is used to automatically update the knowledge base. Figure 2 shows the system architecture:



4. Findings

- i. Organizational knowledge about departments and positions, projects, and events
- ii. Knowledge about individual members of the staff
- iii. Knowledge about non-human resources such as office technologies as well as documents, standard forms, and databases.
- iv. Knowledge about office procedures and tasks.
- v. Knowledge about the goals and perspectives of the enterprise.

5. CONCLUSION

According to the findings from this knowledge-based research, the knowledge gathered during the design and little implementation of the knowledge base that support the tool for documents was developed together with the recommendation of a two-phased artificial intelligence-solving problem strategy.

The office automation tool is a system that aims to facilitate communication among office workers in augmenting the knowledge representation with the existing office procedures. The document model was used to capture the semantic knowledge in document pieces and then used to guide the report composition process. More so, the approach supports building organizational memory in which the past and the current projects are well represented. A tool was developed, an object-oriented DBMS



and network software that promotes the decomposing document which builds several document types and composes a final document piece.

6. SUGGESTIONS FOR FURTHER STUDY

For future studies, there is a need to study the nature and relationships between business activities to design and develop a system that can easily support the integration of all office activities, using Neural and Expert Systems.

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-29-

PERCEIVED IMPACT OF BUSINESS EDUCATION AS A TOOL FOR SKILL ACQUISITION AND ENTREPRENEURSHIP FOR NATION BUILDING

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Abstract

This article investigated the impact of Business Education and its increasing interconnectivity of skills acquisition and entrepreneurship for undergraduates of business education after graduation. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. A descriptive survey research design was adopted. The study sample consisted of 130 Business Education Lecturers drawn from 5 Universities and 5 Colleges of Education in the South East, Nigeria. The main instrument for data collection was a four-point rating scale questionnaire with 33 items. The data collected were analyzed using mean and standard deviation to answer the research questions and determine the homogeneity or otherwise of the respondents while the t-test was used to test the two null hypotheses. The findings revealed that the respondents rated positively all the items of skills acquisition offered by Business Education Programmes and the challenges facing Business Education students and lecturers in tertiary institutions in the South East, Nigeria. The result of the test of the two hypotheses revealed that there was no significant difference in the mean ratings of male and female business education lecturers on the skills acquisition offered by Business Education Programmes and challenges facing Business Education Programmes. It was concluded that the study would enable Business Education students to succeed in the 21st century and escape from the peril of economic recession. Based on the findings and conclusion of the study, it was recommended among others that, the Federal Government should institute tertiary institutions crime commission to avert the financial irregularities that inhibit the smooth operations of tertiary institutions including (Business Education Programmes).

Keywords: Business Education, Skill Acquisition, and Entrepreneurship.

Introduction

The mission of Business Education at the Universities and Colleges of Education is to train the necessary manpower for industry, public, and private business establishments. Thus, it emphasizes job competency, career preparation, and work adjustment. Ullinfun cited in Eze (1995) viewed Business Education as training in business skills and competencies that are required for use in business offices, clerical occupations, and business policy analysis. Too, it is making people literate in business and economic affairs, particularly in the areas of accounting, business management, office education, marketing, data processing, and business communications. Similarly, Ano cited in Eze (1995) also remarked that business education as an educational process has a primary aim in the preparation of people for roles in enterprises as employees or entrepreneurs. According to Duruamaku-Dim (2002), a Business Education programme is a component of educational programmes which involves general knowledge, vocational literacy, and entrepreneurship. He maintained that vocational business education is the acquisition of necessary skills for the world of work and for career development aimed at producing professionals in their respective fields.

Nevertheless, the acquisition of knowledge and competencies is a necessary prerequisite for employment in a particular business occupation. In this study, business competence appears to be a relevant concept. Hence, Oduma (2010) indicated that professional business competencies have to do with aptitudes, capability, dexterity, expertise, skill, talent, and knowledge required by an individual to perform a particular activity in a given field of study. He further buttressed that



professional business competencies describe those essential work characteristics which need to be acquired by recipients of business education, to enable them to perform given related activities in modern business organizations. Thus, these professional business competencies are needed by beneficiaries of business education to discharge their functions effectively either as business teachers, employees in business organizations, or self-reliant.

Owing to the embarrassing level of unemployment among segments of Nigerian Youth, Business Education is a scaffolder in curbing youth unemployment in Nigeria. Simply put, Business Education is a tool for skill acquisition and entrepreneurship for nation-building. The Nigerian business scene is witnessing the encroachment of computer technology and data processing systems. More and more business establishments in Nigeria vis-à-vis the banks, commercial houses, government establishments, oil companies, etc have all adopted or are in the process of implementing office automation. This information technology has created new jobs such as word processing operators, reprographics specialists; typing, duplicating, or photocopying documents for customers. Thus, business education has increased the skills and marketability of our graduates for the world of work and in reducing their unemployability. Business Education encourages the formation of small businesses and minimizes small business failure arising from our skill acquisition.

Longman Oxford Dictionary (2005) defined skill as an ability to do something well especially because you have learned and practiced it. Atakpa (2014) defined skill as the rapidity, precision, expertise, dexterity, and proficiency exhibited through mental and manual repetition of the performance of an operation. It is a well-established habit of doing something through the acquisition of performance capabilities. Etonyeaku (2008) captured skill as the capacity of a person to accomplish a task with desired precision and certainty. It involves practical knowledge in combination with cleverness, expertise, dexterity, and the ability to perform a function that could be acquired or learned in school. Ekpenyong (1988) defined skill as the ability to use one's knowledge effectively and readily in the execution of performance. However, skill acquisition according to Omidiji & Ogwu (2019) is a systematic and sequential development of skills that promotes efficiency and effectiveness in the performance of a specified job. According to them, the objective of skill acquisition is to bring the knowledge acquired to the maximum level of competency. Some of the needed skills in business education for effective use include communication skills, reading skills, and manipulative skills. Ezeji & Okorie (1988) noted that the acquisition of requisite skills is a means of increasing the productive power of any nation.

Omidiji and Ogwu (2008) observed that Business Educators are part of the lubricants in the engine of the nation's economy. According to them the skills process by business educators have a significant impact on the graduates. They termed 21st-century skills as a collaboration of digital literacy, critical thinking, and problem-solving which help students thrive in the present economic world. In addition, social skills are crucial to the success of business education and business education graduates because they need interaction and frequent connection with others around them who may be individuals or corporate organizations. This networking skill if properly developed by business education students, will enable them to maintain long-lasting relationships with their business partners or customers thereby promoting the business image and productivity.

The skills acquired through business education assist one to be self-reliant and successful entrepreneur thereby reducing the scourge of unemployment in the nation's economy. Entrepreneurship has to do with managing and utilizing skills and knowledge acquired for critical thinking and productivity. Entrepreneurship is also the process of identifying, developing, and bringing a vision to life. The vision may be an innovative idea, an opportunity, or simply a better way to do something. Who is an entrepreneur? Entrepreneur means different things to different people. Generally, an entrepreneur is a person who takes the commercial risk of starting up and running a



business enterprise. Elizabeth (2005) opined that an entrepreneur is a self-employed person, he is called the owner of a small business firm because he has chosen to assume risk, identify business opportunities, gather resources, or initiate action and establish a business organization to meet some demand of the market opportunities. Like the godly woman in Proverbs 31(13-17) who actively and heartily sought wool and flax, worked them, and used the proceeds to bless her family and others. An entrepreneur has established economic independence for him /herself as exhibited by the godly woman. According to Cardon (2010), flexibility and adaptability, intercultural communication, and collaboration, skills are needed by business students to succeed.

According to Cardon, small entrepreneurs could be metamorphosis into conglomerates and global businesses. He cited the case of China and India in which both countries have significantly reformed their economies to integrate with the global economy. They are currently the fastest growing major economies in the world and form the bulk of the BRIC(Brazil, Russia, India, and China) countries which collectively have been projected to outsize the economies of the G8 Countries (United States, United Kingdom, Canada, France, Germany, Italy, Japan, and Russia) within 40 years (Cardon, 2010). Nigerian graduates have a lot to learn from the rags to riches of founders of some notable local and international businesses such as Dangote Industries Limited. According to Okereocha (2012), Aliko Dangote started as a small-time trader in the late 1970s and has grown the company into one of the biggest quoted and most diversified conglomerates in the world. With a N500,000 loan Dangote took from his uncle to start commodity trading in cement, he has transformed the business into a behemoth with tentacles spread across virtually all the sectors of the economies of Africa such as cement, agriculture, manufacturing, textile, haulage, oil and gas, and telecoms, among others. The business mogul is rated the richest man in Africa and one of the richest men in the world. Ranked among the world's billionaires by Forbes, he is one of only 16 Africans on the 1,226-member list with a personal fortune estimated at \$ 11.2 billion (Okereocha, 2012). Okereocha, also maintained that Michael Adeniyi Ishola Adenuga, founder of GlobaCom Nigeria Limited the second largest telecoms operator in Nigeria, from a humble beginning as a cab driver and security guard to pay his tuition fees while schooling in the United States, is today one of the world's billionaires with a net worth of \$ 4.3 billion as at March, 2012, according to Forbes. Adenuga is an entrepreneur extraordinaire whose rise to fame and fortune is undoubtedly a study of courage, determination, hard work, and ruggedness (Okereocha, 2012).

Businesses owned and operated by entrepreneurs take different forms. While some are owned by an individual, others are owned by two or more persons. The form of business ownership an entrepreneur selects may be dependent upon his/her circumstances, abilities, resources, environment, and the characteristics of the business. The prospective owner should evaluate in detail the characteristics of each form of business and their advantages and disadvantages and then select a form of business ownership that matches his/her interest. Several small business ideas abound from agriculture to manufacturing, construction to transportation, and communication.

A lot of challenges face business education programmes. Zakari (2014) noted that most business educators are theoretical when teaching skill subjects and other related subjects. Thus, Okoye (2019) emphasized that some lecturers don't attend lectures as enshrined in the school timetable until a few weeks before the end of lectures, they haphazardly organized lectures resulting in poor performance by students, in the alternative ask for financial gratification from students to give them good grades. Okoye further maintained that sometimes, institution authorities like vice-chancellors, rectors, or provosts are compelled by superior powers like the president, governor, ministers, etc to employ interlopers or unqualified persons in various departments. The consequence of those classes of mediocre lecturers is that they are careless and unfair to their students and this attitude mar students' effort in learning. There is a dictum that no education could rise beyond the quality of its teachers. Therefore this study examined business education as a tool for skill acquisition and entrepreneurship for nation-building.



The following checklist or catalog of small /medium scale businesses covering various sectors of the economy is provided for budding entrepreneurs' use.

Table1: Small/Medium Scale Businesses

(A) Agriculture /Agro-Allied Business	20	Soluble coffee making
1 Tubers production	21	Tractor hiring services
2 Cassava flour processing	22	Tree crops production
3 Cassava starch production	23	Palm products: brooms, baskets,
4 Carbonated beverages	24	Yam flour process
5 Cocoa farming	25	Turkey farm
6 Fish farming	(B) Baby Items	
7 Farm tools production	26	Baby power production
8 Fruits Processing	27	Baby cream production
9 <i>Garri</i> production	28	Baby shoes shop
10 Goat /Sheep rearing	29	Baby cloths production
11 Grains production	30	Baby nappy production
12 Grass cutter rearing	31	Baby oil production
13 Snail production	32	Baby jelly production
14 Groundnut shelling	33	Children's toys production
15 Livestock feed production	34	Disposable diapers production
16 Piggery	35	Baby items shop
17 Poultry	(C) Catering and Hospitality Business	
18 Rabbit farming	36	Biscuits production
19 Rice milling	37	Bottled water production
38 Bread making	88	Operating nursery/ primary school
39 Butchery	89	Secondary school
40 Catering school	90	Seminar organizing
41 Cold store	91	Conference organizing
42 Cutlery making	92	Distance learning services
43 Fast food centre	93	Daycare center
44 Ice block	94	Continuing education centre
45 Ice cream production	95	Extramural lesson
46 Hoteling	96	Resume writing
47 Lunch pack making	97	School bags production
48 Palm oil production	98	Pen making
49 Rice storage sale	99	Markers making
50 Popcorn making	100	School chalk production
51 Restaurant operation	101	Library glue production
52 Sachet water production	102	Computer School
53 Seafood sale	(G) Fashion & Styles	
54 Soya beans milk production	103	Barbing saloon
55 Tea making	106	Undies making
56 Vegetable oil production	107	Face lotion production
57 Yogurt production	108	Fashion Designing
58 Foodstuffs sale	109	Fashion school
(D) Chemical and Allied Business	110	Fashion show business
59 Adhesive production	111	Hair cream production
60 Battery electrolyte production	112	Hand purses /wallet production
61 Car liquid wax	113	Manicure services
62 Carburetor cleaner	114	Sale of shale materials
63 Carpet cleaner production	115	Shampoo production



64	Fertilizer production	116	Sunglasses production
65	Fumigation services	117	Tailoring services
66	Glass sprayer	118	Travel bags making
67	Herbicides production	(H)	Forest Based and Furniture Business
68	Home disinfectants	119	Dye production
69	Insecticides production	120	Firewood sale
70	Leather perseveration	121	Home furniture making
71	Lighter fluid production	122	Office furniture making
72	Metal polish production	123	Safety matches production
73	Paint production	124	Sawmilling
74	Stain removers production	125	School furniture making
75	Termite proofing	126	Toothpicks production
76	Wood polish production	127	Upholstering
77	Shoe polish	128	Wood carving
(E)	Construction	(I)	Garment Industry
78	Bolts and nuts	129	Bath towels production
79	Burglary proof construction	130	Bed sheets production
80	General welding	131	Belts production
81	Iron bending	132	Blankets production
82	Iron chair making	133	Curtains production
83	Iron doors construction	134	Face caps production
84	Iron table making	135	Handkerchief production
85	Iron/ steel bars marketing	136	Factory uniform production
86	Local iron satellite disc construction	137	Neckless production
87	Store stand construction	138	Pillowcases production
(F)	Educational Services	139	Pyjamas production
140	Raincoats production	(N)	Printing & Publishing
141	Suspenders production	188	Bookbinding
142	Sweatshirts production	189	Christian books publishing /marketing
143	Swimsuits production	190	Diary /calendars production
144	Under=wears production	191	Exercise books /Envelops Production
145	Wooden /plastic hangers files	192	Foolscap/ duplicating paper production
(J)	General Services	193	Greeting cards production/ marketing
146	Auto mechanic	194	Graphic Designing
147	Block making	195	Jotters production
148	Car wash	196	Lithographing
149	Carpentry	197	Magazine publishing
150	Chair/ general rental services	198	Newsletter printing
151	Clock repair	199	Newspaper publishing
512	Digital photo laboratory	200	Note pad production
153	Electrical works	201	Office flat files production
154	Fabrication	202	Past exams questions and answers publishing
155	Gymnasium /fitness centre	203	Stickers production
156	Laundry/ dry cleaning	204	Story books writing & publishing
157	Photo Studio	205	Textbooks publishing
158	Plumbing works	206	Vernacular books publishing
159	Vulcanizer	(O)	Professional Services
160	Welding works	207	Accounting practice



(K) Infotech Business	208	Architectural practice
161 Computer repairs	209	Auction service
162 ICT consulting	210	Educational consulting
163 Sale of computer accessories	211	Engineering consulting
164 Sale of laptop	212	Estate valuing services
165 Sale of portable computers (PC)	213	Graphic art & design
166 Software engineering	214	Investment consulting
(L) Internet Based Business	215	Legal services
167 Automobiles net marketing	216	Management consulting
168 Banner designer	217	Marketing consulting
169 Cyber copywriting	218	Medical practice
170 Download site	219	Outdoor advertising
171 Games site	220	Stock analyst
172 Internet press releases	221	Veterinary services
173 Multi-media production site	(P) Soaps and Detergent Business	
174 News site	222	Aloe vera soap production
175 Search engine positioning	223	Antiseptic soap production
176 Sporting goods site	224	Black soap production
177 Travel site	225	Car washing soap production
178 Web design	226	Detergent production
179 Web production	227	Dishwashing detergent
180 Web site overhaul	228	Laundry bleach production
(M) Leather Making	229	Laundry soap production
181 Hockey /cricket balls	230	Liquid detergent production
182 Leather bags making	231	Medicated soap production
183 Leather boxes making	232	Soap holders production
184 Leather shoes making	233	Toilet bowl cleaner
185 Leather tanning	(Q) Telecommunication Business	
186 Volleyballs	234	GSM unlocking
187 Footballs	235	Handset repairs
236 Handset sales	246	Marine transportation services
237 Prepaid calling operator	247	Motor park operation
238 Recharge card sales	248	Motor cycle hiring
239 Ringing tone production	249	Oil transportation
240 SIM pack sales	250	Taxi services
241 Telephone booth operation	251	Tipper hiring service
242 Vsat sale & installation	252	Trailers hiring services
(R) Transportation Business	(S) Rubber /Plastic Business	
243 Airline operation	253	Rubber products: Balloons, feeding bottle ripples, pipes, shoes, surgical gloves, tyres, etc.
244 Car hiring business	254	Plastic making: buckets, chairs, layers, toys, etc
245 Industrial goods transportation		

Source: Authors Fieldwork (2020)

Statement of the Problem

Since Nigeria's independence in 1960, tertiary education has undergone tremendous reformation. Entrepreneurship education was introduced in all the programs in the universities, polytechnics, colleges of education, and mono-technics to equip the students with employable skills and self-reliance. This is in addition to students' Industrial Works Experience Scheme (SIWES), teaching



practice, (TP), students excursion/field trip, and integration of the use of new technologies into the education system (including business education). Despite the inclusion of entrepreneurship education in various programmes including business education and experiences, students acquire from SIWES, TP, excursion/field trips, etc, Nigeria's economy is bedeviled by protracted unemployment. Unfortunately, business education programmes are seriously challenged by various factors that elude students; including in-depth skill acquisition for entrepreneurship opportunities. These challenges are inadequate facilities for teaching and learning, epileptic electric power supply, poor internet network service, incompetent business educator(s) to utilize the few available facilities, and poor funding by the government.

Other challenges are: some heads of the Department of business education are appointed by the management base on nepotism, sentiment, or political patronage as such flagrant abuse of office occurs. Experiences, students acquire from these schemes such as SIWES are not adequate for the students' training needs, lack of schools/ industry collaboration for research assistance, poor curriculum implementation such as accreditation exercises where absence of facilities are adjudged to be available due to corruption, absence of in-service training, absence of scholarships/ career seminars, some business educators rely heavily on lectures for transmitting information. Some lecturers are burdened by teaching overload where excess hours per day or week or semester and large class sizes are assigned to individual lecturers to teach, the result is poor productivity. In consonance, some business educators are doing their best to ensure that students acquire skills in the business field, but some student mindsets are focused on how to get rich quickly; hence armed robbery, kidnapping, cybercrimes, militancy, prostitution, advance fee fraud (419), assassins, crooks, *yahooers*, illicit drug peddlers, scammers, and others are on the increase nowadays. The dignity of labour has no space in some students' minds. Some students prefer the certificate only and not the knowledge. Some students do not understand that it is only through acquiring knowledge and skill that genuine money could come. Therefore, the problem of this study was that there is a severe problem of graduates' unemployment amidst poor training of students for adequate skill acquisition hence this study is to catalyze adequate skill acquisition and viability of entrepreneurs as well as adequate service delivery for nation building.

Purpose of the Study

The study examined Business Education as a tool for skill acquisition and entrepreneurship for nation-building. Specifically, the study sought to:

1. Determine skills acquisition offered by business education programmes
2. Determine challenges facing students, lecturers, and vibrancy in business education programmes.

Research Questions

1. What are the skill acquisitions offered by business education programmes?
2. What are the challenges facing students, lecturers, and vibrancy in business education programmes?

Hypotheses

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

1. There is no significant difference between the mean ratings of male and female business education lecturers in the Universities and Colleges of Education in Southeast, Nigeria on the skills acquisition offered by business education programmes.
2. Universities and Colleges of Education Business Education lecturers in the South East, Nigeria will not differ significantly in their mean ratings on the challenges, facing students, lecturers, and vibrancy in business education programmes.



Methodology

Descriptive survey research design was adopted for this study. The design was considered appropriate because it focuses on the respondents' opinions, attitudes, and behaviour. The population of the study is made up of one hundred and thirty academic staff of business education from five Universities and five Colleges of Education in the South East, Nigeria. i.e. one University and one College of Education were selected from each State of the South East geopolitical Zone of Nigeria. The entire population was used for the study without a sample. A structured questionnaire titled: Business Education as a Tool for skill acquisition and Entrepreneurship for nation building (BESA-E) was used for data collection. The questionnaire contained 33 items on a four-point rating scale of Strongly Agree (4 points), Agree (3 points), Disagree (2 points), and Strongly Disagree (1 point).

As a basis for the decision, any item with a mean of 2.50 and above was accepted while any item with a mean of less than 2.50 was rejected or regarded as negative. Two experts, one in business education and one in measurement and evaluation validated the questionnaire instrument. A pilot test was conducted to establish the internal consistency of the instrument by administering it to 20 business education lecturers in two tertiary institutions (one university and one college of education) outside the scope of the study and data collected were analyzed using Cronbach alpha to obtain reliability coefficient of 0.80 and 0.74 respectively for the different clusters with an overall coefficient of 0.78 indicating that the instrument was reliable for the study. Meanwhile, out of 130 copies of the questionnaire distributed, 95 were retrieved, representing a 73% return rate. Data collected were analyzed using descriptive statistics of mean and standard deviation. The two hypotheses were tested using t-test at an alpha level of 0.05. A null hypothesis is accepted if the calculated t-value (t-cal) is less than the critical or t-table value at 0.05 level of significance. On the other hand, the null hypothesis is rejected if the calculated t-value is equal to or greater than the t-critical or t-table value at 0.05 level of significance.

Results

Research Question 1

What are the skills offered by business education programmes?

To answer research question 1, the mean and the standard deviation were computed. The result of the computation is shown in Table 1.

Table 2: Respondents' mean ratings on the skills acquisition offered by business education programmes (N = 95)

S/N	Skills acquisition offered by business education programmes are:	\bar{x}	SD	Remark
1	Basic skills (reading, writing, listening, speaking, and mathematics skills)	3.20	1.02	Agreed
2	Communication skills	3.32	1.06	Agreed
3	Teamwork skills	3.83	1.10	Agreed
4	ICT skills	3.40	1.43	Agreed
5	Problem-solving skills	3.46	0.98	Agreed
6	Social skills (help students to solve problems cooperatively, enable students to practice empathy and caring), etc	2.67	0.89	Agreed
7	Emotional intelligence skills (help students to manage emotion properly, self-control, helps students to relax and focus on learning)	2.73	0.89	Agreed
8	Technical skills	2.78	0.92	Agreed
9	Mentoring skills (coaching helps students' learning needs)	2.63	0.92	Agreed
10	Accounting skills	2.95	0.83	Agreed
11	Information management skills	3.11	0.78	Agreed
12	Work ethic (responsibility, honesty, punctuality, good work attitude)	2.61	0.72	Agreed
13	Professionalism skills	3.00	0.59	Agreed
14	Leadership skills	3.60	1.42	Agreed
15	Brainstorming skills (two heads are better than one theory)	3.35	1.32	Agreed
16	Entrepreneurial skills	3.55	1.28	Agreed
17	Marketing skills	2.98	0.88	Agreed
18	Planning and organizing	2.67	0.76	Agreed
19	Business law skills	2.54	0.85	Agreed
20	Listening and Questioning skills	3.79	1.27	Agreed

The result of Table 2 shows that all the twenty items on the skills acquisition offered by business education programmes were accepted by the respondents. This indicated that the respondents agreed that business education programmes offer these skills to their students. This is because all the items mentioned obtained mean values that are greater than 2.50 which is the cut-off point for acceptance.

Research Question 2

What are the challenges facing students, lecturers, and vibrancy in business education programmes? To answer research question 2, the mean and standard deviation were computed. The result of the computation is shown in Table 2.

Table 3: Respondents' Mean Ratings on the Challenges facing students, lecturers, and vibrancy in business education programmes (N= 95)

S/N	Challenges facing students, lecturers, and vibrancy in business education programmes are:	\bar{X}	SD	Remark
21	Inadequate facilities for teaching and learning	3.75	1.31	Agreed
22	Epileptic electric power supply	3.68	1.34	Agreed
23	Poor Internet network service	3.10	0.80	Agreed
24	Incompetent business educators that fail to utilize the few available facilities	2.79	0.86	Agreed
25	Inadequate training from SIWES	3.58	1.39	Agreed
26	Lack of schools /industry collaboration for research assistance	3.26	0.77	Agreed
27	Poor curriculum implementation such as accreditation exercise where absence of facilities were adjudged to be available due to corruption	3.27	0.95	Agreed
28	Absence of career seminars for students	3.01	0.93	Agreed
29	Some lecturers are not committed to their instructional delivery	4.03	1.53	Agreed
30	Teaching overload on some individual lecturers	3.03	0.67	Agreed
31	Inadequate self-development by some lecturers such as failure to participate on seminars, conferences, postgraduate studies, to update their knowledge.	3.50	0.60	Agreed
32	Some lecturers are overwhelmed by apparent indifference, slovenliness and lackadaisical attitude to their primary assignment.	2.90	0.94	Agreed
33	Some student mindsets are focused mainly on how to get rich quickly resulting to armed robbery, prostitution, crooks etc.	3.64	0.82	Agreed

The result of Table 3 shows that all the nineteen items were accepted as the challenges facing students, lecturers, and vibrancy in business education programmes in the Universities and Colleges of Education in the South East, Nigeria. This is because all the items listed had mean values that are greater than 2.50 which is the minimum decision rule for acceptance.

Test of Hypotheses

H₀₁: There is no significant difference between the mean ratings of male and female business education lecturers in the Universities and Colleges of Education in the South East, Nigeria on the skills acquisition offer by business education programmes.



Table 4:The t-test Analysis of the Mean Ratings of Male and Female Business Education Lecturers on the Skills Acquisition offer by Business Education Programmes.

S/N	Gender	N	\bar{X}	SD	Df	T-cal	T-crit	Decision
1	Male	52	3.31	0.46	93	0.01	1.96	Accept HO ₁
	Female	43	3.30	0.40				
2	Male	52	3.43	0.60	93	1.12	1.96	Accept HO ₁
	Female	43	3.24	0.64				
3	Male	52	3.38	0.56	93	1.43	1.96	Accept HO ₁
	Female	43	3.06	0.52				
4	Male	52	3.17	0.70	93	0.82	1.96	Accept HO ₁
	Female	43	3.11	0.66				
5	Male	52	2.90	0.83	93	1.03	1.96	Accept HO ₁
	Female	43	3.04	0.72				
6	Male	52	3.21	0.61	93	1.15	1.96	Accept HO ₁
	Female	43	3.17	0.65				
7	Male	52	3.26	0.73	93	0.61	1.96	Accept HO ₁
	Female	43	3.27	0.69				
8	Male	52	3.33	0.50	93	0.43	1.96	Accept HO ₁
	Female	43	3.43	0.68				
9	Male	52	3.12	0.67	93	0.88	1.96	Accept HO ₁
	Female	43	3.88	0.80				
10	Male	52	3.30	0.43	93	1.87	1.96	Accept HO ₁
	Female	43	3.34	0.48				
11	Male	52	3.33	0.63	93	0.94	1.96	Accept HO ₁
	Female	43	3.42	0.57				
12	Male	52	3.38	0.49	93	1.22	1.96	Accept HO ₁
	Female	43	3.07	0.69				
13	Male	52	3.26	0.60	93	1.27	1.96	Accept HO ₁
	Female	43	3.36	0.70				
14	Male	52	3.23	0.58	93	0.92	1.96	Accept HO ₁
	Female	43	3.21	0.65				
15	Male	52	3.16	0.69	93	0.74	1.96	Accept HO ₁
	Female	43	3.02	0.62				
16	Male	52	3.08	0.67				
	Female	43						

The t-test analysis in Table 4 shows that the t-test value of 0.73 was less than the critical t-value of 1.96 at 0.05 level of significance and degree of freedom of 93. Therefore, H_{01} is not rejected. This means that there is no significant difference between the mean ratings of male and female business education lecturers in the Universities and Colleges of Education on the skills acquisition offered by Business Education Programmes in the South East, Nigeria.

H₀₂: The T-test Analysis of the Mean Ratings of Universities and Colleges of Education Business Education Lecturers on the challenges facing students, lecturers, and vibrancy in Business Education Programmes.

Table 5: The t-test Analysis of the Mean Ratings of Universities and Colleges of Education Business Education lecturers on the challenges facing students, lecturers, and vibrancy in Business Education Programmes.

S/N	Type of Institution	N	\bar{X}	SD	Df	T-cal	T-crit	Decision
21	Universities	40	3.20	0.40	93	1.60	1.96	Accept H_{02}
	Colleges of Education	55	3.33	0.42				
22	Universities	40	3.38	0.56	93	0.69	1.96	Accept H_{02}
	Colleges of Education	55	3.35	0.64				
23	Universities	40	3.34	0.58	93	0.62	1.96	Accept H_{02}
	Colleges of Education	55	3.36	0.63				
24	Universities	40	3.14	0.67	93	0.48	1.96	Accept H_{02}
	Colleges of Education	55	3.07	0.69				
25	Universities	40	3.12	0.72	93	0.50	1.96	Accept H_{02}
	Colleges of Education	55	3.30	0.68				
26	Universities	40	3.08	0.80	93	0.38	1.96	Accept H_{02}
	Colleges of Education	55	3.13	0.73				
27	Universities	40	2.91	0.62	93	0.95	1.96	Accept H_{02}
	Colleges of Education	55	3.11	0.90				
28	Universities	40	3.24	0.64	93	0.66	1.96	Accept H_{02}
	Colleges of Education	55	3.17	0.60				
29	Universities	40	3.30	0.71	93	0.52	1.96	Accept H_{02}
	Colleges of Education	55	3.29	0.72				
30	Universities	40	3.06	0.46	93	0.57	1.96	Accept H_{02}
	Colleges of Education	55	3.14	0.48				
31	Universities	40	3.35	0.59	93	0.66	1.96	Accept H_{02}
	Colleges of Education	55	3.38	0.49				
32	Universities	40	3.15	0.65	93	1.43	1.96	Accept H_{02}
	Colleges of Education	55	2.93	0.67				
33	Universities	40	3.25	0.73	93	1.71	1.96	Accept H_{02}
	Colleges of Education	55	3.34	0.62				
T-test value						0.69	1.96	Accept H_{02}

The t-test analysis in Table 5 shows that the t-test value of 0.69 was less than the t-critical value of 1.96 at 0.05 level of significance and degree of freedom of 93. Therefore, H_{02} is not rejected. This means that there is no significant difference between Universities and Colleges of Education Business Education lecturers in their mean ratings on the challenges facing students, lecturers, and vibrancy in Business Education Programmes.



Discussion of Findings

The finding from the result of the analysis of research question one in Table 1 revealed that business education lecturers in Universities and Colleges of Education in the South East, Nigeria accepted all the variables as skills acquisition offered by business education programmes such as basic skills, communication skills, teamwork skills, ICT skills, problem-solving skills, social skills, emotional intelligence, technical skills, mentoring skills, accounting skills, information management skills, work ethics, professionalism skills, leadership skills, brainstorming skills, entrepreneurial skills, marketing skills, planning and organizing skills, business law skills, listening and questioning skills.

The above findings are in accordance with the views of Omidji and Ogwu (2008) that 21st-century skills have to do with the collaboration of digital literacy, critical thinking, social skills, and problem-solving skills which help students thrive in the present economic world.

The finding from hypothesis one in Table 3 revealed that there is no significant difference in the mean ratings of male and female business education lecturers in the Universities and Colleges of Education in the South East, Nigeria on the skills acquisition offered by business education programmes. The result of hypothesis one in Table 3 agrees with Cardon (2010) whose investigative result revealed that flexibility and adaptability, intercultural communication, and collaboration skills are needed by business students to succeed.

The finding from the result of the analysis of research question two in Table 2 revealed that Business Education lecturers in the Universities and Colleges of Education in the South East, Nigeria accepted all the challenges facing students, lecturers, and vibrancy in business education programmes such as inadequate facilities for teaching and learning, epileptic electric power supply, poor internet network service, incompetent business educator fail to utilize the few available facilities, inadequate training from SIWES, lack of schools /industry collaboration for research assistance, poor curriculum implementation, absence of career seminars for students, some lecturers are not committed to their instructional delivery, teaching overload on some individual lecturers, inadequate self-development by some lecturers, poor students mindsets on learning, and some lecturers apparent indifference to teaching.

The above findings aligned with Zakari (2014) who maintained that most business educators are theoretical when teaching skill subjects and other related subjects. The finding from hypothesis two in Table 4 revealed that there is no significant difference in the mean ratings of Universities and Colleges of Education Business Education lecturers on the challenges facing students, lecturers, and vibrancy in business education programmes. The result of hypothesis two in Table 4 agrees with Okoye (2019) who conducted a study on ethical considerations in business education for national development. The result of the study revealed that some lecturers don't attend lectures as enshrined in the school timetable until a few weeks before the end of lectures, they haphazardly organize lectures resulting in poor performance by students.

Conclusion

Based on the findings of the study, the researcher concluded that Business Education is a tool for skill acquisition and entrepreneurship for nation-building. It is therefore pertinent that all stakeholders of Business Education programmes are committed to adopting measures that will improve the perceived impact of Business Education through skill acquisition and entrepreneurship for the needs of society.



Recommendations

Based on the findings of the study, the researcher made the following recommendations:

1. Since a lot of damage, inefficiency, and the collapse of the tertiary education system in Nigeria is a result of corruption, the Federal Government should institute an anti-corruption commission in tertiary institutions. This commission could be called Tertiary Institutions Financial Crime Commission (TI-FCC) The Federal & State Governments should reduce the tuition fees in the Federal and State Tertiary Education System. It will help the students to acquire necessary school items by themselves for their effective learning and good academic achievement.
2. Employment of academic staff should be based on merit.
3. Federal Government should harmonize the Nigerian economy to promote the economic well-being of its citizenry through the employment of youths in private and public establishments.

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HUMAN MANAGEMENT INFORMATION SYSTEM AUTOMATION

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ABSTRACT

Concerning the manual approach of information management being adopted by some organizations, numerous problems had been encountered in the process of handling some crucial activities such as recruitment of employees, salary payment, and retirement administration among others. For this reason, there is a need to devise a better and more effective means of solving the problems of human resource function with the aid of developing a web-based personnel information system to solve the problem associated with manpower planning, procurement, performance, and staff motivation. This paper, therefore, addresses this issue critically through a well-conducted feasibility study and automated system analysis (efficient web-based personnel information system) of the human resource management operations in terms of recruitment and staff training development to achieve high and effective management of the human resource in an organization with the view to increase capability in a highly fulfilling environment.

Keywords: HMIS, Human Resources, Personnel, Information System, MIS, Organization,

1. INTRODUCTION

To sustain growth and maintain any organizational aim and objectives is critically based on certain functions. One such factor is the efficient management of personnel (human capital resources) both within and outside the organization and its environment, in order to operate at maximum capability in a highly fulfilling environment. The human resource management profession has undergone tremendous change over the past decades with its associated complexity by moving from the manual system into an automated embedded system in terms of recruitment, training, salary payments, data security, and staff evaluation among others.

It must be noted that people are still the most important asset to any organization. An examination of the most successful corporations and government agencies usually reveals that a quality workforce has made the difference between mediocrity and success. Personnel information supports the organization's mission, goals, and strategies. However, in recent years, a new wave of awareness has existed in the organization as it concerns the use of computers in administrative and planning areas of business activities. These areas require both quantitative and qualitative information. Organizations have thus, adopted the use of web-based Personnel Management Information System (MIS) and decision support system (DSS) in their decision. The internet, however, has a significant impact on the way HR professionals have accomplished this aforementioned task. This Information technology tools (Web-based personnel information system) have brought about improvements that hereby makes human resource professionals spend less time on administrative task and more time with employees by building intelligence into a computing system.

With a personnel management Information System, Information needed by any section/department in an organization should be collected by one source, stored, and made available to any section of the organization that needs it. Until a manager has the correct information at the right time, he is unlikely to make the right decision; and the higher the quality of the information, the better the result of the decision-making (Unamka and Ewurum, 1995). Though the existing manual system of recording information is useful, however, with the development of Personnel Information System software, personnel records will be simultaneously integrated and rationalized. It should then be seen as a route to eradicating all the problems of the manual method of handling records through the creation of a



single system that would provide accurate information to all in a time and cost-efficient manner. In this paper, some requirements about personnel management such as postings, qualifications, tests, training attended, family details, etc are catered for in this system through software design of a user-friendly graphical interface, data/information retrieval of individual personnel or collective information grouped by certain categories. These categories could be designation, retirement time, length of service, place of work or location, etc. Thus, the issue of ghost workers, hiding of files, falsification of records, and other vices that are often associated with the manual system will be eradicated.

2. LITERATURE REVIEW

2.1 Human Resource Management Overview

Human Resource Management (HRM) is a term often synonymously used as personnel administration which emerged as a clearly defined field in the 1920s in the US and largely concerned with the technical aspects of hiring, evaluating, training, and compensating employees in organizations (Werther, W. B. & Davis K, 1996). HRM hereby came into existence in response to the substantial increase in competitive pressure that organizations experience as a result of globalization, deregulation, and rapid technological change. These gave rise to an enhanced concern on the part of firms to engage in strategic planning--a process of anticipating future changes in the environmental conditions and aligning the various components of the organization in such a way as to promote organizational effectiveness.

However, Human resource management consists of all the activities undertaken by an enterprise to ensure the effective utilization of employees toward the attainment of individual, group, and organizational goals. (Dessler, G. 2000). It focuses on people management, especially on growth and employee development. It also emphasizes developing individual potential and skills (Elwood, F., and Trott. 1996). Such practices help the organization deal effectively with its people during the various phases of the employment cycle (Ivancovich, John. 1999) including pre-hire, staffing, and post-hire activities.

Therefore, components of HRM include but are not limited to the following: Administration and organization structuring, recruitment and selection, personnel information management, employee self-service, timesheet management, leave management, performance management, payroll, benefits, report generation, etc.

2.2 Organizational Performance Metrics

Performance management is used as a generic term referring to methodologies, metrics, processes, and systems that monitor and manage corporate performance, to continuously measure its effectiveness and efficiency according to strategic, operational, human resources, information systems, marketing, and financial perspectives (Chvatalova & Koch, 2015).

This evaluation is required by the management to allow the development of the organization and its management system (Lebas and Euske, 2004). Organizational performance management can be seen either from the Management perspective or Measurement point of view. According to Bourne et al, 2003; Kennerley and Neely, 2003; Marr, 2004; Frolick, and Ariyachandra, 2006, Organizational performance management encompasses methodologies, frameworks and indicators to perform the followings:

- (i) to assist organizations in formulating and evaluating the strategy,
- (ii) to motivate people
- (iii) to communicate or to report the performance to stakeholders.

Meanwhile, performance measurement requires an extensive use of quantitative and qualitative data, with clear definitions and specific frequency for analysis. Therefore, the choice between them depends on the purpose of the measurement and, in many cases, the availability of the data (Popova and Sharpanykh, 2010).

3. METHODOLOGY

The proposed system covers the areas of personnel online recruitment (hiring), registration, seamless selection, Staff performance, and evaluation. This is carried out by data capturing of personal information documents (such as CV/credentials) upload and other post-hiring functions; through a unique applicant homepage where the administrators can communicate with the individual applicants about their interview selection, eligibility, performance, and so on.

3.1 Descriptive Model Design

Design can be defined as procedures/process of applying various techniques and principles to define a process or a system in sufficient details to permit its physical realization”. It may be defined as a process of applying various techniques and principles to define a device, a process, or a system in sufficient detail to permit its physical realization. The design model used for this work is the waterfall model. This is because the waterfall model prescribes a systematic approach to software development which starts with a well-defined, specification of requirements and moves through a deployment in linear form. The waterfall lifecycle works by following a strict path through the development process not moving on to the next stage until the previous stage has been completed (being a complete data-driven solution that resolves around the management of employee files/profiles beginning from the recruitment stage). Since the requirements do not change in the course of the work, this methodology suits the work. If the requirements are dynamic, a more agile methodology would have been chosen. The specification of requirements includes a form to collect relevant job seeker data, a data warehouse where employee-related files and transactions are stored, an appropriate viewer for job seekers to track available jobs and their applications, an appropriate viewer for administrators to see applicant data, feedback from the user to administrators and vice versa.

3.2 Model Development & System Flow

Model development and design will be implemented using web-enabled programming languages and tools such as PHP, Apache server, MySQL, and HTML (Figure 1). This will cut across the Designing of database tables; attributing the constraints to the database table fields; designing of front-end interface of the solution; scripting and linking the front-end to the back-end; testing the solution; and finishing and compiling for distribution.

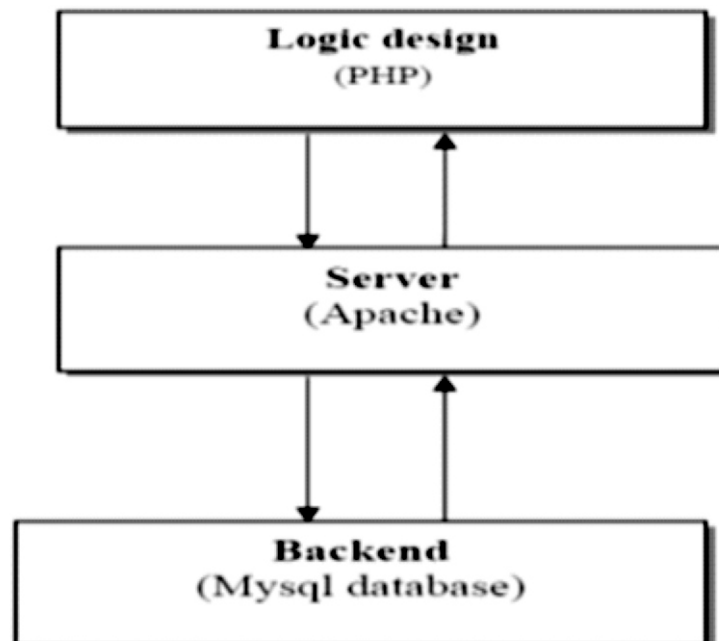


Figure 1: Human Management Information System Architectural Design

The system flow chart of the proposed Human Management and Information System (HMIS) for an organization is hereby shown below (Figure 2)

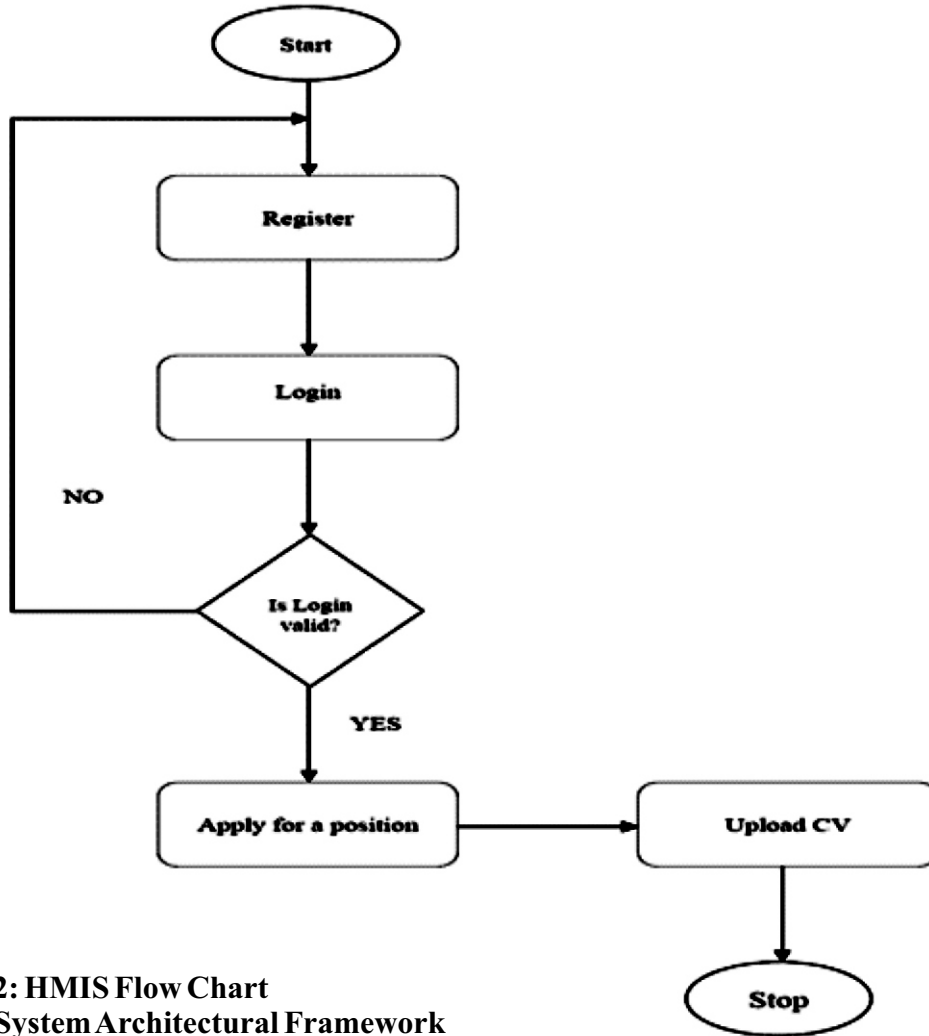


Figure 2: HMIS Flow Chart
3.3 System Architectural Framework

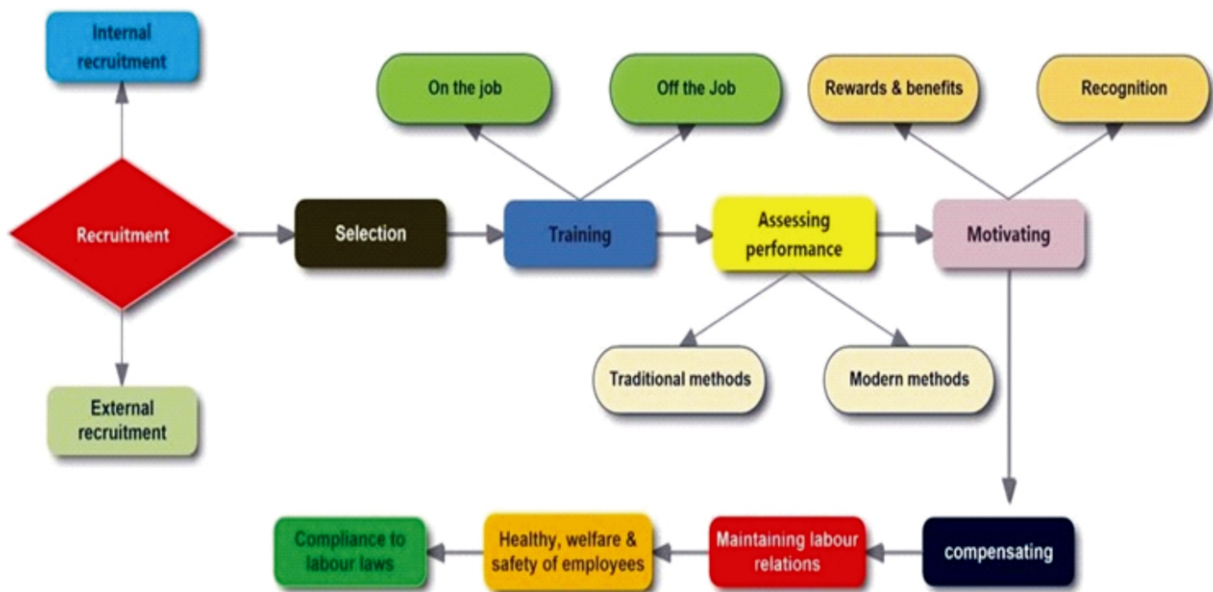


Figure 3: System Architectural Design

This represents a broad framework within which individual information systems fit within the context of Management Information Systems (MIS) as subsystems. The architecture of the MIS plan provides a system structure and its input, output, and linkages. It also provides a way to handle the systems or subsystems. It spells out the subsystems from data entry to processing, analysis to modeling, and storage to printing.

4. SYSTEM IMPLEMENTATION

It must be noted here that Personnel Recruitment System is just one of the other components implemented in the proposed HMIS. The system requirements are made up of the hardware requirements, software requirements, and the environment through which this new system will be adopted for proper and effective implementation of the HMIS.

4.1 Index Page

This is the user's (employee) page and can also be referred to as Login / SignUp Page (Figure 4). When the application is launched using any of the web browsers, this page is displayed. All New Users must sign up or Register as indicated on the page. However, Pre-registered users log into their accounts by entering their Usernames and Password accordingly. Users then supply the required personal information and make the necessary upload of their documents as specified by the system flow (Figure 2) requirements for the recruitment process. This is also represented in the database Table schema (Figure 5)

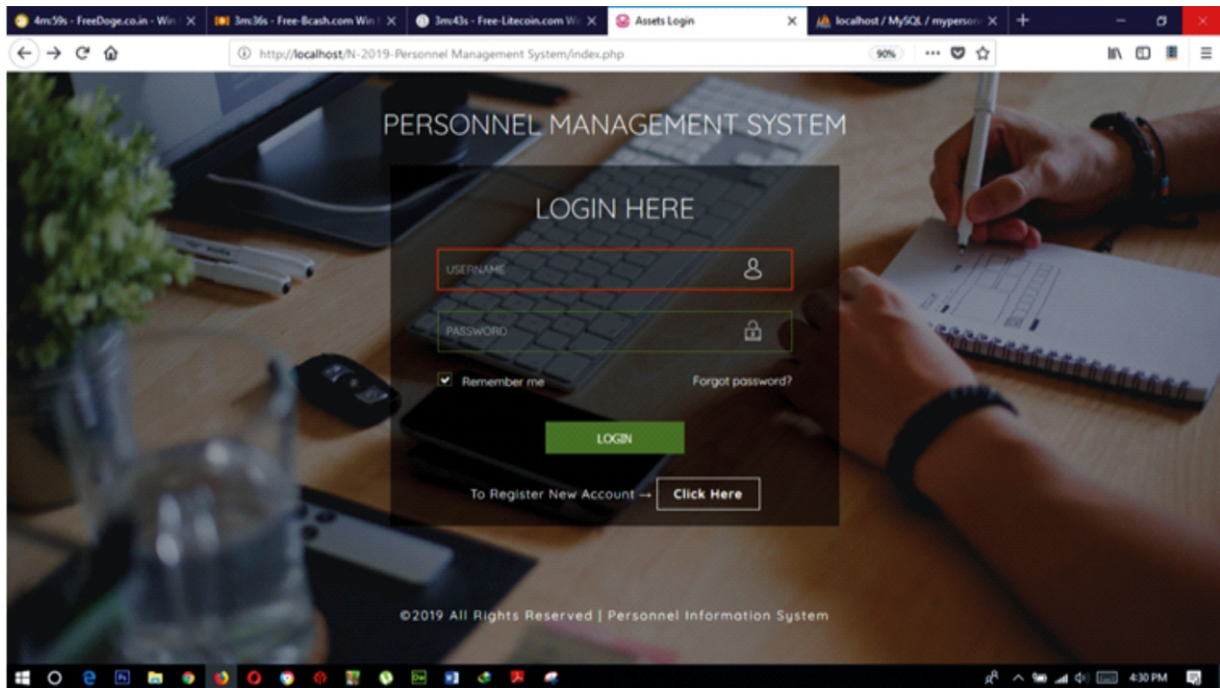


Figure 4: Index Page


Name	Type	Collation	Attributes	Null	Default	Comments	Extra
id 	int(11)			No	None		AUTO_INCREMENT
staffid	varchar(20)	latin1_swedish_ci		No	None		
myname	varchar(50)	latin1_swedish_ci		No	None		
mygender	char(20)	latin1_swedish_ci		No	None		
myage	int(11)			No	None		
email	varchar(255)	latin1_swedish_ci		No	None		
phone	varchar(20)	latin1_swedish_ci		No	None		
academic	text	latin1_swedish_ci		No	None		
pubpap	int(11)			No	None		
myseminar	int(11)			No	None		
status	char(20)	latin1_swedish_ci		No	None		

Figure 5: Database Table Description

4.2 Administrator's Page

The role of this module is for the organizational assessment, feedback, and control of user data. This is being managed by IT-inclined personnel specifically assigned by the organization managers. This module (Figure 6) comprises the following links – New Staff Upload and Staff Evaluation page: directly connected to the database for data communication, transmission, and storage across every section of the organization's human capital resources.

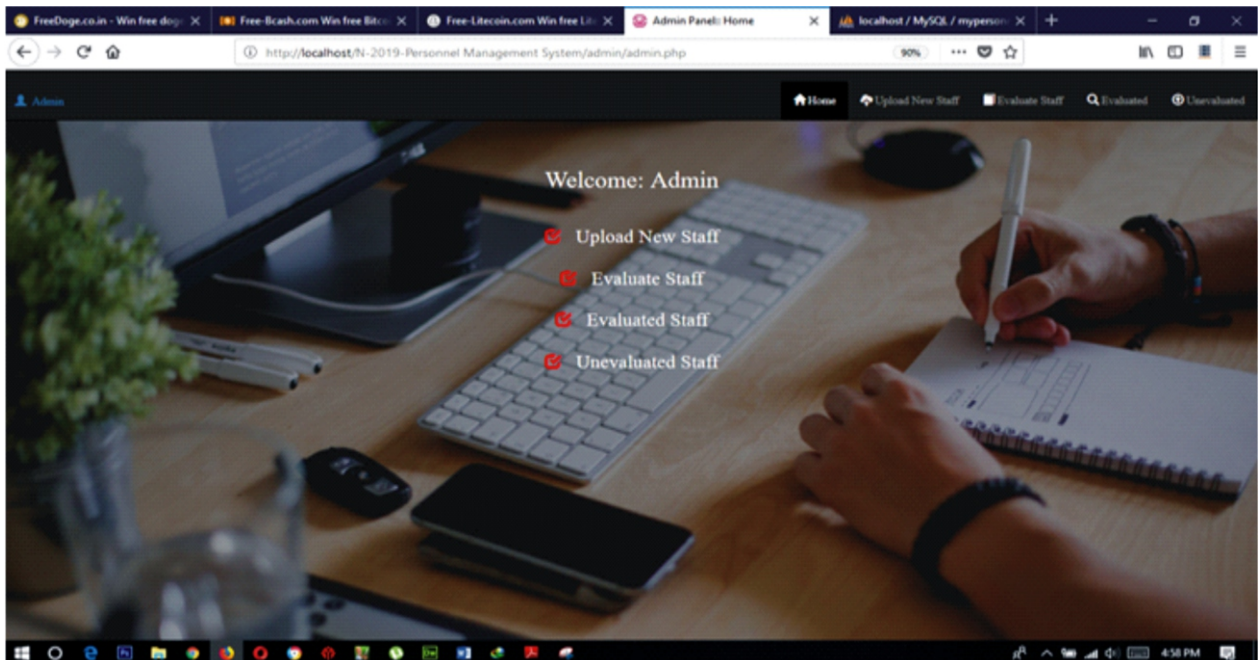
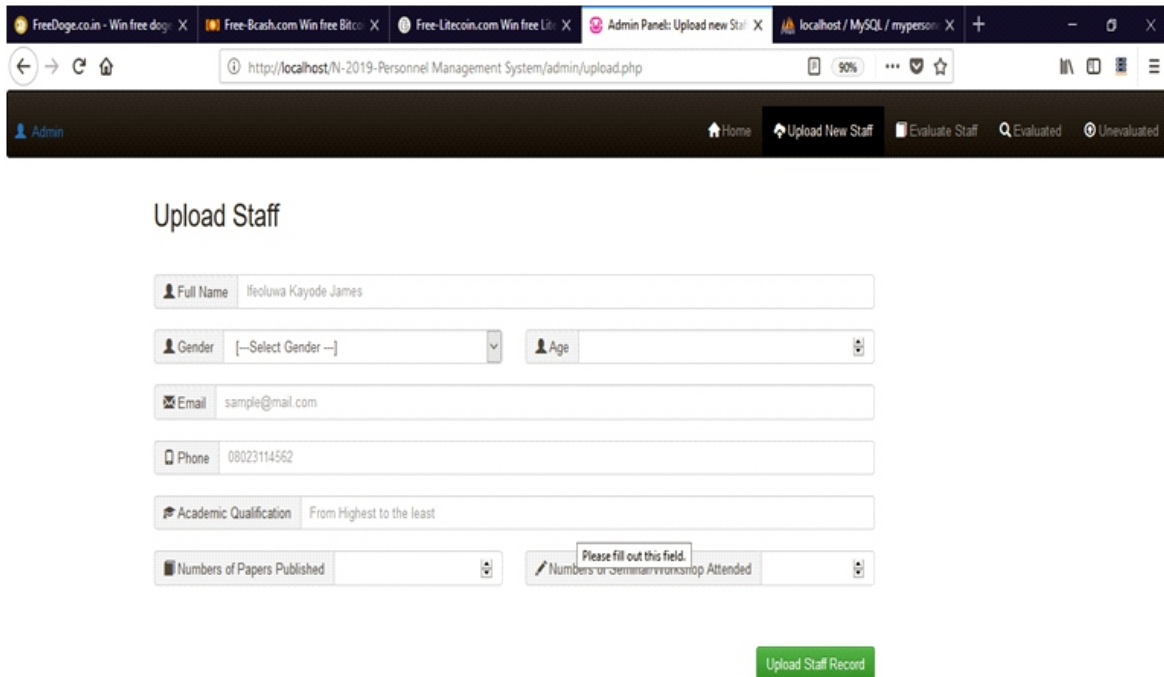


Figure 6: Admin Page

4.3 Staff Upload

Since every organization is made up of personnel/workforce, information about each staff of the organization is captured by the HMIS. This can be assessed anytime by the management within the organization when the need arises (Figure 7). However, this is being accessed and monitored by the system administrator (admin), acted upon as directed by the human resource manager and directly uploaded to the database.



The screenshot shows a web browser window with the URL `http://localhost/N-2019-Personnel Management System/admin/upload.php`. The page title is "Upload Staff". The form contains the following fields:

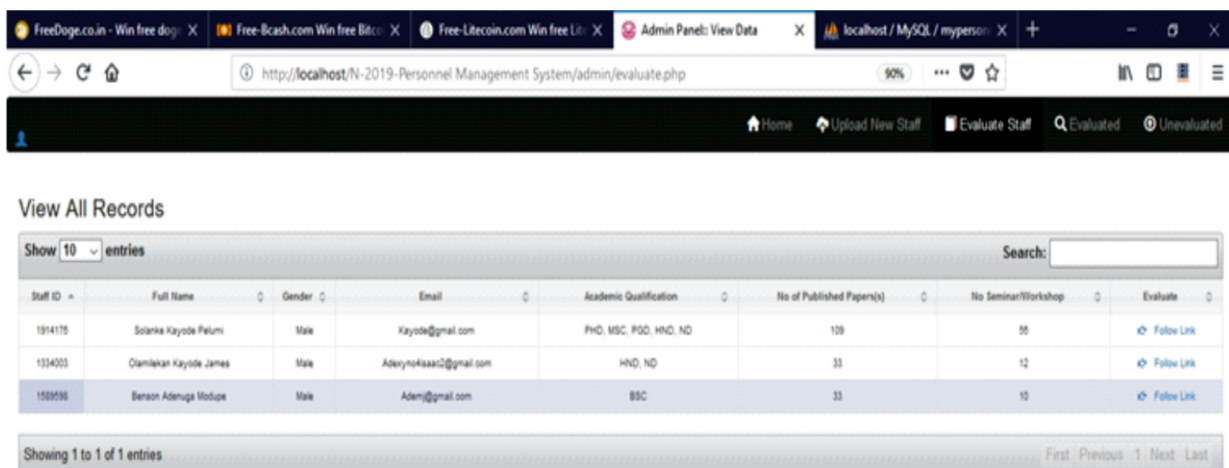
- Full Name: Ifoluwa Kayode James
- Gender: [--Select Gender --]
- Age: []
- Email: sample@mail.com
- Phone: 08023114562
- Academic Qualification: From Highest to the least
- Numbers of Papers Published: []
- Numbers of Seminars/Workshop Attended: [] (with a tooltip "Please fill out this field.")

A green button labeled "Upload Staff Record" is located at the bottom right of the form.

Figure 7: Upload Staff Page

4.5 Staff Evaluation Performance

Staff performance is measured via the evaluation module (Figure 8) as every workforce is being commended by the authorities where the personnel has served across various sections/units. Therefore each staff is being evaluated online by the developed system to motivate other staff thereby bringing development/progress to the organization. However, the results of this evaluation will be automatically sent to individual registered accounts.



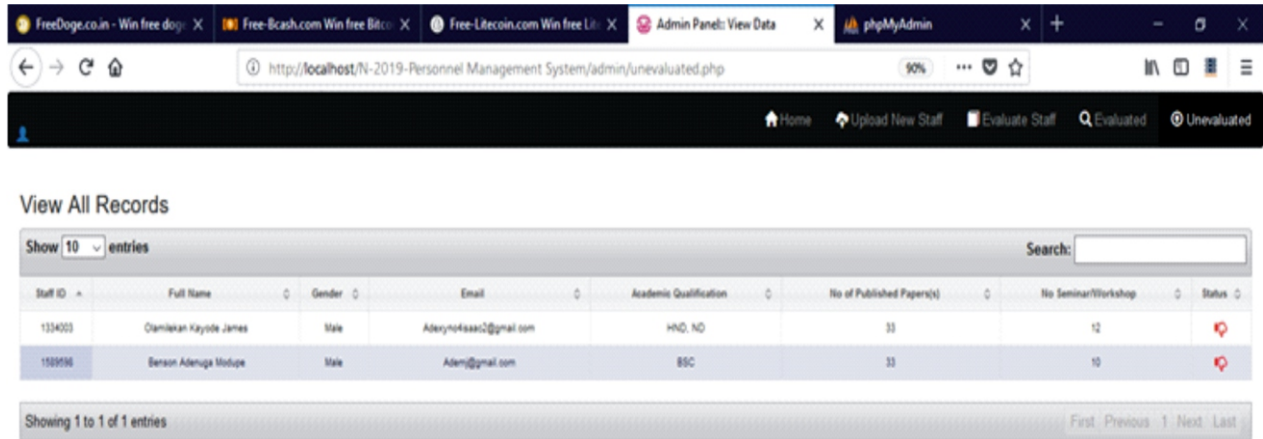
The screenshot shows a web browser window with the URL `http://localhost/N-2019-Personnel Management System/admin/evaluate.php`. The page title is "View All Records". The table displays the following data:

Staff ID	Full Name	Gender	Email	Academic Qualification	No of Published Papers(s)	No Seminar/Workshop	Evaluate
1914175	Solanka Kayode Pelumi	Male	Kayode@gmail.com	PHD, MSC, PDD, HND, ND	109	58	Follow Link
1334003	Olanikan Kayode James	Male	Adewinokassid@gmail.com	HND, ND	33	12	Follow Link
1589598	Benson Adenuga Ifodupe	Male	Adem@gmail.com	BSC	33	10	Follow Link

Showing 1 to 1 of 1 entries. Navigation: First Previous 1 Next Last

Figure 8: Evaluated Staff

Meanwhile, the unevaluated staff is indicated with a red flag on the page's right-hand side as displayed in the graphical user interface (GUI) below (Figure 9). This can be a result of poor attitudes to work or other failed criteria as stipulated by the organization as a yardstick.



Staff ID	Full Name	Gender	Email	Academic Qualification	No of Published Paper(s)	No Seminar/Workshop	Status
1334003	Damikan Kayode James	Male	Aderyn4444@gmail.com	HND, ND	33	12	🚩
1009136	Benson Aderuga Modupe	Male	Adem@gmail.com	BSC	33	10	🚩

Figure 9: Unevaluated Staff

5. CONCLUSION AND RECOMMENDATION

Personnel recruitment and staff evaluation across levels requires that an assessment of the present and future needs of the organization be compared with present resources and future predicted resources. Appropriate steps should then be planned to bring demand and supply into balance. The central aim of modern human resource management is to enhance the effective use, involvement, and contribution of employees throughout the organization. This requires a great deal of information accretion, classification, and statistical analysis as a subsidiary aspect of personnel management. What future demands will be is only influenced in part by the forecast of the human resource manager, whose main task may well be to scrutinize and modify the crude predictions of other managers. However, this can be achieved with ease using system automation by the application of the IT paradigm thereby making the process seamless, faster, more effective, and efficient to the benefit of both personnel and the organization. Personnel management information software developed to assist managers keep track of employee records as implemented in this research work. It is hereby recommended that organizations should invest more in information technology for efficient management of organizational resources to maximize productivity and great improvements.

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INVESTIGATING THE NEXUS OF INSTITUTIONAL SOCIAL FARMERS GROUP AND MULTIDIMENSIONAL POVERTY AMONG THE SELECTED RURAL HOUSEHOLDS IN OSUN STATE

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Abstract

The study assessed the importance of participation in farmers' groups or associations by the rural farmers and the relationship that exists between institutional social farmers Groups and multidimensional poverty in the rural farming households in Osun State. *The specific objectives were to; describe the socio-economic characteristics of the rural farmers, assessed farmers' motives for belonging to farmers' groups, ascertain the number of farmers' groups the farmers belong to and identify the benefits in terms of access to agricultural inputs derived from belonging to farmers' groups.* The study investigated the relationship and the impact of farmers' groups on the poverty status of members and compared the same with the status of farmers who do not subscribe to any farmers' groups. A total number of Three Hundred questionnaires were administered and one hundred and fifty were retrieved. The unit of analysis was the household head; the period of research was the month of August 2021 to November 2021. The majority of the respondents were male (60%) while 40% were female. % of the respondents have a family size of between five and eight people. There was no significant relationship between sex, marital status, and participation in the farmers' group. There was a significant relationship between the educational level of the respondents and their participation in farmers' groups. The pseudo R^2 of the Membership of Social Groups parameters is 0.518. The implication of this is that the independent variables accounted for 51.8% variation in the dependent variable. And for the Non-Membership of Social Groups, the pseudo R^2 is 0.541, in other words, the independent variables accounted for 54.1% variation in the dependent variable. The log-likelihood of Membership in Social Groups is 52.096. That is, there is a 52.01% likelihood that there would be an increase in poverty among the farmers due to unit changes in independent variables in the equation. The log-likelihood for Non-Membership of Social Groups is 38.946. That is, there is a 38.95% likelihood that there would be an increase in poverty among the farmers due to unit changes in independent variables in the equation. The study revealed that farmers' groups can be enhanced by empowering them with requisite information and strategies on household food security, as the farmers can be reached using the groups they can repose their trust in.

Keywords: Social Group. Food Security. Rural Farmers. Household.

Introduction

Globally, agriculture provides livelihood to more people than any industry according to Food and Agriculture Organization 2015 report on social protection and agriculture.

Agricultural growth, at increasing levels, provides opportunities for many people to raise their income and escape poverty. It also provides raw materials for agricultural-dependent industries and meets the food security needs of the faster-growing urban population. Agriculture plays a critical role in reducing and preventing poverty among the teeming numbers of farming households. Akpan, Udoh, and Patrick (2016) posited that the agricultural sector is known to employ more than 70 % of the rural population and is a major absorber of labour during periods of economic crises or recession. In other words, agriculture is a veritable tool used by many economies as a buffer during economic

shocks, poverty alleviation interventions, youth empowerment, rural economic growth strategies, and food security. Agriculture is greatly essential to world economies. The populace of both developed and developing nations derive their economies from the operations within it. While agriculture accounts for 21 percent of Nigeria's GDP, the sector employs 70 percent of the labor force (World Bank 2017). Based on Nigeria's official definition of smallholders, more than 80 percent of farmers in Nigeria are considered smallholders because they own less than 5 hectares of land. Smallholders produce 99 percent of Nigeria's agricultural outputs, yet their productivity is hindered by several limitations. Major constraints to smallholder farming in Nigeria include the lack and high cost of labor and agricultural inputs in rural areas; a system that prevents the acquisition of new land; inconsistent support from local government councils, limited access to information, modern agricultural technology, and adequate financial services. (Mgbenka and Mbah 2016). Another characteristic of smallholder farming in Nigeria in the words of Anderson, Marita, Musiime, and Thiam (2017) is that smallholder farmers view farming as a family business, and labor is largely sourced from family members. And due to this, Information on agricultural activities, including financial advice, is sourced from family members and friends rather than from professionals and experts in the subject matter.

In an attempt to reduce poverty incidence in any social system, it is essential to review various factors that are contributory to poverty, especially among the economic units in the system. Poverty issue is not an isolated issue, it is a result of intertwined factors within the farming and social systems. In the submission of Yoshida, Uematsu, and Sobrado (2014), to lift the incomes of the rural poor above the extreme poverty line in sub-Saharan Africa, it would require an average increase in income of at least 60 percent above the estimated average income of the poor in 2010. In other words, it is imperative to close this income gap to achieve a reduction in poverty incidence.

The memberships of social groups and non-Memberships of social groups are types of dichotomy found within the rural areas. The differences in the poverty situations within these two have often time, escape the attention of research endeavours. And due to this fact, many of the interventions to reduce poverty incidences had always been using the same blanket approaches to solve the poverty issues among types of farming systems. These blanket approaches do not adequately deal with problems associated with poverty issues peculiar to these dichotomies. Therefore, this study aims at bridging the knowledge gap by investigating poverty differentials among farmers who belong to institutional social groups and those who are not, intending to discover if, participating in a farmer's social groups has a relationship with the multidimensional poverty status in the study areas.

The general objective of this study is to investigate the effects of membership in institutional social groups on the multidimensional poverty status of farming households in Osun state. The specific objectives are:

1. describe the socio-economic characteristics of the respondents in the study area.
2. explain the differences in the investment and production profiles of the respondents.
3. examine the factors that contribute to poverty status among the respondents.

MATERIALS AND METHODS

Study Area

The study area of the research was the Osun central senatorial district of Osun State. This comprises 13 local government areas of Osun State of Nigeria. Three local governments, namely, Ifedayo, Boluwaduro, and Odo-Otin local government areas were purposively chosen due to their degree of rurality and prevalence of smallholding farming activities. The study population is all registered farmers with the Department of Agriculture and natural resources of the local government areas for the farmers who are members of farmers' social groups. The 150 farmers were randomly selected from the list. A household visit was done to identify farmers who do not belong to any farmers' social



groups. For the farmers who do not belong to any farmers' social groups, 50 farmers were sampled per each local government. given a total of 150 farmers sampled. The total number of farmers sampled was 300.

Sample Collections

The source of data collection for the study was through primary and secondary sources. Data were collected through the administering of questionnaires to the respondents with 50 questionnaires not retrieved.

The instrument for data collection was subjected to pre-existing validation and reliability tests through face validity to determine the extent to which the instrument measures what was designed to measure, and consistency within the instruments The data was analyzed by frequency distribution, means and percentage, Chi-square, and Pearson product-moment correlation and regression analysis were used to explore the relationship between variables. The independent variables for this study are selected socioeconomic characteristics (age, education, marital status, gender)

Multi-dimensional Poverty Analysis

The MPI was created using a method developed by Alkire and Foster (2007) which builds on intuitive yet rigorous ways of using people's deprivation profiles. The **Alkire Foster** methodology is flexible and can be used with different dimensions, indicators, weights, and cutoffs to create measures specific to different societies and situations. The methodology had been developed, to assess multidimensional poverty in developing countries. Both the incidence and the intensity of these deprivations are highly relevant pieces of information for poverty measurement.

The Probit Regression Model

The probit model is a type of regression where the dependent variable can take only two values. In this study, it was used to establish the factors influencing and determining multi-dimensional poverty among the respondents. **The Probit Regression** model was used to analyze and examine the factors that influenced multi-dimension poverty among farming households. The dependent variable was the Multi-dimension Poverty status of the farming households. It was dichotomous in measurement, in the sense that if a farming household status is multi-dimensionally poor, it was 1 otherwise, it was 0. The Multidimensional Poverty Index of farming households was determined by using three dimensions with ten indicators to measure the occurrence of poverty.

This can be expressed as:

$$\text{Prob.}(q_n=1) = \frac{e^{\beta x_{it}}}{1 + e^{\beta x_{it}}} \dots\dots\dots 1$$

$$q_i = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + b_{10}x_{10} + e \dots\dots\dots 2$$

Where:

qi=multidimensional poverty status (1-poor, 0-non-poor)

x_i- vector of explanatory variable

b=vector of parameters to be estimated

e= error term

The Approach of the Multidimensional Poverty Index Measurement

Poverty has traditionally been measured in one dimension, usually income or consumption. In this analysis, a basket of goods and services considered the minimum requirement to live a non-impovertised life is valued at the current prices. People who do not have an income sufficient to cover that basket are deemed poor. Income poverty certainly provides very useful information. Yet poor people themselves define their poverty much more broadly to include lack of education, health, housing, empowerment, employment, personal security, and more. No one indicator, such as

income, is uniquely able to capture the multiple aspects that contribute to poverty. For this reason, since 1997, *Human Development Reports (HDRs)* have measured poverty in ways different than traditional income-based measures. The Human Poverty Index (HPI) was the first such measure, which was replaced by the Multidimensional Poverty Index (MPI) in 2010 (Santos and Alkire 2015)

The MPI is an index designed to measure acute poverty. Acute poverty refers to two main characteristics. First, it includes people living under conditions where they do not reach the minimum internationally agreed standards in indicators of basic functioning, such as being well nourished, being educated, or drinking clean water. Second, it refers to people living under conditions where they do not reach the minimum standards in several aspects at the same time. In other words, the MPI measures those experiencing multiple deprivations, people who, for example, are both undernourished and do not have clean drinking water, adequate sanitation, or clean fuel. The MPI combines two key pieces of information to measure acute poverty: the incidence of poverty, or the proportion of people (within a given population) who experience multiple deprivations, and the intensity of their deprivation - the average proportion of (weighted) deprivations they experience. Both the incidence and the intensity of these deprivations are highly relevant pieces of information for poverty measurement. To start with, the proportion of poor people is a necessary measure. It is intuitive and understandable by anyone. People always want to know how many poor people are in society as a proportion of the whole population. The MPI also has some important advantages. Because of its rich functional form and direct measures of acute deprivation, it allows for comparisons across countries or regions of the world, as well as within-country comparisons between regions, ethnic groups, rural and urban areas, and other key household and community characteristics. It also allows for comparison between farming operations. According to Alkire and Santos (2015), it enables analysis of patterns of poverty: that is, how much each indicator and each dimension contributes to overall poverty.

The Components of Multidimensional Poverty Index Measurement

The MPI is composed of three dimensions made up of ten indicators as depicted in Figure 1. Associated with each indicator is a minimum level of satisfaction, which is based on international consensus. This minimum level of satisfaction is called a deprivation cut-off. Two steps are then followed to calculate the MPI:

Step 1: Each person is assessed based on household achievements to determine if he/she is below the deprivation cut-off in each indicator. People below the cut-off are considered deprived in that indicator.

Step 2: The deprivation of each person is weighted by the indicator's weight. If the sum of the weighted deprivations is 33 percent or more of possible deprivations, the person is considered to be poor.

Composition of the MPI (Dimensions and Indicators according to Alkire and Foster (2007))

S/N	Three Dimensions of Poverty	
Health	Education	Living Standard
Nutrition	Years of Schooling	Cooking Fuel
Child Mortality	School Attendance	Sanitation
		Water
		Electricity
		Floor
		Assets

Source: Alkire and Foster (2009)

RESULTS AND DISCUSSION

Social-Economic Characteristics of the Respondents

Social Group Membership

The table 1 indicates that 57.2 % of the respondents belong to diverse social groups. In the study areas, membership in social groups was deemed expected to play critical roles in how the respondents cope with poverty. Submission of Liverpool and Winter-Nelson (2010), opined that Social networks indirectly affect agricultural productivity by influencing farming practices and the household's propensity to adopt newer technologies via the supply of information through social networks.

Table 1: Distribution of the Respondents by Social Group Membership

Items	Frequency	Percentage
Membership in Institutional Social Groups	143	57.2
Non-Membership in Institutional Social Groups	107	42.8
Total	250	100

Source: Field Survey 2021

Table 2: Age Distribution of the Respondents

Age (years)	Members of Social Groups		Non-membership Social Groups	
	Frequency	Percentage (%)	Frequency	Percentage (%)
31 – 40	26	18	24	23
41 – 50	60	42	48	45
51 – 60	50	35	27	25
Above 60	7	5	8	7
Total	143	100.0	107	100.0

Source: Field Survey 221

Mean (Members of Social Groups) = 48.02 years

Mean (Non-membership Social Groups) = 47.8 years

Table 2 shows the average age of respondents who are Members of Social Groups is 48.02 years while for respondents who are not active in any membership of social Groups is 47.8 years

This finding further supports the submission of Anderson, *et al* (2017) on smallholder farming households in Nigeria. They submitted, based on their field findings, that the youngest generation shows the most interest in agriculture and values hard work and achievement.

Table 3 reveals that 76% of the respondents (Membership of **Social Groups**) were Male respondents, with 34% female respondents. For the respondents who are not **Members of Social Groups**, 69% were Male and 31% were Female. The significance of this is that the farming sector is still dominated by Male farmers. The same trend was found among the non-Membership of Social Groups. Table 3 shows that 75% of the respondents among the non-Membership of Social Groups were male farmers.

Table 3: Sex Distribution of the Respondents

Gender	Membership in Social Groups		Non-membership Social Groups	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Male	109	76	74	69
Female	34	24	33	31
Total	143	100	107	100

Source: Field Survey 2021

Educational Level of the Respondents

Table 4 shows that, among the respondents who are **Members of Social Groups**, the largest percentage 45.5% possess primary school education, while 9.1% of the framers have no formal education. The general overview of Table 3 shows that appreciable numbers of respondents can be said to be literate. The Table further shows that 28.9% of the respondents who are not active members of social groups possess tertiary education and 31.8% possess secondary school education. The finding is in line with the submission of **Okoruwa, Obi-Egbedi, and Adeniran (2015)**, that a large number of years of schooling is expected to have a positive effect on the adoption of the agricultural programme.

Table 4: Distribution of Educational Level of the Respondents.

Educational Level	Membership in Social Groups		Non-membership Social Groups	
	Frequency	Percentage	Frequency	Percentage
No Formal Education	13	9.1	4	3.7
Primary Education	65	45.5	15	14.0
Adult Education	22	15.4	23	21.5
Secondary Education	27	18.8	34	31.8
Tertiary Education	16	11.2	31	28.9
Total	143	100	107	100

Source: Field Survey 2021

Marital Status

Table 5 indicates that the largest percentage of the respondents are married. This shows that the family will work together in their quest to improve their living standard and this will enhance the utilization of innovations and the ability to discuss and make a wise decision as regards adoption. Marital seems to play a critical role in the household decision-making process.

Table 5: Distribution of the Respondents by Marital Status

Marital Status	Membership in Social Groups		Non-membership Social Groups	
	Frequency	Percentage	Frequency	Percentage
Single	5	3.7	9	8.4
Married	120	83.9	68	63.6
Widowed	15	10.3	27	25.2
Divorced	3	2.1	3	2.8
Total	143	100	107	100

Source: Field Survey 2021

Farming Experience of the Respondents

Tables 6 indicate the farming experiences among the respondents. The average farm experience among the respondents who are active members of the social groups is 28 years compared to those who are not active members of the social groups, which is 20 years.

Table 6: Distribution of Farming Experience of the Respondents

Experience(years)	Membership in Social Groups		Non-membership Social Groups	
	Frequency	Percentage	Frequency	Percentage
1 – 10	13	9.1	27	25.2
11 – 20	18	12.6	28	26.2
21 – 30	72	50.3	23	21.5
31 – 40	31	21.7	21	19.6
Above 40	9	6.3	8	7.5
Total	143	100.0	107	100

Source: Field Survey 2021

Mean farm experience for membership of social group= 28 years

Mean farm experience for non-membership of social group= 19years

House Size of the Respondents

Table 7 shows that 52.4% of the respondents in Membership of Social Groups have 5 household members. The same applies to non-Membership of Social Groups, where 55.3% of the respondents have about 6 household members. This closely follows Balogun and Obi-Egbedi's (2012) finding of an average of six persons per household in Southwest Nigeria. Among the Membership of Social Groups, 41.3% of the respondents had more than six household members, and 34% of the non-Membership of Social Groups also had more than six household members. The large household size implies the household poverty status. The large number of household members will result in more household expenditures on consumption.

Table 7: Distribution of House size of the respondents

House size	Membership of Social Groups		Non-Membership of Social Groups	
	Frequency	Percentage	Frequency	Percentage
1 – 3	4	2.8	4	3.9
4 – 6	75	52.4	57	55.3
7 – 9	59	41.3	35	34.0
10 – 12	5	3.5	7	6.8
Total	143	100.0	103	100.0

Source: Field Survey 2021

Mean household size for **Membership of Social Groups** = 5

Mean household size for **Non- Membership of Social Groups** = 6

Farm size of the Respondents

Table 8 shows that 45.4% of Membership of Social Groups in the study areas had farm sizes of 4.1 to 5.0 hectares, while 44.6% of the respondents who are not active members of social groups had farm sizes of 4.1 to 5.0 hectares. The average farm size among the respondents is 4.8 hectares.

Table 8: Distribution of Farm size of the Respondents

Farm Size (Hectares)	Membership of Social Groups		Non-Membership of Social Groups	
	Frequency	Percentage	Frequency	Percentage
1.1 – 2.0	6	4.2	8	7.8
2.1 – 3.0	3	2.1	5	4.9
3.1 – 4.0	3	2.1	3	2.9
4.1 – 5.0	65	45.4	46	44.6
5.1 – 6.0	57	39.9	33	32
6.1 – 7.0	4	2.8	4	3.9
Above 7.0	5	3.5	4	3.9
Total	143	100.0	103	

Source: Field Survey 2021

Respondents' motive for joining Farmers' groups.

The respondents were asked to choose the most singular reason for joining institutional social groups. A large percentage of the respondents, 98% chose access to Credit facilities as the most singular reason for joining social groups. In the other responses, table 3 shows that 70% of the respondents choose the issues of personal welfare and support as the second reason for joining social groups while market information and network ranked third (65%) as a reason to join the social group. Access to agricultural inputs was an important issue the farmers are confronted with, 54% of the respondents chose access to agricultural inputs as a reason to join social groups.

It is a common process for government agencies to relate with farmers on a group basis rather than on an individual basis. This may account for the respondent joining farmers' groups and associations to access government aid in terms of credit, training, and other benefits. The results further show that all respondents joined their farmers' group because of financial credits and assistance. Okumadewa

(1999) submitted that the majority of the poor are rural dwellers, who lack basic agricultural equipment and inputs and are subjected to a decline in productivity. In the process to adjust to their poor condition, the rural dwellers resort to joining social groups that would supply the necessary farm support services they lack.

Table 9: Distribution of respondents according to the main reason for joining a social group

Variables	Frequency	Percentage
Market information and network	2	28.5
Welfare and support	2	30
Access to Extension services	0	8.2
Political Influence	0	1.7
Agricultural Inputs	1	0
Credit facilities	245	98
Information seeking and awareness	0	10

Source: field survey 2021

Respondents' motive for abstaining from Farmers' groups.

Table 10: Distribution of respondents according to the main reason for abstaining from social group (Ranking in the percentage of responses)

Variables	Percentage (%)
Historical bad experiences (government and institutions inconsistencies)	27.2
Demands of resources, time, and commitment	21.6
Opaqueness in the style of management	15.6
Ignorance of the process and benefits	12.8
Restriction of individual rights	9.6
Internal politics	8.0
Prejudice	5.2

Source: field survey 2021

Table 10 shows that bad experiences from members of the farmers' social groups have a strong impact on the perspective of farmers who are not active members of any farmers' groups. 27.2% of the respondents agreed that the historical bad experiences with the farmers' groups shut the possibility of joining any formal farmers' group. While prejudice was not considered a main reason, the fact that 8% of the respondents felt they would be judged and deferred the possibility of joining the farmers' group. The 21.6% of respondents felt the demands from the farmers' group outweigh the benefits of joining.

The results in Table 10 are more of the perception and experiences of the respondents, who are more concerned about the constraints to joining or belonging to farmers' groups; and the absence of transparency in the process to access the intended benefits of membership of farmers' groups.

Respondents' membership of Social Group.

The results show that all respondents belong to one or the other crop farmers' association which is the umbrella body of farmers in the study areas. The umbrella farmers group has opportunities to deal directly with government agencies on behalf of their members. The respondents are well

knowledgeable about the importance of deriving strong social capital by joining farmers' associations. The largest percentage of the respondent (96%) are members of government-registered cooperative societies and while only 26.8% belong to Micro-Financed supported credit groups. The interest offered by the cooperative societies provides succor and financial safety for farmers compares to the high interest demanded by the micro-finance bank. 80% of the respondents are members of groups formed and supported by intervention agencies, Non-Governmental Agencies, these agencies provide extension services and market information to the farmers. The analysis from the table shows that the respondents belong to more than one social group.

Table 11: Distribution of respondents according to membership of social group

Variables	Membership	Percentage (%)
Institutional Cooperative society	240	96.0
Produce marketers	184	73.6
Crop farmers (FADU, AFAN)	200	80.0
Micro-credit group (micro-financed bank supported)	67	26.8
Fadama Users Group (disbanded)	145	58.0
NGO and organized group	200	80.0
Welfare Community Association	86	64.3

Source: field survey 2021

Estimation of Poverty Profile

Table 12 shows that 70% of Membership of Social Groups were deprived of electricity, which is the highest among the indicators. The issue of deprivation in electricity is unique to poverty incidence. 58.3% of non-Membership of Social Groups were deprived of electricity, which is half of the respondents; it shows that, once there is a lack of electricity supply, the economic growth in the study areas is expected to witness stunted growth. Regarding the non-Membership of Social Groups, the highest level of deprivation is the ownership assets in the area of mobility, which is 66.7%. a critical point of note is adequate sanitation that is, the availability of modern toilet facilities. Among the maize/cassava and non-Membership Social Groups, 51.7% and 35% respectively were deprived of adequate sanitation. According to Abubakar (2017), access to improved sanitation facilities is key to the socio-economic well-being and sustainable development of any society. The majority of the respondents in the study areas possessed handset phones. 6.7% of Membership of Social Groups were deprived of handset phones while 0% of the non-Membership of Social Groups were deprived of phones.

On the issue of potable water, 15% of maize/cassava was deprived, while 0% of non-Membership of Social Groups were deprived. In terms of ownership of assets, 90%, 18.3%, 76.7%, and 13.3% of Membership of Social Groups were deprived of refrigerators, radios, cars, and cemented house floors respectively. On the issues of deprivation in education, 38.3% and 11.7% of the maize/cassava households are deprived of basic education and school enrolments respectively. Among the non-Membership of Social Groups, 20% and 8.3% were deprived of basic education and school enrollment. From this finding, there is high school attendance by school-age children in households in the study areas. As reported by Udoh, Akpan, and Uko (2017), 20% of the rural farmers in their study have a primary school education and 53% have a secondary school education. There is a low deprivation indicator in the area of quality healthcare among the respondents. 6% of Membership of Social Groups were deprived of access to quality healthcare services and 5% of non-Membership of Social Groups were deprived of access to quality healthcare services.

Table 12: Differences in the Incidence of Deprivation across Indicators

Indicators	Membership of Social Groups		Non-Membership of Social Groups	
	Frequency	Percentage	Frequency	Percentage
Secondary education	23	38.3	12	20.0
School Age Enrolments	7	11.7	5	8.3
Electricity	42	70.0	35	58.3
Potable water	9	15.0	0	0.0
Adequate sanitation	31	51.7	21	35.0
House floor	8	13.3	7	11.7
Kerosene stove	27	45.0	4	6.7
Car	46	76.7	40	66.7
Quality health care	6	6.0	3	5.0
Phone	4	6.7	0	0.0
Refrigerator	54	90.0	31	51.7
Radio	11	18.3	28	46.7
Motorbike	27	45.0	19	31.7

Source: Field Survey 2021

Multidimensional Poverty Estimates

Table 13 shows the multidimensional poverty status of the respondents in the study areas. The tables show 53 % of the respondents among the farmers who are Members of Social Groups are experiencing deprivation in more than one identified dimension (education, consumption, and living standard), while 56.3% of the farmers who are not members of the farmers' group are experiencing poverty. Relatively, poverty incidence is high in the study areas.

Table 13: Distribution of Respondents by Multidimensional Poverty Status

Headcount	Membership of Social Groups		Non-Membership of Social Groups	
	Frequency	Percentage	Frequency	Percentage
Poor	76	53.0	58	56.3
Non- poor	67	47.0	45	43.7
Total	143	100.0	103	100.0

Source: Field Survey, 2018

Multidimensional Poverty Index (MPI) Estimate

Table 14 revealed the headcount, average poverty gap, and adjusted headcount ratio (MPI). Among the farmers who are non-members of farmers' groups, the headcount ratio is 0.570, which means 57% of the farmers who are non-members of farmers' groups in the study areas were far away from the poverty line. It also implies that; the poverty incidence is on average among the farmers who are non-members of farmers' groups. The average poverty gap ratio was 0.440, which means, that an average person who is a non-member of farmers' groups was poor in 44% of the indicators. This shows the intensity of poverty among the farmers who are non-members of farmers' groups. Also, the adjusted headcount ratio was 0.250, which means 25% of the farmers who are non-members of farmers' groups in the study experienced poverty in all indicators of the poverty dimension. One critical point of note from these findings is that the poverty among the non-member of farmers' groups is on the average rather than on the high side.

Table 14 also revealed the headcount ratio among the farmers who are members of farmers' groups. It reveals that 36% of the farmers who are members of farmers' groups in the study areas are far away from the poverty line. An average farmer who is a member of farmers' groups is poor in 40.5% of the indicators in the dimensions. 15% of the farmers who are members of farmers' groups experienced poverty in all indicators of poverty dimensions in the study areas. This is low when compared with the farmers who are non-members of farmers' groups. The poverty incidence is not high among the farmers who are members of farmers' groups in the study areas

Table 14: Multidimensional Poverty Index (MPI)

MPI	Membership of Social Groups	Non-Membership of Social Groups
Head Count	0.570	0.369
Average Gap	0.440	0.405
M ₀ Adjusted Headcount	0.250	0.150

Source: Field Survey 2021

Table 15 Determinants of Multidimensional Poverty among the respondents

Variables	Membership of Social Groups			Non-Membership of Social Groups		
	Co-Efficients	Standard Error	P-value	Co-efficients	Standard Error	P-value
Constant	1.077	0.757	5.376	-14.663	3.361	0.000
Age	4.306	1.857	0.053*	-0.022	0.048	0.054*
Gender	0.052	0.050	0.035**	-0.078	0.031	0.038**
Marital	1.03	0.757	0.037**	2.350	1.795	0.012**
Household size	-3.012	0.01	0.040**	0.591	0.271	0.029**
household income	-0.22	0.258	0.042**	-0.393	0.002	0.050*
Farming experience	0.026	0.199	0.104	-0.055	0.034	0.112
Access to credit	- 1.4	1.006	0.084*	-3.755	0.239	0.036**
Farm size	-0.03	0.033	0.070*	-0.392	0.856	-0.019**
Membership of Social Groups	-1.555	0.499	0.069*			
Education	-4.11	0.205	0.026**	-8.184	0.001	0.000***
Pseudo R ²	0.518			0.541		
Log Likelihood	52.096			38.946		

The age of the farmers has an inverse relationship with multidimensional poverty at a statistically significance level of 10%. The a priori expectation is that, if the coefficient of age is positive, that is, as age increases, the probability of experiencing multidimensional poverty increases. The study corroborated this expectation. The following explanatory variables are significant, gender, marital, household size, access to credit, farm size, education, and membership of farmers' groups. The farming experience has no significant relationship with multidimensional poverty among the respondents in the study areas.

The pseudo R^2 of the Membership of Social Groups parameters is 0.518. The implication of this is that the independent variables accounted for 51.8% variation in the dependent variable. And for the Non-Membership of Social Groups, the pseudo R^2 is 0.541, in other words, the independent variables accounted for 54.1% variation in the dependent variable.

The log-likelihood for Membership in Social Groups is 52.096. That is, there is a 52.01% likelihood that there would be an increase in poverty among the farmers due to unit changes in independent variables in the equation. The log-likelihood for Non-Membership of Social Groups is 38.946. That is, there is a 38.95% likelihood that there would be an increase in poverty among the farmers due to unit changes in independent variables in the equation.

Conclusion and Summary

Agricultural innovation can contribute to rural development through both direct and indirect effects. The relative importance of each of these will be largely determined by the speed with which households adopt new technologies relative to others, by the condition of the household as net food buyer or seller, by the degree of market liberalization that conditions whether the particular products is tradable or non-tradable, and by the institutions and incentives facing farmers' adoption of innovation. The direct effects of social capital are those benefits that are captured by the farmers who implemented the information learned during the process of interaction. The main form of direct effects is higher profits from agricultural production.

New technologies can improve a farmer's income when they reduce the marginal cost of producing one unit of output. Since for a time output prices will still be driven by the prevalent (old) technology, profits will increase for those farmers who adopt the new technology.

Household food security can be further enhanced through the empowerment of various farmers' groups by exposing them to training on improved farm practices, basic home economics, and effective food storage practices.

It is therefore recommended that:

1. The farmers should deepen their participation in social groups by forming and involving in partnerships and guidelines for designing self-driven poverty alleviation strategies.
2. Policymakers should lay more emphasis on empowering local farmers' groups.
3. Agricultural extension communication strategies by the government should employ more extension agents and also disseminate information on livelihood growth and diversification among the farmers. The extension agents should be able to offer economic advice to farmers to prevent them from falling deeper into poverty and facilitate the farmers' involvement in social groups.



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AUDITORS' CHARACTERISTICS AND TAX AGGRESSIVENESS OF LISTED SELECTED FAST-MOVING CONSUMER GOODS IN NIGERIA

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Abstract

The study investigated the effect of auditors' characteristics on tax aggressiveness among selected listed Fast Moving Consumer Goods Firms in Nigeria. An ex-post facto research design was adopted using a sample size of seven listed FMCG firms purposively. Data were extracted from the annual financial reports of the selected firms between the years 2013 and 2022. Audit fee, auditor's tenure, and auditor's type (Big 4 or Non-Big 4) were considered as auditors' characteristics while Effective Tax Rate (ETR) was adopted as a proxy for tax aggressiveness. Regression analysis was used to analyze data. The study found that audit fee and audit type had a positive significant effect on an effective tax rate ($\beta = 0.236$, $p < 0.05$) and ($\beta = 0.181$, $p < 0.05$) respectively. Audit tenure had a negative insignificant impact on the effective tax rate of selected firms ($\beta = -0.115$, $p > 0.05$). It was concluded that audit fees and auditor's type had an impact on the tax aggressiveness practices of FMCG firms in Nigeria. The study, therefore, recommended that management of the firms in FMCG should reduce audit fees and employ the service non-Big 4 audit firms to maximize the shareholders' wealth rather than involving in tax-aggressive practices which enriched audit firms.

Keywords: Audit fee, Auditor's Tenure, Audit type, and Tax Aggressiveness

1. Introduction

Public interest entities carried out legal operations or activities with the view of achieving their economic objective. The government imposed a tax on the economic benefits derived by firms from their various lawful economic activities. Tax is a type of cost imposed by the government on revenue-generating business units (Mahdi, Hossein, and Tahereh, 2019). Olaoye and Ekundayo (2019) viewed the tax as a compulsory deduction by the government for which gain is not received in return. The contributions to the nation's revenue common pulse by the registered companies do not attract identifiable benefits in returns. This made tax compliance to be low and tax payment made attractive to the taxpayers most especially the corporate entities (Anyaduba & Ogbeide, 2022). Anyaduba & Ogbeide (2022) opined that taxes paid by corporate entities have direct implications on their profit before tax. Tax decision solely lies on the agent (management) who engaged in the sporadic effort of minimizing the tax burden on the earnings of firms (Ogbeide, 2017).

Tax aggressiveness is described as a wide range of activities with the sole aim of reducing the total tax debt or tax liability (Martinez & Rodrigue, 2019). Anyaduba & Ogbeide and Ogbeide, (2017) viewed tax aggressiveness as a concept that encompasses all activities (legally or rationally) a firm engages in to optimize its tax burden. Tax aggressiveness can be used interchangeably with tax avoidance. Tax avoidance as a legal means of minimizing the tax burden leads to increased net cash flows which can be used to boost viable investment, settle financial obligations or earnings to the shareholders in the form of dividends (Anyadugba and Ogbeide (2022) and Jihene & Moez, 2019). Tax aggressiveness is a wide range of legal activities aimed at reducing the level of tax liabilities (Ariff and Hashin, (2014); Mahdi et al, (2010) and Anyaduba & Ogbeide, (20220). Management can use any tools whether financial or nonfinancial activities to minimize the tax burden of a firm.

There were limited studies on the behaviours of auditors towards tax aggressiveness. Mahdi et al, (2019) outlined two perspectives to tax aggressiveness. The study initially viewed that if firms are

trying to avoid the payment of extra taxes while within the armpits of law, they seek advice from tax consultants. The majority of companies received tax advice from their independent auditors. Auditors who are more versatile or have longer durations in clients' affairs can better provide advisory roles on tax-related matters. Auditors are likely to demand more fees from their clients. Auditors who are among the Big 4 in Nigeria may involve in tax advisory roles and charge high fees which may eventually lead to tax aggressiveness. Subsequently, the study established that tax aggressiveness might be the image emanating from the agency theory which portrays tax decisions based on the managers' interests (Mahdi et al, 2019). Tax aggressiveness is not a tax offense.

The previous had not established the impact of auditors' characteristics on tax avoidance of the listed firms in Nigeria. Onatuyeh and Ukolobi (2020) established that tax aggressiveness had a negative influence on audit fees. Audit fees had an indirect relationship with tax aggressiveness. This showed that companies that are willing to minimize their tax burden may appoint auditors that will charge high fees. Audit quality which is one of the characteristics of auditors was affirmed to have a positive and significant effect on tax aggressiveness. Ogbeide (2017) established that audit quality has a significant effect on tax aggressiveness. Anyaduba and Ogbeide (2022) used audit types using Big 4 audit firms as dummy variables. Previous works of literature had attempted to use audit fees and audit type as auditors' characteristics however works of literature had failed to view perspective auditors' tenure on tax aggressiveness. This remains a vacuum created by the existing works of literature.

1.2 Objective of the Study

In an attempt to fill the vacuum created by the previous studies, the study investigated the effect of auditors' characteristics on the tax aggressiveness of listed FMCG firms in Nigeria. Causal research was adopted using the quantitative data extracted from the financial reports of selected listed FMCG firms in Nigeria between the years 2013 and 2022. The following research objectives were investigated:

- Effect of audit fees on tax aggressiveness of listed selected FMCG firms in Nigeria.
- Impact of auditor's tenure on tax aggressiveness of listed selected FMCG firms in Nigeria.
- Effect of auditor's type on the tax aggressiveness of listed selected FMCG firms in Nigeria.

1.3 Statement of Hypotheses

H₀1: Auditor's fee has no significant impact on tax aggressiveness of listed Fast Moving Consumers Goods Firms in Nigeria

H₀2: Auditor's tenure has no significant impact on tax aggressiveness of listed Fast Moving Consumers Goods Firms in Nigeria

H₀3: Auditor's type has no significant impact on tax aggressiveness of listed Fast Moving Consumers Goods Firms in Nigeria

2.1. Concept of Tax Aggressiveness

Consensus was not reached among the previous authors as regards the definition of tax aggressiveness. Tax aggressiveness had been used in previous studies to mean tax planning, tax strategy, and tax avoidance (Anyaduba & Ogbeide, 2022; Onatuyeh & Ukolobi, 2020; Mahdi et al, 2019 and Ogbeide, 2017). Hanlon and Heitzman (2010) pinpointed that tax avoidance is likened to a spectrum of tax planning strategies with legal tax avoidance such as investment in bonds at one end and tax noncompliance, tax evasion, tax aggressiveness, and more generally illegal tax avoidance at the other end. Tax aggressiveness can be defined as a concept that encompasses all activities (either legally or rationally) a firm engages in to optimize its tax burden (Anyaduba & Ogbeide, 2022). Onatuyeh & Ukolobi (2020) viewed tax-aggressive actions are viewed as a veritable investment for firms and shareholders as they can be used to reduce tax liabilities and improve revenue. Mahdi et al, (2019) described tax avoidance as a legal measure to reduce tax liabilities. The purpose of tax avoidance is to minimize tax liabilities. This study affirmed that tax aggressiveness can be used interchangeably with tax planning or tax avoidance.

2.2. Auditors Characteristics

The auditor's characteristics can be used interchangeably with the audit's quality. Ozegbe & Jeroh (2022) defined audit quality as the ability of an auditor to detect and eradicate earnings manipulations and window-dressed indicators in the financial statements of companies. The auditor's characteristics could be evaluated through qualities exhibited which were able to detect financial inadequacies in the financial statement of clients. (Tanko & Polycarp, 2019&Jeroh, Ekwueme & Okoro, 2015). There are many indicators of auditors' characteristics which are independence, audit fees, audit tenure, audit firm size, and auditor's tenure. For this study, audit fees, auditor's tenure, and auditor's type are considered as variables to be regressed against tax aggressiveness.

2.3. Audit Fees

Past studies have examined the link between tax aggressiveness and corporate governance. However, there was little literature on external audit fees and tax aggressiveness relationships. The few related studies include corporate governance, tax aggressiveness and earnings management (Putric, Adam & Fuadah, 2018), tax avoidance, corporate governance and firm value (Yee, Sapiei, & Abdullah, 2018), and tax planning, corporate governance and equity value (Abdul Wahab, & Holland, 2012). Nonetheless, the only research study that has attempted a blend of tax aggressiveness, corporate governance, and audit fees was performed by Martiner and Lessa (2014). Onatuyeh & Ukolobi (2020) described audit fees as the cost of conducting an audit to express an opinion thereon about the conformity of financial statements with generally accepted accounting principles. Dinh (2012) opined that the request for audit engagement is made by users, such as primary investors, prospective investors, the government, and the public. However, users of audit services hardly have similar goals because they do not have the same interest. For instance, management will be interested in reporting higher revenue to get higher bonuses and keep their positions. On the other hand, prospective investors will be interested in knowing whether the firm is profitable or not so that they can make informed investment decisions.

Generally, audit fee figures are usually transformed into natural logarithms to control for the skewed nature of the figure and make results uniform (Martinez & Lessa, 2014). Prior studies on audit fees outlined various perspectives on audit fees. Firstly, The client- related perspective includes audit client size, audit client complexity, profitability, and industry of operation (Boo & Sharma, 2008 Zaman, Hudaib, & Haniffa, 2011). The auditor-related perspective includes audit firm size, and audit firm tenure (Onatuyeh & Ukolobi, 2020; Urhoghide & Emeni 2014). However, a different stream of studies continues to discuss other drivers of audit fees, such as earnings management (Martinez, & Jesus-Moraes, 2017), tax aggressiveness (Donohoe & Knechel, 2014; Hanlon, Krishnan & Mills, 2012; Saremi, Mohammadi & Nezhad, 2016), and corporate governance mechanisms (Boo & Sharma, 2008; Boussaidi & Hamed, 2015; Urhoghide & Emeni, 2014). This study, therefore, focused on the effect of tax aggressiveness on audit fees of listed Fast Moving Consumer Goods in Nigeria.

2.4. Auditor's Tenure

Ozegbe and Jeroh (2022) described audit tenure as the entire period of the auditor-client relationship. The longer the duration of the auditor-client relationship the more the auditor's objectivity would be compromised, resulting in the investigator's lack of attentiveness. Capkun, Collins & Jeanjean, (2016) opined that aside from the threat to independence, the audit appointment may become normal over time, and if this occurs, the auditor will spend less time detecting internal control flaws and risk sources. Implicitly, the refusal of the audit firm to disclose acts of misreporting by Tesco resulted from the long-standing ties between the auditors and the company's management as a link that had a negative and consequential effect on the auditor's independence.

Audit tenure has attracted a good number of researchers in accounting, we notice that emphasis has been on how tenure affects the objectiveness and outcomes of audit exercise –independence and quality respectively (Ozegbe and Jeroh,2022; Martani, Rahman, Fitriany & Anggraita 2021; Buntara & Adhariani, 2019; Kyriakou & Dimitras, 2018). However, the previous studies had not been exploited on the effect of audit tenure on tax aggressiveness practices except the study of Mahdi et al (2020) which established that audit tenure had a positive significant effect on tax avoidance of Iranian Companies. Jeong & Bae (2013) found that corporate tax avoidance increased with auditor tenure showing the client-beneficial tax arrangement, which minimized tax payments that could be more offered when the auditor's tenure is elongated. Previous studies in Nigeria on tax aggressiveness like Anyaduba & Ogebeide, 2022; Olori & Olufemi, 2022) & Ogebeide, 2017) failed to considered the impact of the auditor's tenure on the tax aggressiveness. This study extended the frontline of the study of Mahdi et al, (2020) in Iran in Nigeria and investigated the effect of audit tenure on tax aggressiveness of Fast-Moving Consumer Goods Firms in Nigeria.

2.5. Auditor's Types

Ozegbe & Jeroh (2022) described an audit firm as a professional organization set up to uphold high-quality reporting among public-interest entities. Previous researches suggested that the size of audit firms have been used as proxy for audit quality given that largeraudit firms are known with areputation of upholding and guaranteeing impartial and high-quality audit services(Ayora & Ogeto, 2022). In comparison to smaller audit firms, the financial resources of large audit firms alongside their research facilities, technologies, and ability to attract talented workforce provides a platform for them to have larger client base and higher capacity to resist management pressure; thereby reducing their overall dependency level on a single or group of clients when necessary. This is not the case for smaller audit (often referred to as non-big 4) firms whose focus is to offer more individualized services due to their smaller client bases which may compel them to give in to management demands where situations abound (Chen, Cheng & Liu, 2021 and Sawan & Alsaqqa, 2013;). Previous studies focused on the impact of audit firm sizes on financial performance of firms in Nigeria (Ayora & Ogeto, 2022 and Ozegbe & Jeroh, 2022). There is little or no research on the effect of auditor's type on tax aggressiveness in Nigeria except Anyaduba& Ogebeide (2022) which used audit type using audit firm categorized as BIG 4 or Non Big4 in Nigeria as a measure of firm size. The study used the BIG 4 as a control variable. However, Madhi et al, (2020) opined that the auditors who are more experienced can better provide advisory roles on tax related matters. In order to extend the study of Madhi et al, (2020), this study also focused on the effect of auditor type (using the BIG 4 auditors) on tax aggressiveness of listed FMCG firms in Nigeria

2.6. Theoretical Framework

This study hinged on agency theory. This was adopted in explaining the effect of audit characteristics on tax aggressiveness of Fast-Moving Consumer Goods in Nigeria. Olufemi & Olori (2022) suggested that tax aggressiveness was a tripartite relationship involving the investors, managers, and the government. Therefore, there was bound to be a conflict of interest between those three parties. According to the agency view of tax avoidance, conflicts between a firm's owners and its management may arise because managers who are generally expected to make tax-effective decisions may behave opportunistically and divert corporate wealth for their private benefit (Jensen & Meckling, 1976). On the other hand, the agency theory is equally relevant to the study because, in the first place, the opportunity for management to engage in tax planning activities on behalf of the shareholders (business owners) is embedded in the concept of the agency relationship. Thus, based on the agency-view of tax avoidance, conflicts between a firm's owners and its management may arise. After all, managers who are generally expected to make tax-effective decisions may behave opportunistically and divert corporate wealth for their private benefit. The conjecturing of the framework of the study's analysis is that the degree of tax management may likely be influenced by

the size of the firm, profitability level, the size of institutional investors, and other firm-specific characteristics. Tax aggressiveness may potentially reduce the after-tax value of the firm since the combined costs of a company include costs directly related to tax planning activities, additional compliance costs, and non-tax costs; for example, agency costs may surpass the tax benefits for shareholders (Wang, 2012). The agency theory is equally relevant to the study because, in the first place, the opportunity for management to engage in tax planning activities on behalf of the shareholders (business owners) is embedded in the concept of the agency relationship. Thus, based on the agency-view of tax avoidance, conflicts between a firm's owners and its management may arise. After all, managers who are generally expected to make tax-effective decisions may behave opportunistically and divert corporate wealth for their private benefit.

2.7. Empirical Review

Madhi et al, (2020) examined the effect of auditor's characteristics on the tax avoidance of Iranian Companies. The study used 91 listed firms in the Tehran Stock Exchange covering the period of 6 years from 2011 to 2016. Descriptive statistics, the Variation Inflation Factor, and the F-Limer test were used to analyze the panel data. The study showed a significant relationship between the type of audit opinion, audit fees, and tax avoidance. Abdulkadir & Issa (2020) established a significant and positive relationship between tax aggressiveness and leverage. Efuntade & Akinola (2020) established a significant relationship between firm size and Return on assets. Madugba et al, (2020) affirmed that the Effective Tax Rate had a negative and insignificant effect on firm size.

Onatuyeh & Ukolobi (2020) studied the relationship between tax aggressiveness, corporate governance, and audit fees. 107 firms listed firms were sampled at the Nigeria Stock Exchange. Secondary data were extracted from the annual financial reports of the selected firms between 2009 and 2018. Panel regression technique with a preference for the random effect model based on the outcome Hausman test. The results revealed that cash tax rate, audit committee diligence, and board independence have positive and significant effects on audit fees.

Olufemi & Olori (2022) examined the influence of firm complexity on the tax aggressiveness of listed Deposit Money Banks in Nigeria and South Africa. The longitudinal research design was used with a cross-sectional approach from both Nigeria and South Africa. 13 listed Deposit Money Banks from both Nigeria Stock Exchange and Johannesburg Stock Exchange were sampled. Data were extracted from the annual financial report of the selected listed banks for 9 years period of 2012 to 2020. The panel data were analyzed using descriptive statistics, correlation, and regression analysis techniques. The outcome of the Nigeria model showed that firm complexity asserted a significant negative impact on tax aggressiveness in Nigeria while in South Africa, firm complexity has an insignificant negative impact on tax aggressiveness.

Anyaduba & Ogbeide (2022) investigated the relationship between firm attributes and tax aggressiveness in Nigeria and South Africa. A longitudinal research design was adopted with bias on the comparative analysis approach. Variables such as firm size, age, profitability, leverage, liquidity, complexity, foreign ownership, and tax aggressiveness. The study covered the period from 2012 to 2020. Data were extracted from the annual financial statements of the selected banks from both Nigeria and South Africa. Data were analyzed using multiple regression analysis and it was established that firm size had a positive and significant relationship with the tax aggressiveness of banks in both Nigeria and South Africa.

3. Methodology

The work used an ex-post facto research design using secondary data extracted from the annual financial reports of the selected listed Fast Moving Consumers Goods in Nigeria between 2013 and 2022. Seven listed FMCGs were selected purposively from the 22 listed FMCG firms in Nigeria as of 31st December 2022. These are PZ Nigeria Plc, Cadbury Nigeria Plc, Unilever Nigeria Plc, Honeywell Flour Mill, Dangote Flour Mill, Union Dicon Nigeria Plc, and Nigeria Breweries Plc. The choice of the sample size was based on the availability of the annual reports of the companies as of 31st May 2023. The study used descriptive statistics, correlation, and regression analysis as the data analysis methods.

Model Specification

Tax Aggressiveness is $f(\text{Auditors' Characteristics})$

Thus operationalized as follow:

$$ETR = \beta_0 + \beta_1 (Af)_{it} + \beta_2 (At)_{it} + \beta_3 (Aty)_{it} + \beta_4 (Fs)_{it} + \text{uit} \dots \dots \dots (i)$$

$$ETR = \beta_0 + \beta_1 (Af)_{it} + U_{it} \dots \dots \dots (ii)$$

$$ETR = \beta_0 + \beta_2 (At)_{it} + U_{it} \dots \dots \dots (iii)$$

$$ETR = \beta_0 + \beta_3 (Aty)_{it} + U_{it} \dots \dots \dots (iv)$$

Effective Tax Rate is a proxy for tax aggressiveness

β_0 = intercept or fixed variable

Af= Audit Fee

At= Auditors' tenure

Aty = Auditors' types

FS = Firm Size as the control variable

$\beta_1, \beta_2, \beta_3, \beta_4$ are coefficient of the independent variables\

Apriori Expectation: $\beta_1, \beta_2, \beta_3, \beta_4 < 1$

Variable Measurement

Variables	Acronyms	Class	Measurement of Variables	Sources
Tax Aggressiveness	ETR	Dependent Variable		Ayanduba & Ogbeide (2022); Mahdi et al, (2020)
Audit fees	AF	Independent Variable	Natural log of Audit fees	Mahdi et al, (2020); Onatuyeh & Ukolobi (2020)
Auditors' Tenure	AT	Independent Variable	Natural Log of Auditor's Tenure	Nil
Auditors' Type	Aty	Independent Variable	If among BIG 4 allocate 1 otherwise 0.	Ayanduba & Ogbeide (2022); Ogbeide (2017)
Firm Size	FS	Control variable	Natural log of Total Assets	

Source: Study Compilation, (2023)

4. Results and Discussions

Descriptive Statistics

	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Dev. Statistic	Skewness Statistic	S E	Kurtosis Statistic	S. E
ETR	-0.7456	0.8875	0.2104	0.2411	-0.8710	.287	3.881	.566
Audit fee	1500.0000	92769.0000	30761.8000	21006.1521	0.9550	.287	1.131	.566
A.Tenure	1.0000	13.0000	6.000000	3.3362	0.1810	.287	-1.048	.566
A's Type	0.0000	1.0000	0.714286	0.45501	-0.970-	.287	-1.092	.566
LogTA	4.7581	8.7933	7.5876	1.1204	-1.6950	.287	1.626	.566
Valid N								

The Table above showed the descriptive statistical results of all variables considered in the study. The effective tax rate mean is 0.2104 (21.04%) with a maximum value of 0.8875 and a minimum value of -0.7456. The ETR figure is below the statutory tax rate of 30% as stipulated by the Nigerian government. The result showed that the sampled listed Fast Moving Consumer Goods firms were tax aggressive in the periods between 2013 and 2022. The standard deviation of 0.2411 (24%) for ETR

connoted the risk related to tax aggressive strategy which may likely include: penalties imposed by tax authorities after a tax audit and/or a decrease in market value of firms after cases of tax offenses. The mean audit fee is N30.7618 million with a maximum value of N92.769 million and a minimum value of N1.5 million respectively. This indicated that FMCG goods paid high audit fees to minimize tax liabilities. The average audit tenure is 6 years with a maximum auditor-client relationship of 13 years and a minimum relationship of 1 year. This indicated that the longer the auditor's tenure the more the client engaged in tax-aggressive practice. Audit type had a mean of 0.7143 with a maximum value of 1 and minimum value of 0. This indicated that the majority of the firms sampled were audited by independent auditors within the cycle of Big4 in Nigeria. Firm size measured by the natural logarithm of total assets has a mean of 7.5876 representing about N7.5876 billion, with a standard deviation of 1.1204. Firm Size for the period ranged from a minimum value of 4.7581 (approximately N5 billion) to a maximum value of 8.7933 (approximately N9 billion), this showed broad variation among the sampled firms in terms of sizes.

Correlation Result

Correlations Matrix

	ETR	A.Fee	LogA.Ten	Auditor's Type	LogTA
ETR	1.000				
A. Fee	.463**	1.000			
A.Tenure	-.208	-.057	1.000		
A. Type	.410**	.739**	.035	1.000	
LogTA	.417**	.713**	-.037	.371**	1.000

** . Correlation is significant at the 0.01 level (2-tailed).

The above table showed the Spearman rank correlation table. The correlation low value in the correlation coefficient showed that there is an absence of multi-collinearity. Audit fees had a positive and significant association with the effective tax rate. This indicated that as audit fees increased, the effective rate also increased. The high audit fee paid is an indicator of tax aggressiveness. Audit tenure had a negative association with ETR. As audit tenure increase ETR decreases. This indicated that audit tenure or auditor-client relationship has an inverse relationship with tax aggressiveness of selected FMCG firms under review. Audit type has a positive and significant relationship with ETR. As Big4 firms are engaged the more tax-aggressive practices among FMCG firms in Nigeria. Firm Size had a positive and significant association with ETR. This indicated that larger firms are more likely to be involved tax aggressive practices than small firms.

Regression Analysis

Effect of Auditors' Characteristics on Tax Aggressiveness of Fast-Moving Consumer Goods Firms in Nigeria

Model Summary

Model	R	R Squared	Adjusted R Squared	Std. The error in the Estimate
1	.466 ^a	.218	.169	.2197190

a. Predictors: (Constant), LogTA, LogA.Tenure, Auditor's Type, Log Audit Fee

The above table showed the model summary of the model formulated in this study. The table showed the adjusted R² of 16.9% which means that all independent variables such as Audit fees, Auditor's tenure, Audit type, and Firm size could explain about 16.9% of the dependent variable proxy as Effective Tax Rate. Other variables which were not considered in this study constituted about 83.1%.



ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	.873	4	.218	4.520	.003 ^b
1	Residual	3.138	65	.048		
	Total	4.011	69			

a. Dependent Variable: ETR

b. Predictors: (Constant), LogTA, LogA.Tenr, Auditor's Type, LogA.Fee

The above table showed the analysis of variance. The result indicated that all variables considered in the study were statistically significant. Therefore, the model statistically satisfied the test of Goodness fit.

Test of Hypothesis One: Auditor's fee has no significant impact on tax aggressiveness of listed Fast Moving Consumers Goods Firms in Nigeria

The study separately regressed the independent variable individually with the dependent variable (ETR).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.459 ^a	.211	.199	.2157430

a. Predictors: (Constant), Log Audit Fee

The Table above showed the model of audit fee regressed against the Effective Tax Rate (proxy as tax aggressiveness). The adjusted R2 showed a result of 19.9% which indicated that the Audit fee could explain about 19.9% of the Effective Tax Rate. This means that clients who paid high audit fees to independent auditors tend to engage in tax-aggressive practices. Other variables that can explain the effective tax rate constituted about 80.1%.

The table above showed the coefficient of the independent variable. Audit fees had a positive and significant effect on the effect tax rate. This means that high audit fees could trigger tax-aggressive practices among the Fast-Moving Consumer Goods Firms in Nigeria.

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	.846	1	.846	18.170	.000 ^b
1	Residual	3.165	68	.047		
	Total	4.011	69			

a. Dependent Variable: ETR

b. Predictors: (Constant), LogA.Fee

The Table above shows the analysis of the variance which exist between audit fee and Effective tax rate. The Fstatisti of 18.17 with a p-value less than 0.05 indicated that audit fees are statistically significant in influencing the effective tax rate. Since the p-value is less than 0.05, Ho is declined while Hi is upheld. It is therefore concluded that Audit fees had a significant effect on the Tax aggressiveness of listed Fast Moving Consumer Goods Firms in Nigeria. This was consistent with the study of Onatuyeh & Ukolobi (2020) and Mahdi et al, (2020). FMCG indulged in tax aggressiveness practices by engaging the service of independent auditors with high audit fees. Existing works of literature had not been proved contrarily.

Test of Hypothesis Two: Auditor's tenure has no significant impact on tax aggressiveness of listed Fast Moving Consumers Goods Firms in Nigeria

Model Summary				
Model	R	R Squared	Adjusted R Square	Std. Error of the Estimate
1	.150 ^a	.022	.008	.2401253

a. Predictors: (Constant), LogA.Tenr

The Table above shows the adjusted R2 of 0.008 which means that Auditor tenure explained about 0.8% of the dependent variable (ETR). Other variables not captured constituted about 97.8%. This indicated that the model does not satisfy the test of goodness fit. The model is not realistic in predicting the tax aggressiveness of the FMCG firms in Nigeria.

Coefficients^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.290	.070		4.160	.000
	LogA.Tenr	-.115	.092	-.150	-1.249	.216

a. Dependent Variable: ETR

The coefficient table above showed the influence of Audit tenure on the Effective Tax rate. Auditor's tenure had a negative insignificant influence on Effective Tax Rate $\beta = -0.115$ p-value greater than 0.05. This indicated the long duration of auditors does not affect tax aggressiveness practices.

ANOVA^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.873	4	.218	4.520	.003 ^b
	Residual	3.138	65	.048		
	Total	4.011	69			

a. Dependent Variable: ETR

b. Predictors: (Constant), LogTA, LogA.Tenr, Auditor's Type, LogA.Fee

The table above showed the analysis of variance. The F statistic = 1.559 with a p-value greater than 0.05. H0 which proposed that Auditor's tenure has no significant effect on tax aggressiveness is upheld the Hi is declined. It is therefore concluded that Auditor's tenure does not influence tax aggressiveness practices of FMCG firms in Nigeria. Existing works of literature have not established the relationship between an auditor's tenure and tax aggressiveness. However, this study was able to establish that long durations of auditors do not affect tax aggressiveness practices of listed Fast Moving Consumer Goods Firms in Nigeria

Test of Hypothesis Three: Auditor's type has no significant impact on tax aggressiveness of listed Fast Moving Consumers Goods Firms in Nigeria

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.341 ^a	.116	.103	.2283205

a. Predictors: (Constant), Auditor's Type

The model summary table above showed an Adjusted R² of 10.3%. This indicated that the auditor's type or Auditor's size could explain about 10.3% of the effective tax rate. Other variables constituted about 89.7%. Therefore, the model does not satisfy the test of goodness fit.

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Std. Error			
1	(Constant)	.081		1.595	.115
	Auditor's Type	.181	.060	.341	.004

a. Dependent Variable: ETR

The coefficient table above showed the influence of Audit tenure on the Effective Tax rate. Auditor's tenure had a negative insignificant influence on Effective Tax Rate $\beta = -0.115$ p-value greater than 0.05. This indicated the long duration of auditors does not affect tax aggressiveness practices.

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.466	1	.466	8.938	.004 ^b
	Residual	3.545	68	.052		
	Total	4.011	69			

a. Dependent Variable: ETR

b. Predictors: (Constant), Auditor's Type

The Table above shows the analysis of variance. The F statistic = 8.938 with a p-value greater than 0.05. H₀ which proposed that Auditor's tenure has no significant effect on tax aggressiveness is rejected the H₁ is upheld. It is therefore concluded that Auditor's type has an impact on the tax aggressiveness practices of FMCG firms in Nigeria. This agreed with the finding of Olufemi & Olori (2022). Anyaduba & Ogbeide (2022) only used the audit type proxy as Big4 or non-Big4 audit firms as control variables. No existing works of literature had proved otherwise. FMCG firms that engaged the service of Big4 audit firms tend to involve in tax aggressive strategy than those that employed the service of Non-Big4 firms in Nigeria.

4. Conclusion and Recommendations

The study investigated the effect of auditors' characteristics on tax aggressiveness practices among selected Fast-Moving Consumer Goods Firms in Nigeria between the years 2013 and 2022. The auditor's characteristics such as audit fee, auditor's tenure, and auditor's type (Big 4 or Non-Big 4) were adopted and regressed with Effective Tax Rate proxy as tax aggressiveness. Many firms which engaged services of Big4 audit firms are paid high audit fees which serve tax-deductible expenses which reduce the tax liabilities. Big 4 audit firms are opined to have the expertise and may be willing to offer tax advisory roles to the clients. Many audit firms had a duration of more than one year with their clients. Audit firms which have longer duration will be prone to advise clients on tax-related matters. It could be concluded that auditors' characteristics generally influence the tax aggressiveness strategy of Fast-Moving Consumer Goods firms in Nigeria

It is, therefore, recommended that the management of Fast-Moving Consumer Goods Firms desist from involvement in tax aggressive strategy to reduce the cost incurred in audits. The audit fees incurred in engaging the services of Big4 audit firms will erode the profitability of the firms involved.

The firms in FMCG should adopt auditor rotations. The audit firm should state longer than 5 years in clients' services and this is in line with the provision Sarbanes Oxley Act, 2002, and the Code of Corporate Governance for the Private Sector in Nigeria. Service of non-Big 4 audit firms can be encouraged to minimize the cost of audit and earnings for the shareholders.

Suggestion for Further Studies

Many works of literature had exploited tax aggressiveness in different dimensions. The study suggested further studies on the subject matter with bias on post and pre-IFRS adoption. Sectorial Comparative Analysis or investigation can also be embarked on the effect of audit characteristics on tax aggressiveness.

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BANK CREDIT ACCESS AND ITS IMPACT ON AGRICULTURAL PRODUCTIVITY IN NIGERIA

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Abstract

Bank credit access is a prominent factor affecting the performance of the agricultural sector. Hence, the performance of the agricultural sector in Nigeria largely depends on the provision of affordable credit services to both the rural and urban populations engaged in the agricultural sector. Several policies have been made to solve these problems in which the banks have been targeted to provide pivotal roles in the area of funding through the provision of credits. Hence, the main objective of this study is to examine the relationship between deposit money bank (DMB) credit, interest rate, and agricultural productivity in Nigeria. This study used the auto-regressive distributive lag (ARDL) model and bounds test with the aid of Eviews software to estimate the dynamic, short, and long-run relationship among the variables. The time series data are extracted from the CBN Annual and Quarterly Reports, the CBN Statistical Bulletin, and World Development Indicator (online). These data include the banks' credit to the agricultural sector, interest rates, and agricultural GDP. Some information was also retrieved from the websites. The result of the bounds test revealed that bank credit contributed to a 65% increase in agricultural productivity in Nigeria. This study, therefore, recommended a low bank interest rate to give room for better agricultural productivity.

Keywords: Bank credit, Agricultural productivity

Introduction

A major way of achieving a reduction in poverty and alleviating the poor welfare situation of the populace is to increase agricultural productivity. This will, at the micro level, translate to an increase in farm income, food security, poverty reduction, and improved rural household welfare.

Agriculture happened to be the primary foreign exchange earner for Nigeria till the mid-70s but the focus is now on the mineral sector. Inadequate capital is considered the single most important factor affecting the performance of the agricultural sector. Hence, the performance of the agricultural sector in Nigeria largely depends on the provision of affordable financial services to both the Rural and Urban populations engaged in the Agricultural sector.

Deposit Money Banks are the major sources of financial services in the form of loans and advances and that is why Deposit Money banks in Nigeria have been directed to devote a major part of their funding to finance this sector, besides other government-owned banks like the Nigerian Agricultural and Cooperative Bank (NACB) (Sunny, 2013).

Till this moment, the kind of relationship between the banking sector and the agricultural sector in Nigeria is still debatable. It is therefore pertinent to examine the impact of Deposit money banks' credit on agricultural productivity.

Presently in Nigeria with her vast expanse of rich soil, a sizable number of her citizens suffer from hunger and starvation as a result of neglect of agriculture. Few agro-industries around depend greatly on the importation of necessary raw materials in their production and many of the Nigerian youths roam about unemployed. It is of note that various policies have been made to solve these problems in



which the banks have been targeted to provide pivotal roles in the area of funding through the provision of credits. However, the fact remains that the banks precisely the commercial banks have not come to grapple with the problem as much has not been felt in the area of credits to agriculture.

Agriculture which used to be the only source of food to the teeming population and the major foreign exchange earner in Nigeria as well as the provision of employment before the discovery of oil has not been performing well in recent years, its contribution to GDP has been falling, the nation is depending on other countries for food while agro-allied industries available in the country depend greatly on imported raw materials. It has been envisaged that lack of finance could be one of the major problems facing the sector.

The main objective of this study is to examine the relationship between deposit money bank (DMB) credit, interest rate, and agricultural productivity in Nigeria. The specific objectives are:

- To examine the impact of Deposit Money Bank's Credit on Agricultural Output in Nigeria
- To examine the effect of interest rates on Agricultural Output in Nigeria

Literature review

According to Reis (2016), the gross domestic product of a nation's agriculture is the summation of the yearly output of its components. According to him, the output consists mainly of wheat, maize, rye, millet and barley, animal products, wine, and olive oil. Gross farm output value has also been described by the Department of Agriculture, Forestry and Fisheries (DAFF) as the sum of all the values of farm enterprises, which include crops and livestock enterprises plus sundry farm income.

Kareem, Osisanya, and Isiaq (2017), examined the effect of deposit money bank financing on agricultural sector output in Nigeria, covering the period 1981 to 2014 by using the Ordinary Least Square method. The study revealed that 99.6% of the variation in the real agricultural gross domestic product is explained by commercial banks' loans to agriculture. Ayegba and Ikani (2013), investigated the impact of agricultural credit on rural farmers in Nigeria by using a simple percentage to interpret the result. The study revealed that private money lenders constitute the major source of credit.

Dori (2016), used descriptive statistics and content analysis to examine the impact of agricultural credit guarantee scheme funds on the agricultural and economic development of Nigeria. By using the secondary data to analyze, the result revealed that in Nigeria the scheme had increased the flow of credit to the farmers and has expanded the beneficiaries' acquisition and adoption of modern farming inputs, output, earnings, and finally standard of living.

The study of Friday, Chris, and Fredrick (2016) employed Vector Autoregressive (VAR) approach to examine the impact of credit supply and various deposit money bank loan schemes on agricultural sector production in Nigeria. The study which covered the period 1981 to 2013 revealed that ACGSF performed poorly in explaining agriculture sector performance, while deposit money bank loans to agriculture had a significant impact on agricultural production in Nigeria.

The outcome of the related research study remains debatable which calls for further investigation. This study will therefore investigate the ease of accessing deposit money banks credits and its impact on agricultural output in Nigeria for the period 1991 – 2021.

The finance growth hypothesis postulated the supply-leading relationship between financial and economic development. It argued that the existence of the financial sector, as well-functioning financial intermediations in channeling the limited resources from surplus spending units to deficit spending units would provide efficient allocation of resources thereby leading the other economic

sectors in their growth process (Schumpeter work cited in Papka, Innocent, and Enam 2019). This research work will anchor on both the finance-led growth theory and the Balance Sheet Credit channel theory since the study is looking at the impact of commercial banks' credit on agricultural output in Nigeria.

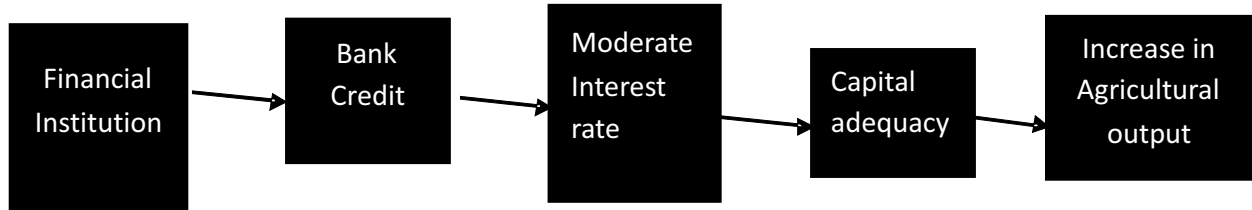


Fig 1: Theoretical framework adapted from Schumpeter theory
Source: Researcher's computation (2023)

Viable financial institutions will serve as a fountain of credit to borrowers (farmers) at moderate interest rates. This will enable capital adequacy in the agricultural sector and ultimately boost agricultural productivity.

Methodology

The research is on the impact of deposit money banks' credit on agricultural output in Nigeria (1991-2021). The work is to find out how to deposit money banks credit on agricultural output in Nigeria. The time series data are extracted from the CBN Annual and Quarterly Reports, the CBN Statistical Bulletin, and World Development Indicator (online). These data include the banks' credit to the agricultural sector, interest rates, and agricultural GDP. Some information was also retrieved from the websites.

This study used auto regressive distributive lag (ARDL) model and bounds test with the aid of Eviews software to estimate the dynamic, short and long run relationship among the variables,

From the variables extracted, the mathematical model can be specified as:

$$AGGDP = f(BCRD, INT) \text{ -----(1)}$$

This can be written econometrically as:

$$AGGDP_{i,t} = \beta_0 + \beta_1 BCRD + \beta_2 INT + U_{it} \text{ ----- (2)}$$

When logarithm is applied it becomes:

$$LAGGDP_{i,t} = \beta_0 + \beta_1 LBCRD + \beta_2 LINT + U_{it} \text{ ----- (3) where:}$$

AGGDP = GDP of Agriculture that proxy Agricultural productivity

BCRD = Bank credit

INT = Interest rate

L = logarithm

β_0 = Intercept

β_1, β_2 = coefficients of the independent variables

The major innovation is the comparative trend analysis of agricultural financing during the military and democratic era which previous related studies have not been focused upon. To what extent were the banking policies used by various regimes promote agricultural output? The inclusion of government policy as a variable in the model has not been captured by any previous related research. Also, the study coverage period of research (1991 – 2021) shows the inclusion of current data which either serves as an update to related studies or exposes the current influence of global financial and economic crises which has never been investigated.

Results

Stationary tests were conducted on all the variables. All were stationary at the first difference I(1) except the interest rate which is stationary at level I(0).

Table1

ARDL Error Correction Regression
 Dependent Variable: D(LAGGDP)
 Selected Model: ARDL (4, 1, 3)
 Case 2: Restricted Constant and No Trend
 Date: 05/28/23 Time: 11:31
 Sample: 1991 2021
 Included observations: 27

ECM Regression
 Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LAGGDP(-1))	0.339824	0.109722	3.097149	0.0069
D(LAGGDP(-2))	-0.197174	0.120981	-1.629790	0.1227
D(LAGGDP(-3))	-0.397491	0.110926	-3.583374	0.0025
D(LBCRD)	-0.063410	0.088226	-0.718721	0.4827
D(INT)	0.008875	0.006616	1.341487	0.1985
D(INT(-1))	-0.067686	0.010539	-6.422269	0.0000
D(INT(-2))	-0.033793	0.005707	-5.921775	0.0000
CointEq(-1)*	-0.389232	0.052090	-7.472294	0.0000
R-squared	0.839596	Mean dependent var		0.167642
Adjusted R-squared	0.780499	S.D. dependent var		0.157490
S.E. of regression	0.073785	Akaike info criterion		-2.134120
Sum squared resid	0.103441	Schwarz criterion		-1.750168
Log-likelihood	36.81062	Hannan-Quinn critter.		-2.019951
Durbin-Watson stat	2.478774			

* p-value incompatible with t-Bounds distribution.

In Table 1 above, CointEq(-1)* represents the lagged error correction term. The coefficient is -0.389232 and the t-statistic is -7.472294 which is statistically significant with the p-value of 0.0000. This means the speed of adjustment back to equilibrium is 38.9%. It also confirms a long-run relationship existence among the variables.

Table 2

ARDL Long Run Form and Bounds Test

Dependent Variable: D(LAGGDP)

Selected Model: ARDL(4, 1, 3)

Case 2: Restricted Constant and No Trend

Date: 05/28/23 Time: 11:43

Sample: 1991 2021

Included observations: 27

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.452996	0.471151	0.961467	0.3506
LAGGDP(-1)*	-0.389232	0.109771	-3.545863	0.0027
LBCRD(-1)	0.269080	0.086340	3.116512	0.0066
INT(-1)	0.060722	0.015030	4.040159	0.0009
D(LAGGDP(-1))	0.339824	0.136402	2.491334	0.0241
D(LAGGDP(-2))	-0.197174	0.137868	-1.430163	0.1719
D(LAGGDP(-3))	-0.397491	0.152641	-2.604087	0.0192
D(LBCRD)	-0.063410	0.130606	-0.485507	0.6339
D(INT)	0.008875	0.008837	1.004268	0.3302
D(INT(-1))	-0.067686	0.012948	-5.227354	0.0001
D(INT(-2))	-0.033793	0.006863	-4.923770	0.0002

* p-value incompatible with t-Bounds distribution.

Levels Equation

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LBCRD	0.691309	0.053179	12.99959	0.0000
INT	0.156004	0.059920	2.603552	0.0192
C	1.163820	1.028642	1.131414	0.2746

$$EC = LAGGDP - (0.6913*LBCRD + 0.1560*INT + 1.1638)$$

F-Bounds Test Null Hypothesis: No levels of relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	11.75478	10%	2.63	3.35

Asymptotic:
n=1000

In Table 2 above, the result of the ARDL shows that bank credit has about a 69% effect on agricultural productivity while interest rate has a 15.6% effect on agricultural productivity. Both effects are statistically significant with their p-value less than 0.05.

The result of the Bounds test gave the Test statistic with a value of 11.75478 greater than the critical values 3.35, 3.87, 4.38, and 5 at 10%, 5%, 2.5% and 1% significance level respectively. This is evidence of the existence of both short and long-run relationships between Bank credits, interest rates, and agricultural productivity.

N-STEP STABILITY TEST

The result of the N-STEP recursive test shows that Fig. 1 below revealed that the N-step probability plot does not cross the 5% critical lines. This connotes that the estimated coefficients are relatively stable. This validated the strong reliability of the data used.

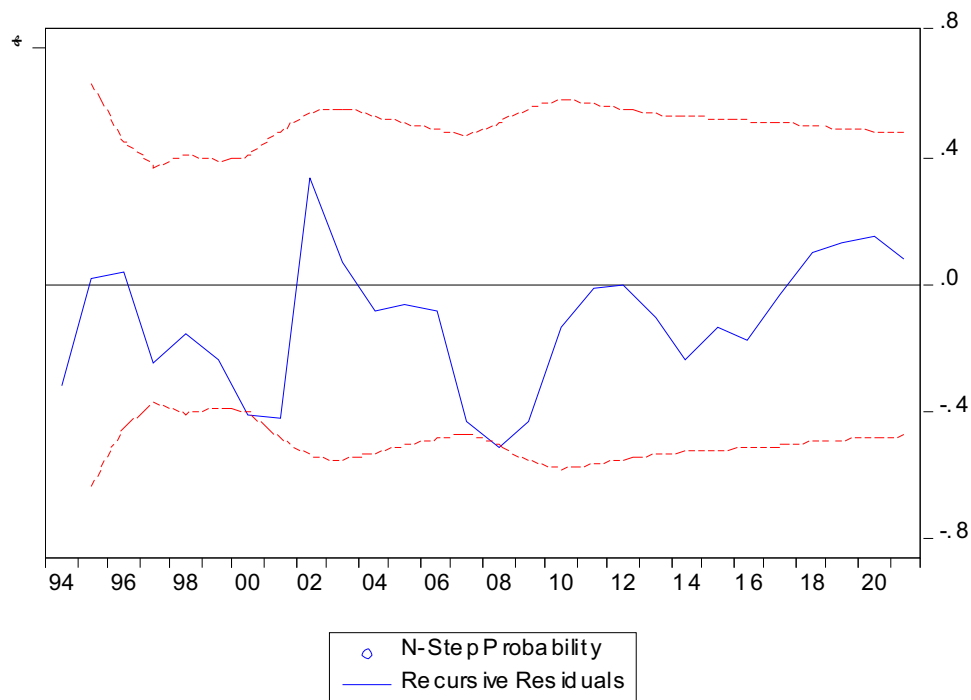


Fig. 1

Conclusion and Recommendation

The result of the ARDL test revealed that bank credit in Nigeria contributed about 69% positive change in agricultural output. Hence, this study, therefore, recommends a lower bank interest rate to give room for better agricultural productivity



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EFFECT OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ON SUSTAINABLE CONSTRUCTION DEVELOPMENT IN NIGERIA

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Abstract

Sustainability in construction development can be perceived in the areas of ICT barriers and benefits management. Management of sustainable building materials and waste management in the implementation of construction projects affects the overall success of construction projects as the global ICT Development Index ranking by the International Telecommunication Union (ITU) shows that Nigeria moved up two places from 135 spots in 2012 to 133 in 2013. The objective of this study was to assess the effect of Information and Communication Technology on Sustainable Construction Development in Nigeria; determine the effects with respect to need, barriers, and benefits of ICT implementation on sustainable construction development; and make recommendations on possible improvement. A total of 240 questionnaires were administered to respondents in construction companies to provide empirical data for the analysis. Findings indicated that Nigerian Construction Industry needs ICT throughout the construction stages right from pre-design, through and up to operation and maintenance. For sustainable construction development to be achieved, the cost of installation of ICT infrastructure, lack of regulations by the government in the adoption of ICT, lack of knowledge about ICT and other software in the construction industry, unwillingness to change by senior construction professionals, and poor management of the supply chain are the major barriers that are to be addressed in Nigerian construction industries. The study recommended that **Government should come up with a policy regulating the adoption of ICT for construction works and proper ICT training.**

Keywords: Sustainable construction development; Information and Communication Technology (ICT); Barrier and benefit management.

I. INTRODUCTION

Sustainable development leads to the fulfillment of societal ideals considered relevant to the needs and aspirations of society. Factors, which influence such developments, are based on the human ability to explore, invent, and utilize. Satisfaction of spiritual, physical, and material needs and the mastery of the environment are parameters of development when applied to human society (Nwabueze and Ozioko, 2011). Information and Communication Technology (ICT), also known as information technology (IT) has radically transformed the way we live, learn, work, and play. Many companies in the construction industry do not generally appear to have appreciated the positive changes and surveys in developing and emerging economies such as South Africa in 1999 (Arif and Karam, 2001), and Nigeria in 2005 (Oladapo, 2007). However, one of the major challenges today in developing countries of which Nigeria is one is sustainable development (Nwankwo *et al.*, 2019). On this note, the study seeks to assess the effect of Information and Communication Technology on Sustainable Construction Development in Nigeria.

II. OBJECTIVES OF THE STUDY

The objective of this study was to assess the effect of ICT on sustainable construction development in Nigeria to facilitate construction industry growth and this is achieved through the following objectives;

- i. to evaluate the need for ICT implementation in the construction industry in Nigeria
- ii. to examine the barriers against ICT implementation in the construction industry in the study



area

- iii. to ascertain the effects of ICT on sustainable construction development in the study area

III. LITERATURE REVIEW

Information and Communication Technologies (ICT)

ICT is a technology that can be used to facilitate contact between all stakeholders involved in project work, including designers, architects, managers, and owners (Singh *et al.*, 2021). IT-based technology has many resources and technologies that have an immense potential to ease work related to the flow of information or data storage. It is an important and effective tool for both current and future users (Gomes-Meneses *et al.*, 2014; Holmstrom *et al.*, 2014; Sunbul *et al.*, 2016]. Insufficient communication efficiency and the resulting weaknesses and design defects have often been overlooked as a source of delays in the industry. The magnitude of the communication barriers could not be seen as a significant factor affecting the execution of the project, especially in terms of time and price or overall project cost. However, some organizations have pointed out that this aspect is a key factor that impacts projects on an enormous scale (Aliagha *et al.*, 2015; Hampson *et al.*, 2003; Alsafouri and Ayer, 2017).

ICT in the Nigerian Construction Industry

The construction industry in Nigerian consists of diverse professionals such as engineers, builders, architects, quantity surveyors, land surveyors, contractors, suppliers, and geo-informatic experts among others, which require an exchange of project data and information in discharging their services of achieving project objectives of time, cost, and quality to the project owners (Olubunmi, Olaniyi, & Fisayo, 2014). A large number of professional teams and the data-intensive nature of the industry requires specialized coordination of project tasks using ICT to achieve the project objectives (Bilal *et al.*, 2016).

Historically, the Nigerian construction industry after the millennium breakthrough was still faced with the use of a traditional paper-based approach to information and communication management (Amusan *et al.*, 2018). The report published by the International Telecommunication Union (ITU) showed that Nigeria ranked 153rd among 178 countries in global ICT ranking and 27th among 51 African countries. This result was not surprising as the industry was characterized by three major constraints: inadequate and erratic electricity supply, high cost of computer software and hardware, and insufficient jobs among the contractors operating in the industry (Gambo, 2017).

Fifteen years later, the ICT Development Index (IDI) of Nigeria was 2.60 in 2017 compared to 2.44 in 2016 while still maintaining the 143rd position among 176 countries globally and 15th position among 38 African countries (ITU, 2016; ITU, 2017). Even though the IDI went up from 2.35 in 2013 and now 2.60 in 2017, the percentage growth in IDI over the 4 years is still low when compared with the IDI growth of other African countries. The percentage of households with computers and internet access stands at 10.56 and 15.23, respectively (ITU, 2016). The research suggested that ICT penetration at the household level can be used to explain ICT penetration at the organizational level (Hilty and Aebischer, 2015). As such, the statistics of ICT usage at the household level in Nigeria help draw a background for understanding ICT penetrations in the Nigerian construction industry.

Need of ICT in the Construction Industry

ICT is needed for construction works such as predesign activities, design activities construction activities, operational activities, and maintenance activities (Paudyal and Prakriti, 2016).

Pre-design: To define the requirements of the clients concerning space management, cost, quality, and time of completion of the project. It includes preliminary design, layouts, site soil tests, topography, etc. to check the feasibility of the project. For pre-design the following **computer programs may be**



found applicable: Google Earth, GPS, and GIS.

Design: The designing phase includes virtual construction before starting the real construction to check the efficiency of the project. It's considered a major step to be taken in the construction that highly improves the performance of the project in all respects. The design software includes the following: CAD, SAP, ETAB, STAAD BIM, etc

Operation: Computerized system is used in the operation of structures like the adjustment of the gate of the dam. It is also highly useful in structures like hospitals, and shopping complexes for the operation of elevator, lift, escalator etc.

Construction planning: It involves cost estimation and schedule management or any one of them. It may also include the choice of technology, time taken to complete each task, required resources, etc. In bigger projects, both the dimensions i.e. schedule and budget information must be considered. Microsoft Project is a software commonly used for construction management.

Maintenance: Regular maintenance of the constructed structures can be done using ICT. For example, Scanner can be used to detect the width of internal cracks and determine whether the structure is safe or not.

Construction: Construction includes the following: a) Batching: Concrete mix aggregates are introduced in the mixture in correct proportion within accuracy by the direct input of data in the computer. b) Compaction: By fixing the number and frequency of vibrations digitally compaction in roads, foundations, etc. can be done easily, and c) Curing: The amount of water required for curing can be instructed from the computerized system.

Barriers to ICT Implementation

Various barriers affect the use of information, communication, and technology in the building and development industry. Several researchers have identified the initial cost of ICT equipment, the cost of maintaining ICT resources and technologies, and their training and growth as a major barriers to ICT adoption (Mitropoulous and Tactum, 1999; Root and Thorpe, 2001). Inter-industry management in construction projects is limited, but ICT communication technologies will boost collaboration (Shankar *et al.*, 2010) The lack of strategic decisions of the organization leads to a lack of investment in ICT technology (Root and Thorpe, 2001).

Infrastructural Deficiency: Infrastructural deficiency is real in Nigeria and is a vital technology adoption issue among Nigerian construction firms (Egoeze, Misra, Akman, & Colomo-Palacios, 2014; Mudi, Bioku, & Kolawole, 2015). Most construction firms in Nigeria lack adequate infrastructure to effectively tap into the opportunities provided by cyberspace due to low access speed from internet providers and poor and erratic power supply from the national grid (Onyeji-Nwogu, Bazilian, & Moss, 2017; Vincent & Yusuf, 2014). The logistic performance index (LPI) is a function of the infrastructural performance of countries around the world. A review of the LPI global ranking showed that Nigeria which ranked 100th position among 160 countries in 2010 with an LPI score of 2.59 now ranked 110th position with an LPI score of 2.53 (The World Bank, 2018).

Technical Skills Deficiency: The lack of qualified and globally recognized IT personnel in Nigeria is an issue that is affecting IT adoption and development in Nigerian construction firms (Ejiaku, 2014; Faloye, 2014). In a period of constantly changing business environment, Nigerian construction firms are still faced with a lack of adequate human resources that possess the skill to design, program, install, configure, and maintain information technology and infrastructure (Ejiaku, 2014; Turaki *et al.*, 2015). The training and education necessary to support skill transfer and acquisition are not encouraging, and neither is the industry taking advantage of the importation of

technical equipment and technical skill from industrialized nations into Nigeria as a way of achieving the acquisition of technological skills domestically (Ebong, Udoh, & Obafemi, 2014; Faloye, 2014).

Security and Protection: The adoption of technology concerning security concerns involves hackers, cyber fraud, virus attacks, and spyware infections (Waziri et al., 2017). A recent study concluded that the fear of insecurity is the main reason some users of IT in Nigeria declined the use of online facilities (Masa'Deh et al., 2015). The fear of hackers limits the interest of Foreign Service providers to invest in internet technology in Nigeria (Turaki et al., 2015).

Cost and Funding Constraints: Though cost is often said not to be the most important factor influencing the technology adoption decision (Sepasgozar & Davis, 2018), the cost of funding IT adoption seems to be an important issue in Nigeria and among Nigerian constructions firms (Awosan, 2014; Shaikh and Karjaluo, 2015; Usman and Said, 2014). The lending rate from banking institutions in Nigeria has never been static and generally high, ranging from 16% to 26%, and varies from bank to bank. Apart from the high lending rate, there is a consensus that construction firms face delays from their clients to make payments as and when due for certified work (Kehinde et al., 2015). The fluctuating high lending rate, when combined with delayed payments, creates cash flow forecast constraints, thereby affecting true knowledge of the economic cost of IT adoption (Usman & Said, 2014).

Unethical Behavior: The ethics of technology adoption are the moral and professional principles guiding the adoption, implementation, distribution, and use of technological products and outputs. The existence of codes of ethical conduct in most organizations does not seem to impact positively ethical behaviors in construction organizations (Oladinrin & Ho, 2016). There appeared to be a high incidence of unethical behavior in the industry, the most common being the dishonesty of employees (Ogunyemi & Laguda, 2016). Loyalty, trust, and confidentiality of information are ethical factors that users of technology need to comply with. Generally, the big issue of IT adoption for ethics is that technology advances exponentially compared to the rate at which ethical codes are updated in organizations, resulting in a wide regulatory gap between technology and ethics (Wadhwa, 2014).

Faulty Regulatory Policies: The absence of enabling government policies and functioning regulatory agencies remains one of the major issues affecting IT adoption among construction firms in Nigeria (Abubakar, Ibrahim, Kado, & Bala, 2014; Ogunde, Olaolu, Afolabi, Owolabi, & Ojelabi, 2017). There is inconsistency in the area of policy formulation and implementation, which affects construction entrepreneurs working hard to survive in the difficult business terrain (Ogunde, Olaolu, Afolabi, Owolabi, & Ojelabi, 2017). The existing government policies lack attraction for IT adoption among construction firms to take full advantage of cutting-edge and disruptive technology (Abubakar, Ibrahim, Kado, & Bala, 2014). As of today, there are many regulatory agencies such as National Office for Technological Acquisition (NOTA), National Information Technology Development (NITD), and Nigerian Computer Society (NCS), and most often there are controversies as to which regulatory agency has the purview to register IT contractors (Agbata, 2018). The unique nature of the construction industry concerning IT adoption requires industry-specific policy and regulation.

Benefits of ICT on Sustainable Construction Development

According to Shankar *et al.*, (2009), ICT is a strong technology that enhances the exchange of information and definitely enhances successful decision-making. The management of various resources, including human resources, is made more available by the use of information and communication technology (Duan *et al.*, 2016). Web-based resources are very reliable in terms of efficient and future communication, as can be seen in the increased pace of communication or the

virtually effortless storage of a significant amount of data (Georges *et al.* 2019). New technologies such as BIM (Building Information Modeling) have fully changed the perception of architecture in the global market. BIM-related software, such as Revit, offers features that prevent collision design and allow multiple designers to solve tasks quickly and efficiently (Singh *et al.*, 2021). Thanks to the successful use of these technologies (Singh *et al.*, 2021), the team participant cooperates with other group participants. The Internet is being used globally and thus has many advantages, such as additional consulting with world-famous experts. The major benefit of web technology and ICT methods in the construction sector is the very effective management and availability of the supply chain. The major effect on improved efficiency, as well as the reduction of time and cost constraints of a particular project, is addressed. ICT also has several incentives that may help to prosper construction-related companies and extend the reach of the projects. However, a specified approach is required at all levels to ensure the efficient adoption of information and communication technologies (Singh *et al.*, 2021).

IV. RESEARCH METHODOLOGY

A survey method in the form of a questionnaire was adopted to generate data. The work reviewed and analyzed the effect of ICT on sustainable construction development. The themes and issues covered in the research include ICT needs, barriers, and benefits of ICT implementation. The data analyzed were both descriptive and quantitative. The result was used to establish rankings of the benchmark indices among various issues. Efforts were made for the study to cover construction companies domiciled in each of the six geopolitical zones in the country in a bid to make the work as representative as possible. A comprehensive questionnaire was designed, validated by the relevant stakeholders, and administered to the respondents for data collection and analysis. The questionnaire used a five-point Likert-type scale to measure a range of issues from “Undecided” to “Strongly agreed” as the case may be. For authenticity and data integrity, the questionnaire was administered directly to Architects, Builders, quantity surveyors and engineers, and ICT managers of the different construction companies across Nigeria.

Table 1, Population distribution

S/N	Construction professionals	Sample Frame	Sample Size
i.	Architects	69	50
ii	Builders	30	25
iii	Engineers	121	81
iv	Quantity Surveyors	80	72
v	ICT Manager	20	12
	Total	320	240

I. RESULTS AND DISCUSSION

Questionnaire distribution and percentage response information are shown in Table 2. Accordingly, a total of 320 questionnaires were administered and only 240 questionnaires were completed, returned, and found useful. This corresponds to a response rate of 76%.

Table 2: Distribution of questionnaire and percentage response

Questionnaires	Frequency	Percentage (%)
Number of questionnaires returned	240	75
Number of questionnaires not returned	80	25
TOTAL	320	100

Source: Field Survey 2023

Table 3: The Needs for ICT for Construction Development

Need for ICT	Mean	RII	Ranking
Predesign Stage (Google Earth, GPS, and GIS).	4.51	0.90	1 st
Design stage CAD, SAP, ETAB, STAAD BIM	4.30	0.86	2 nd
Construction Planning Stage Microsoft project is software	4.25	0.85	3 rd
Construction Stage	4.20	0.84	4 th
Operational Stage	3.99	0.80	5 th
Maintenance	3.88	0.78	6 th

5 – 1 (Strongly agreed to undecided)

Source: Literature Review and Field Work (2023)

Table 3 reveals that ICT is needed throughout the construction stages as they all have a mean score above average of 0.50. Predesign stage with a mean score of 0.90, Predesign stage with a mean score of 0.86, the Construction planning stage with a mean score of 0.85, the Construction stage with a mean score of 0.84 and the Operational stage and Maintenance stage with a mean score 0.80 and 0.78 respectively.

Table 4: Barriers to the Implementation of ICT

Effects of Design Variation	Mean	RII	Ranking
Cost of installation of ICT infrastructure	4.58	0.92	1 st
Lack of regulations by the government in the adoption of ICT	4.50	0.91	2 nd
Lack of knowledge about ICT and other software in the construction industry	4.50	0.90	3 rd
Unwillingness to change by senior construction professionals	4.39	0.88	4 th
Poor management of the supply chain	4.35	0.87	5 th
Lack of awareness of ICT	4.32	0.86	6 th
Fear of data security on ICT platforms	4.30	0.86	7 th
Every construction project is unique	4.00	0.80	8 th
Cost of maintenance and development of ICT software and hardware	3.95	0.79	9 th
More prominent construction organizations are not adopting ICT, and smaller organizations are following in their footsteps	3.83	0.77	10 th
Fear of data security on ICT platforms	3.83	0.77	10 th
Unavailability of trained staff and cost of training the staff	3.68	0.74	11 th

5 – 1 (Most significant to Not Significant)

Source: Literature Review and Field Work (2022)

Table 4 revealed that the Cost of installation of ICT infrastructure with a mean score of 0.92, Lack of regulations by the government in the adoption of ICT with a mean score 0.91, Lack of knowledge about ICT and other software in the construction industry with mean score 0.90, Unwillingness to change by senior construction professionals with mean score 0.88 and Poor management of the supply chain with mean score 0.87 are the major barriers against the implementation of ICT for construction works in Nigeria. Meanwhile, all the itemized barriers are also significantly affecting the implementation of ICT for construction works in Nigeria as they all have a mean score of above average of 3.5. From Table 4.3 above, it is evident that professionals believe that the postulated barriers are critical.

Table 5: Effect of ICT on Sustainable Construction Development in Nigeria

Effects	Mean	Rank
Project information is stored precisely in a better way	4.40	1
Effective Management control is superior using ICT	4.33	2
Easy to procure and manage supply chain	4.22	3
Rework errors are less	4.21	4
Data availability through ICT is reliable	4.00	5
The project will be completed in the given time and cost	3.99	6
Management control is better by using ICT	3.86	7
ICT provides excellent communication among team members	3.75	8
ICT will enhance decision making	3.70	9
Management of contracts is enhanced	3.68	10
There are more unity and partnership among members of the team	3.64	11
ICT refines the productivity of the organization	3.62	12

Source: Fieldwork (2022)

Table 5 shows the effects of ICT on Sustainable Construction Development in Nigeria with all the identified effects ranking above the average Mean Item Score of 3.00. Project information is stored precisely in a better way and ranks highest with an MIS of 4.42 followed by Effective Management control is superior using ICT and Easy to procure and management of the supply chain with MIS of 4.33 and 4.22 respectively. The lowest ranked effect is ICT refines the productivity of the organization with an MIS of 3.62. Even though it was ranked lowest among the identified effect of ICT, a Mean Item Score of 3.62 is still a strong statistical value to show that it thus has a significant effect in sustaining construction development in Nigeria.

VI. CONCLUSION

ICT is needed throughout the construction stages which involve pre-design, design, construction planning, construction, Operation, and maintenance. Adequate use of ICT in infrastructural facilities, as well as other construction-related activities, can provide the sustainable benefits of a better storage way of project information, easy procurement of effective and superior management control, effective management of supply chain and give a refined productivity of the organization. This in turn gives birth to sustainable construction development in Nigeria. However, for this sustainable construction development to be achieved, the cost of installation of ICT infrastructure, lack of regulations by the government in the adoption of ICT, lack of knowledge about ICT and other software in the construction industry, unwillingness to change by senior construction professionals and poor management of the supply chain are the major barriers that are to be addressed in Nigeria construction industries.

VII. RECOMMENDATIONS

Based on the findings of this research, the following recommendation is made to have benefited sustainable construction development in Nigeria by adopting ICT:

- Government should come up with a policy regulating the adoption of ICT for construction works
- Proper ICT Training for construction workers should be put in place and made affordable.
- Senior construction professionals should be educated and enlightened about the benefits of adopting ICT for sustainable construction development in Nigeria.

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SUITABILITY EVALUATION OF SOILS OF EPOLU RIVER, ESA OKE, OSUN STATE, FOR RICE PRODUCTION

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Abstract

The study evaluated the suitability of soils of Epolu River, Esa-Oke, Osun State for rice production. Three soil profile pits were dug along the toposequence namely: upper basin, mid basin, lower basin, and described following the FAO/UNESCO guideline for soil profile description. Soil samples were collected from 9 identified genetic horizons of the profile pits and were subjected to routine physical and chemical analyses. Land characteristics recognized on the field were combined with those determined in the laboratory to provide the land qualities in the study area. The land qualities obtained were matched with rice requirements to obtain the soil suitability classes. Results indicated that the soils were not deep, light reddish gray to brownish gray, varying from sandy clay loam to clay. The bulk density ranged from 0.49 g/cm³ to 0.86 g/cm³. The soils were acidic with pH ranging from 3.99 to 5.79. Soil organic matter varied from low to high, ranging from 0.2 to 3.22%. The available P varies from low to medium and ranged from 3.10 to 9.40 mg/kg. The high base saturation of greater than 50 % by NH₄OAc places all pedons in order Alfisols (USDA Soil Taxonomy) pedons 1 and 2 correlate as Luvisols while pedon 3 correlate as Fluvisols (FAO/ UNESCO). The soil temperature is isohyperthermic. The soils of pedons 1 and 2 belong to Ustalf due to histic moisture regime and are therefore classified as Isohyperthermic Paleustalf and pedon 3 was an aquic moisture regime and order Psamment and is classified as Typicaquipsament. The soils were unsuitable for rice production. The major limitation of soil was low fertility and high soil acidity. The productive potential of the soil for rice production could be enhanced through the application of appropriate fertilizer.

Keywords: Pedon, Land quality, Alfisols, Fluvisols

1. Introduction

Rice (*Oryza sativa* L.) is a type of cereal and it is eaten as a staple food in many parts of Asia. It is grown in warm parts of the world, mainly Asia, Africa, northern Italy, and the west coast of North America. Rice is the primary staple food for about half of the world's population and it provides 20% of the calories consumed worldwide. Rice has become the main staple and major source of carbohydrates in the Nigerian people's diet across all socio-economic classes (Osinuga *et al.*, 2020). Nigeria is one of the leading rice importers in the world because rice is produced in the country by small-scale farmers (FAO, 2019). Total rice production has increased in the last two decades, but the rises have not met the ever-increasing population because farmer relies on rainfed agriculture, small-scale farming, inadequate irrigation facilities, lack of storage facilities, low input such as fertilizers, and lack of agricultural extension system (Ana, 2010; FAO, 2019).

Development in settlements and population growth have been increasing the human demand for land as well as an increase in the demand for food crops like rice, and maize among others (Aondoakaa and Agbakwuru, 2012). Recently, the price of grains (especially rice) has increased with the cost of cultivation and production (Balogun, 2001). Sadly, in terms of area and production, rice is one of the less important grains crops grown in Osun State, Nigeria. But in terms of economic importance, it is one of the most important crops. It is widely regarded as a superior food, which until recently was mainly consumed by city dwellers and middle and higher-income earners (Dawam, 2000).



In an attempt to improve agricultural production, many agricultural development projects have been established like Fadama programs sponsored by the World Bank in Nigeria. This makes it necessary to carry out strategies to improve food production. It is in this direction that a land suitability study is relevant. De Delta (1981) suggested that land/soil data should be made available and understandable to the users by providing interpretative ratings for specific land uses. The land qualities and land use requirements should be matched to enable farmers to maximize output in agricultural production by identifying the land qualities and the requirements for various land for effective management.

Olaleye (2001) reported that Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, and Manganese are important elements in rice production. Thus, land suitability studies assist in identifying soil nutrients for optimum yields of some crops. In the same direction, FAO (1978) also had land classifications to identify areas suitable for some crops' cultivation.

Studies relating to soil and site characteristics and crop requirements form the basis for soil suitability evaluation (Meena *et al.*, 2009). Land suitability is the ability of a particular land to tolerate and accommodate the production of crops in a sustainable way that can give optimal yield. Its evaluation provides information on the constraints and opportunities for the use of the land and also guides decisions on the potential and optimal utilization of resources, whose knowledge is an essential precondition for land use planning and development (Abdel-Rahman *et al.*, 2016). Moreover, such analysis allows the identification of the main limiting factors for agricultural production. This enables decision-makers such as land users, land use planners, and agricultural support services to develop crop management practices able to overcome such constraints and increase productivity.

Development in settlements and growth in population have been increasing the human demand for land as well as an increase in the demand for food crops like rice, and maize among others. In response to this, so many land uses are evident in the area of which agricultural land use is one of most notable apart from residential. From field observation, the crops grown in the area are maize, yam, pineapple, and plantain. However, the interest of any farmer lies mainly in how profitable it is to grow a particular crop and what amendments are necessary to optimize the productivity of the soil for the specified crop (Fasina and Adeyanju, 2007).

Land suitability of a particular land is a function of matching the land characteristics with the crop requirements (Mustafa *et al.*, 2011). Enhancing rice production could be met through a systematic survey of the soils, evaluating their potential for a wide range of land use options, and formulating land use plans which are environmentally benign, socially acceptable, and economically viable (Addeo *et al.*, 2001; Sathish and Niranjana, 2010). Therefore, information is needed on soil qualities and conditions of the area, as well as the fertility status of the soil, to ascertain the chemical properties of the soil for rice cultivation. The need for such information constitutes the problem of this research. Information obtained from such research will help in formulating meaningful guidelines in ensuring the sustainability of agricultural practice as well as rice cultivation not only in Esa-Oke but in the Southwest in general.

Therefore, the objectives of this study were to characterize, classify, determine suitability, and identify the types of limitations of soils of Epolu River, Esa-Oke, Osun State, Southwest Nigeria, for sustainable and profitable rice production.

2. Materials and Methods

Study area

The study was conducted in a section of the Epolu River floodplain at Osun State College of Technology, Esa-Oke. It lies approximately between latitudes 7° 44'38 N and 7° 44'38 N and



longitudes 4° 52'33 E and 4° 52'54 E. The climate of the area is humid tropical, with distinct dry and wet seasons. The wet season spans mid-March to late October, and the rainfall pattern is bimodal with peak periods in June/July and September/October. The dry season runs from early November to early March. The influence of the northeast trade wind, which loses all its moisture as it passes over the Sahara desert towards the equator, is felt in the study area as 'harmattan' (cold dry wind) between late December and early January. Atmospheric temperature is moderately high throughout the year, with a low range between the mean monthly minimum and maximum temperatures. Total annual rainfall is about 1500mm (NASA, 2019).

Vegetation and land use

At the time of this study, trees and arable crops were cultivated in the area. The land use at each topographic location was: upper basin: *Theobroma cacao* plantation, mid basin: *Theobroma cacao* plantation, and lower basin: *Theobroma cacao* and *Citrus Sinensis* plantation.

The soils of the study area are fine-grained biotite gneisses and schist in pedon 1 and 2 and alluvial and colluviums material in pedon 3 which are generally moist and poorly drained almost all year round. The soils of the upper basin occupy the highest points on the landscape as a result of which they are most freely and severely drained. The soil of the mid basin and lower basin are shallower with a water table of 90cm respectively.

Soil examination and sampling

The genetic horizons of each soil profile pit were identified, described, and sampled according to FAO (2006) guidelines for soil profile description. Core soil samples were taken for bulk density determination. Soil samples were collected from identified genetic horizons of each of the profiles, starting from the lowest horizon to the uppermost to prevent cross-contamination.

Sample preparation for laboratory analysis

A topo sequence was selected for this study. The toposequence was delineated into three physiographic units namely upper basin, mid basin, and lower basin. One profile pit was dug at each identified physiographic unit and was established, described, and sampled, following the guideline for soil profile description (FAO, 2006). The soil samples were air-dried, crushed gently, and passed through a 2 mm sieve. The fraction less than 2 mm was retained for laboratory analysis. The soil samples were analyzed for the following:

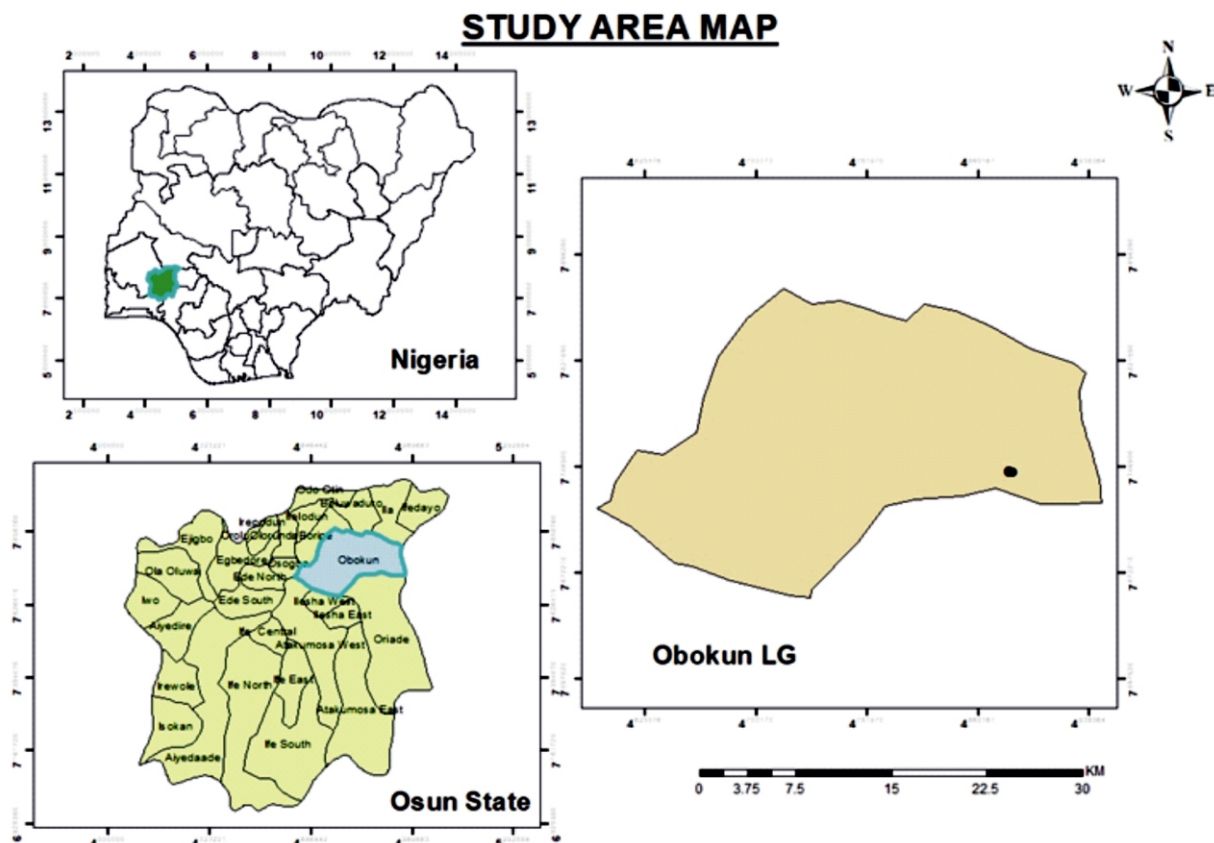


FIGURE 1: MAP OF THE STUDY AREA

Particle size distribution analysis was carried out using the modified hydrometer method (Gee and Or, 2002). The soil pH was determined in distilled water and 1.0 M KCl (Thomas, 1996). Organic carbon was determined using the Walkley-Black method (Nelson and Sommers, 1982). Available phosphorus was determined by the Bray-1 method (Kuo, 1996). Total nitrogen was determined using the micro-Kjeldahl digestion method (Bremner, 1996). Exchangeable acidity ($H^+ + Al^{3+}$) was extracted with 1.0 M KCl and titrated with sodium hydroxide (McLean, 1965). Exchangeable bases were extracted with 1.0 N ammonium acetate (NH_4OAC) at pH 7, the Ca^{2+} and Mg^{2+} content were determined with atomic absorption spectrophotometer while K^+ and Na^+ were determined with a flame photometer (Thomas, 1982; Jones, 1998). Data obtained from field and laboratory analyses were used to classify the soil into its appropriate order, sub-order, great group, and sub-group following the guideline in the USDA keys to soil taxonomy (Soil Survey Staff, 2014 and IUSS Working Group WRB, 2015) while local soil classification was carried out using the method of Smyth and Montgomery (1962). The suitability of the soils for rice production was assessed using the parametric method (Sys *et al.*, 1993). Land characteristics recognized on the field were combined with those determined in the laboratory to make the preferred land qualities which were used as the basis for the land assessment. Each pedon was assigned to a suitability class by matching the land requirements for rice production (Table 1) characteristics with the characteristics of the pedon (Tables 2, 3, and 4). A numerical rating of the land characteristics on a normal scale from a maximum (normally 100) to a minimum value (20) was employed. If a land characteristic was optimal for the considered land utilization type, the maximal rating of 100 was attributed; if the land characteristic was unfavorable, a minimal rating of 20 was applied (Sys *et al.*, 1993). A land index was calculated from the individual ratings using the square root method:

$$I = A \times \sqrt{\frac{B}{100} \times \frac{C}{100} \times \dots \times \frac{F}{100}}$$

where:

I= land index

A= overall lowest characteristic rating

B, C...F = lowest characteristic ratings for each land quality group (Udoh et al. 2006).

Statistical Analysis

The correlation coefficient was used to establish the relationship between the soil requirement of rice and the results obtained from the laboratory. The data set was run using Gretl software where it was discovered that the data set is normally distributed and the data set is devoid of outliers.

Table : Land/soil requirements for suitability evaluation of rice

Land Qualities		S11	S12	S2	S3	N1	N2
		96-100	86-95	61-85	41-60	21-40	0-20
Climate (C)	Annual rainfall (mm)	1200-1500	1000-1200	800-1000	800	?800	?800
	No dry months	0-2	2-3	4-5	6-7	?7	?7
	Mean annual temp (°C)	?25	22-25	20-22	18-20	?18	?18
	Relative humidity (%)	?75	70-75	65-70	60-65	?60	?60
Topography (T)	Slope gradient (%)	0-2	3-6	7-15	16-25	?25	?25
Wetness (W)	Drainage	Wd	Id	Md	Pd	Vpd	Vpd
	Flooding	Fo	Fo	F1	F1	F2	F2
Soil physical properties (S)	Soil depth (cm)	?100	75-100	60-75	50-60	?50	?50
	Surface texture	C, SCL	CL	SC, CL	SL, L	LS	S
	Gravel at 0-20 cm (%)	?2	2-4	5-15	16-30	30-35	?35
	pH in distilled water	7.5-8.0	7.0-7.5	5.5-7.0	5.0-5.5	4.0-5.0	?4.0
Chemical fertility	Organic matter (%)	?5	3-5	2-3	1-2	?1	-
	Total Nitrogen (%)	?0.5	0.4-0.5	0.2-0.4	0.1-0.2	?0.1	?0.1
	Available P (mg/kg)	?10	7-10	4-6	2-4	?2	?2
	Exchangeable K (cmol/kg)	?0.6	0.4-0.6	0.2-0.4	0.1-0.2	0.05-0.1	?0.05
	CEC (cmol/kg)	?16	12-16	8-12	5-8	?5	-
	Base saturation (%)	?75	75	50-75	35-50	?35	?35

S11 (96-100) – No limitation, S12 (86-95)- Slight limitation, S2 (61-85) – Moderate limitation, S3 (41-60) – Severe limitation, N1 (20-40) – Very severe limitation that can be corrected, N2 (0-19) – Very severe limitation that cannot be corrected.

Source: Modified from Sys *et al.*, 1993, FAO, 2007, Ajiboye *et al.*, 2011, Osinuga *et al.*, 2020

3. Results and discussion

Characteristics of the soils

Morphological characteristics of the soils

The summary of the morphological description of the soils is presented in Table 2. The soils occupied a low topographical position and were developed from fine-grained biotite gneiss and schists for pedon 1 and 2 while alluvium and local colluviums for pedon 3 (Smyth and Montgomery, 1962). The color of the surface horizons ranged from reddish gray (7.5R 5/1) in Profile 01 and Profile 03 to light reddish gray (7.5R 7/1) in Profile 02. The color of the subsoil ranged from light reddish gray (7.5R 7/1) in profile 03 to brownish gray (7.5R 5/1) in profile 01. Buol *et al.*, (2003) reported that the reddish color in the subsurface horizon of most profiles could be due to the oxidation of iron oxides (responsible for the reddish color in subsoil horizons). The structure of surface soils was mostly weak and the structure of sub-surface soils was sub-angular blocky. The weak structures in the studied soils were probably due to tillage operation and continuous cultivation in the area. Roots concentration was common in the surface horizons of all the pedons examined and decreased with soil depth.

The soils had sandy clay loam, sandy loam, and loam sand at the top soil underlain by sandy clay to sandy loam at the subsurface. The soils received both alluvium and colluvium. The soil of pedon3 was poorly drained with reddish coloration. The variation in soil color was primarily due to the physiological position of each profile and the drainage of the soil

Table 2: Morphological description of the soils

Horizon	Depth (cm)	Colour (moist)	Texture ^a	Structure ^b	Consistence ^c	Concretion ^d	Boundary ^e	Note
Upper slope (profile 01)								
0-18	7.5R 5/1	ngrsc	1cr	mfr	Vf	Ds		Few fine roots
18-45	10R 6/3	ngrl	2sbk	mvpl	Vf	C		No roots
45-83	2.5YR 7/4	sgrc	1sbk	mvpl	Gr	-		No roots
Mid basin (profile 02)								
0-15	7.5R 7/1	ngrs	1cr	mfr	Rdpl	D		Many fine roots
15-40	10R 6/3	ngrs	2sbk	mst	Rdpl	C		No roots
40-90	10R 6/3	ngrs	2sbk	mst	Rdpl	C		No roots
Lower basin (Profile 03)								
0-15	7.5R 5/1	sgrs	1cr	mfr	Vf	D		Many fine roots
15-42	7.5R 6/2	sgr	1cr	mfr	Vf	C		Few fine roots
42-90	7.5R 7/1	Sgr	2sbk	mvpl	Vf	-		Few fine roots

^aTexture: gr = gravelly, sgr = slightly gravelly, vgr = very gravelly, ngr = non gravelly c = clay, s = sandy or sand, l = loam or loamy

^bStructure: 1 = weak, 2 = moderate, 3 = strong, m = medium, cr = crumb, sbk = subangular blocky, pl = platy

^cConsistence: m = moist, w = wet, fr = friable, st = sticky, nst = non sticky, pl = plastic npl = non plastic vpl = very plastic

^dConcretion: vf = very few, gr = gravel, rd = rounded, st = stone, fr = frequent, vfr = very frequent, cr = saprolite

^eBoundary: c = clear, d = diffuse, g = gradual, s = smooth, w = wavy.

Physical characteristics of the soils

Some selected physical properties of the soils within the study area are shown in Table 3. Particle size distribution data showed that the texture of the surface soils of the three profiles in the study area were sandy clay loam, sandy loam, and loam sand. The content of sand particles was greater than silt

and clay in the surface soils. The subsoil horizons in profiles 01, 02, and 03 had more clay than the surface horizons since clay content increased with depth in these profiles. Clay eluviation from the topsoils to the subsoils and differential sorting of materials are factors that could be accountable (Smyth and Montgomery, 1962). The sand particles appeared to be the most dominant size fraction with a range of 36 to 80%. The clay particles ranged from 8 to 52% while the silt was the least with a range of 12 to 18 % in the soils examined. The bulk density ranged from 0.49 g/cm³ in the AP horizon to 0.86 g/cm³ in the B horizon. Bulk density is a reflection of texture and structure (aggregation). Usually, soils with low bulk density are known to be associated with high total porosity, while root penetration becomes a problem when bulk density exceeds 1.6 g/cm³ (Russell, 1976). The bulk density increased with depth in the study area.

Chemical properties of the soils

Table 4 shows the chemical properties of the soils. The soils were acidic with a pH range of 3.99 to 5.79 in distilled water (pH_(H₂O)) and 3.17 to 5.06 in KCl (pH_(KCl)). The low pH of the soils could be a result of high rainfall in the area which made the soils fragile and susceptible to leaching (Udo *et al.*, 2009). Enwezor *et al.* (1981) stated that the leaching of Ca and Mg was largely responsible for the development of soil acidity. It had also been noted that phytocycling and upward movement of bases due to intense evaporation during the dry season in the humid tropics were further suggested to account for the relatively higher pH of the surface horizons (Amusan, 1991). Adepetu (1986) classified the percentage of soil organic matter (SOM) in Southwestern Nigeria into low (0 - 1.5%), medium (1.5 – 2.5%), and high (>2.5%). The soil organic matter contents were low in the surface horizon of profile 03 and were higher in the surface horizons of profiles 01, and 02 respectively. The high organic matter content at the topsoil of most soil profiles could be attributed to more decomposable plant materials in the surface soils (Lal, 1991). This high content of organic matter at the surface soil was not unexpected since it is at the soil surface that litters accumulate which subsequently decays and mineralizes to yield organic matter (Olayinka, 2009). It was also observed that SOM content in profile 01 was higher than in other profiles examined; this is because profile 01 was under cacao plantation. Visual field observation indicated that greater canopy cover was found within the cacao plantation compared to other of the profile locations, which possibly explained the higher OM content in profile 01 than in other profiles. In all the soil profiles that were examined, organic matter decreased with depth. This agrees with the findings of other workers (Smyth and Montgomery, 1962; Ogunkunle, 1993; Akinbola *et al.*, 2006). The low organic matter in profile 03 (lower basin) could be attributed to the erosion effect and continuous cultivation which is common in the area.

Table 3: Physical characteristics of the soils

Horizon Textural class	Depth (cm)	Sand	Silt	Clay	Bulk density (gcm ⁻³)
		←	→ %		
Upper basin (profile 01)					
AP	0-18	62	16	22	0.49
AB	18-45	48	16	36	0.73
Bg	45-83	36	12	52	0.74
Mid basin (profile 02)					
AP	0-15	66	16	18	0.65
AB	15-52	56	18	26	0.86
B	53-90	48	16	36	0.76
Basin floor (Profile 03)					
AP	0-18	80	12	08	0.67
AB	18-42	80	12	08	0.69
B	42-90	72	14	14	0.83

The available P across the profiles examined varied from low to medium. Adepetu (1986) classified the soil test value of available phosphorus into low (0-8 ppm), medium (8-15 ppm), and high (> 15 ppm). It could be observed that the available phosphorus content of the soils varied from 3.10 to 9.40 ppm in all the soil profiles examined with the highest value at the surface horizons in profiles 01 and 02 while it showed an irregular trend in profile 03, an indication that organic matter contributes significantly to the available phosphorus in these soils. The available P values are considered low in profile 03, as they were below the critical limit recommended for most commonly cultivated crops in the area (Uponi and Adeoye, 2000; Aduayi *et al.*, 2002; Obigbesan, 2009). Total nitrogen (TN) values were low, they ranged between 0.04 - 0.14 g/kg. the value was below 4.5g/kg established for productive soils (Federal Fertilizer Department, FFD, 2012). The low content could be ascribed to rapid microbial activities and crop removal, leading to nitrate loss in the soil environment (Aiboni *et al.*, 2007). The ECEC of the soils was generally low (2.98 – 5.66 cmol /kg) with a value of less than 10 cmol /kg (FFD, 2012).

Soil Classification

The soils of pedon 1 and 2 are characterized by high base saturation of greater than 50 % by CEC determined at pH 7.0 (NH₄OAc) and low CEC (< 16 cmol/kg) placed the soil into Alfisols in the USDA soil taxonomy and the soils belong to suborder Ustalf due to the ustic moisture regime because the soil was dry for 90 or more cumulative day in a year. The soil temperature regime of Southwestern Nigeria is Isohyperthermic (Amusan and Ashaye, 1991). Pedon 1 and 2 were therefore classified as isohyperthermicpaleustalf. (Soil survey staff, 2010) and luvisols (FAO-UNESCO). Pedon 3 was classified as Entisols (recently formed soil) with evidence of fluctuating water table. The soil moisture regime was Aquic. It belongs to sub-order Psamment because of loam sand at the surface and sandy loam at the subsurface. Hence, classified as Typicaquipsamment (USDA 2014) and Fluvisols (FAO-UNESCO) –. Classification at the local level (Smyth and Montgomery, 1962) for Pedons 1, 2, and 3 as Egbeda, Makun, and Jago series respectively.

Soil Suitability Evaluation for Rice Production

Table 1 shows land use requirements for rice production. The factor rating of land use requirement for rice was matched with the properties of the soils (Table 5) to obtain the actual (A) suitability class score of each land unit for rice (Table 6). A numerical rating of the land characteristics on a normal scale from a maximum (100) to a minimum value of 20 was used. A maximal rating of 100 was attributed if land characteristics were optimal for rice production and if unfavorable, the least rating was applied. The potential (B) suitability class scores were obtained after soil fertility had been corrected and attributed to 100. The aggregate suitability class score (land index) for each land unit was calculated using the square root equation method.

The results for the actual suitability rating (A) shows that pedon 1, 2, and 3 were unsuitable (N2) for rice production (Table 6). Nevertheless, after the fertility constraints would have been removed with adequate and proper fertilizer application, the soils are moderately suitable for rice production. The potential suitability (B) reflects what is expected after limiting constraints have been removed. The major limitation of the soils was poor fertility.



Table 4: Chemical properties of soil

Horizon	Depth	PH	OC	OM	TN	Avail	Ca ²⁺	Mg ²⁺	K ⁺					
Na ⁺	EA	ECEC	BS											
Designation	(cm)	H ₂ O	KCl	p				Al						
3+	H ⁺													
(cmol/kg)	(cmol/kg)	%	%	mg/kg		(cmol/kg)								
		Upper	basin											
A	0-5.0	4.6	1.87	3.22	0.14	9.4	1.4	0.4	0.0	0.1	0.0	0.0	2.9	69.8
P	18-6	2				0		8	9	1	2	7	8	0
A	18-4.0	3.2	0.62	1.07	0.07	5.6	1.3	0.4	0.1	0.1	0.0	0.0	2.9	69.4
B	-1	2				0	7	6	1	1	2	7	5	9
	42													
Bg	43-3.9	3.1	0.20	0.34	0.04	6.1	1.3	0.4	0.1	0.1	0.0	0.0	3.0	67.5
	-9	7				0	9	7	1	1	3	7	8	3
	90													
		Mid	basin											
A	0-5.7	5.0	1.56	2.68	0.14	8.3	1.4	0.6	0.1	0.1	0.0	0.0	2.5	92.2
P	15-9	6				0	7	4	3	3	1	1	7	2
A	15-4.4	3.6	0.47	0.81	0.07	4.6	1.0	2.0	0.1	0.1	0.0	0.0	3.6	94.5
B	-1	7				0	7	4	9	4	1	1	4	1
	52													
B	52-4.0	3.2	0.39	0.67	0.07	7.2	1.0	2.0	0.2	0.1	0.0	0.0	4.3	79.2
	-5	2				0	6	3	1	3	3	6	3	1
	90													
		Basi	floo											
		n	r											
A	0-4.4	3.7	0.81	1.41	0.11	3.9	1.4	2.0	0.2	0.1	0.0	1.0	5.6	69.9
P	18-6	2	9			0	9	8	3	6	3	4	6	6
A	18-4.4	3.6	0.19	0.34	0.04	5.3	1.0	2.0	0.2	0.1	0.0	0.0	4.4	77.5
B	-2	8	5			0	7	4	1	4	4	6	6	7
	42													
B	42-5.1	4.2	0.11	0.20	0.07	3.1	1.0	2.0	0.2	0.1	0.0	0.0	4.3	79.2
	-2	4	7			0	7	1	0	4	3	6	2	0
	90													

OC= Organic carbon, OM= Organic matter, TN= Total nitrogen, Avail p= Available phosphorus, EA= Exchangeable acidity
 ECEC=Effective cation exchange capacity, BS = Base saturation



Table 5: Summary of the land characteristics of the soil profile for rice production

Land characteristics	Pedon 1	Pedon 2	Pedon3
Topography (t)	10	5	2
Slope (%)			
Climate			
Annual Rainfall during the growing season (mm)	1500	1500	1500
Mean annual temperature (°c)	20.26	20.26	20.26
Length of dry season (Month)	5	5	5
Relative humidity (%)	74.12	74.12	74.12
Flooding	No	No	No
Drainage	Well drained	Well drained	Poor drained
Texture	SCL	SL	LS
Chemical fertility			
Base saturation	91.2	95.9	92.9
pH in distilled water	5.06	5.79	4.46
Organic matter (%)	3.22	2.68	1.41
Total Nitrogen (%)	0.14	0.14	0.11
Available P	9.40	8.30	3.90
Exchangeable K (cmol/ Kg)	0.09	0.13	0.23
ECEC (cmol/ kg)	2.28	2.47	4.26

SCL= Sandy Clay loam, SL= Sandy Loam, LS= Loam Sand

Table 6: Land Suitability ratings of the study area for rice production

P1 = Pedon 1, P2 = Pedon 2, P3 = Pedon 3

A = actual suitability when characteristics (f) are not corrected by fertilizer application.

P = potential suitability after the correction of characteristics (f) by fertilizer application.

P3 Land qualities A B	P1		P2			
	A	B	A	B		
Topography (T)	70	70	90	90	100	100
Climate (C)						
Mean annual rainfall	96	96	96	96	96	96
Mean annual temperature	85	85	85	85	85	85
Length of dry season	85	85	85	85	85	85
Relative humidity	95	95	95	95	95	95
Wetness (W)						
Drainage	100	100	100	100	60	100
Texture	100	100	60	100	50	100
Soil depth	95	100	95	100	95	100
FERTILITY CHARACTERISTICS (F)						
Base saturation	100	100	100	100	100	100
PH in distilled water	41	100	61	100	30	100
ORGANIC matter %	86	100	85	100	41	100
Total of %	41	100	41	100	41	100
Available P (mg/kg)	95	100	90	100	50	100
Exchangeable k (ml/kg)	41	100	41	100	60	100
ECEC	40	100	40	100	41	100
Suitability index	6	57	7	65	2	69
Suitability class	N2	S2	N2	S2	N2	S2

Aggregate suitability scores: S1(75-100); S2(50-74), S3(25-49); N1(12-24); N2(0-12).

Conclusion

Classification and suitability evaluation of rice soils help to identify production constraints and prospects. Epolu River soils are unsuitable for rice production despite its climate. The slope and soil wetness are highly unsuitable. The major constraints to the optimum performance of rice are soil texture and some chemical fertility (N, P, and CEC). Emphasis should be on management techniques that will enhance the nutrient and moisture-holding capacities of these soils.

Recommendation

The pH value can be enhanced by the application of lime. The productive potential of the soil for rice production could be enhanced through the application of appropriate fertilizer.

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STUDENTS' PROJECT MANAGEMENT AND ALLOCATION SYSTEM

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ABSTRACT

The online student project allocation is an emerging technology and a computer system has revolutionized the world thereby making tasks that seem difficult easy by the use of the Internet. Students no longer need to overcrowd Supervisor's office because of project topics or research suggestions as this has been solved by this web application. Students can now at their comfort proceed with their project work online. What a welcoming development. This research work has emphasized the capabilities and reliabilities of a computer system i.e. accuracy, speed, and timeliness of information that it encompasses. The most important factor from this work is that information is essential and its availability cannot be washed away and the ability to move such information through established networks such as the Internet is the key benefit of the online students' project allocation. In addition, we have conducted a usability study via a website by deploying the web application on a domain for only a few invited developers to test the application to understand usability issues and suggest future improvements.

Keywords: Students, Project, Management, Allocation, Systems, Information, and Web Applications.

1. INTRODUCTION

In many tertiary institutions in the country, students seek a project in a given field of specialty as part of the requirements to obtain their degree program. Usually, a project can be filled by at least one student, though in some cases a project issuitable form or ethan one student to work on simultaneously. To give students something of a choice, there should be as wide a range of available projects as possible, and in any case, the total number of project places should not be less than the total number of students. Typically, a lecturer will also offer a range of projects but does not necessarily expect that all will be taken up.

In this paper, we consider the ways of allocating student projects in our various institutions. In most cases, a graduate project is, according to Valterde Senna (May 2005), “one paper that a student works on for a large portion of the graduate program, especially in his or her final months of the program. This research requires a huge amount of research and may even be ground-breaking for a particular industry”. While there are many definitions and uses for student projects, the basic writing elements are the same. Therefore, students should always research a particular subject and write an academic document with an introduction, body, conclusion, resources, and appendices.



1.1 Statement of Problem

The traditional way of allocating project to students in our higher institution need to be reconsidered since project/research writing is a sensitive aspect of student education in the higher institution. The traditional system creates room for allocating a single topic to more than one student or group of students thereby creating inefficiency in the purpose of student project writing. This system made project writing look less like a class assignment which does not require extra effort to complete but rather an issue of copying also many students can choose the same project without knowing that they doing the same project.

1.2 Aim and Objective

This research is aimed at developing a web-based system (stand-alone which could also be run under a Local Area Network) that manages the activity of “Student Project Management”. This system will manage the database and maintain a list of all student groups that have registered in the department along with their project topic. Allocation of the project will be done by lecturers registered in this system through a list of topics in the department data base organized by the department to guide against a repetition of topics by two or more students.

2. LITERATURE REVIEW

Student projects are long academic documents that students write after they research a particular subject in depth. Therefore, student projects are usually assigned once per course, per semester, or only once as part of an academic program (David J. Abraham, 2007). Usually, the project will be graded by a supervisor, but all students in a particular grade might have to work on a project to pass a grade. In most cases, a graduate project is, according to Valter de Sennaeta l(2005), “one paper that a student works on for a large portion of the graduate program, especially in his or her final months of the program. This research requires a huge amount of research and may even be ground breaking for a particular industry”. Students will then have to defend their project in front of a panel of judges that are familiar with the subject matter in the project. These panel members may ask the student questions related to his or her research or to the project itself. This sort of graduate project is also often called a graduate school dissertation.

While there are many definitions and uses for student projects, the basic writing elements are the same. Therefore, students should always research a particular subject and write an academic document with an introduction, body, conclusion, resources, and appendices (David J. Abraham, 2007).

3. METHODOLOGY

3.1 Choice of Programming language

Our application package for students' project allocation is realized using P.H.P (Hypertext Preprocessor) as the main scripting language, CSS (Cascading Style Sheet) to style the interface, MySQL server as the database server, and Wamp as the web server. The application can be accessed using any web browser.



3.2 Research Layout

This research work is aimed at developing a web-based system (stand-alone which could also be run under a Local Area Network) that manages the activity of “Student Project Management”. This system will manage the database and maintain a list of all student groups that have registered in the department. Allocation of the project will be done by lecturers registered in this system through a list of topics in the department database organized by the department board. We have three roles in this system, an Administrator, a Supervisor/Lecturer, and a Student. An Administrator logs into this system and can register a supervisor who belongs to the department. Students register in this system and get a user ID (similar to a website like Yahoo). A student should register; provide his information (technologies familiar with, prior project experience, etc.). This is saved in a database.

The department shortlist students for supervisors.

The Lecturer/Supervisor assigns project topics in his profile page to students/groups under him/her

3.2.1 Facility for password changing

There is a facility for changing the password for the student as well as the lecturer.

3.2.2 Notification sent to students

Notification is being sent to students or groups that are under him or her that a project topic has been assigned to them. The data entered by the student like name, matric number, phone number, etc. Should be validated appropriately. This feature will improve the robustness of the application; also this feature is a must as it prevents incorrect data from being entered in the database.

3.3 Evaluation of Forms

The system design is based on a three-tier architecture. The three-tier (layer) is a client-server architecture in which the user interface, registration process, and data storage and data access are developed and maintained as independent modules or most often on separate platforms.

The three logical tiers are

- i. Presentation Tier – Dreamweaver, web forms, Master Pages, Images
- ii. Middle Tier – webmodule
- iii. Data Tier – Database.

3.4 System Flow Chart

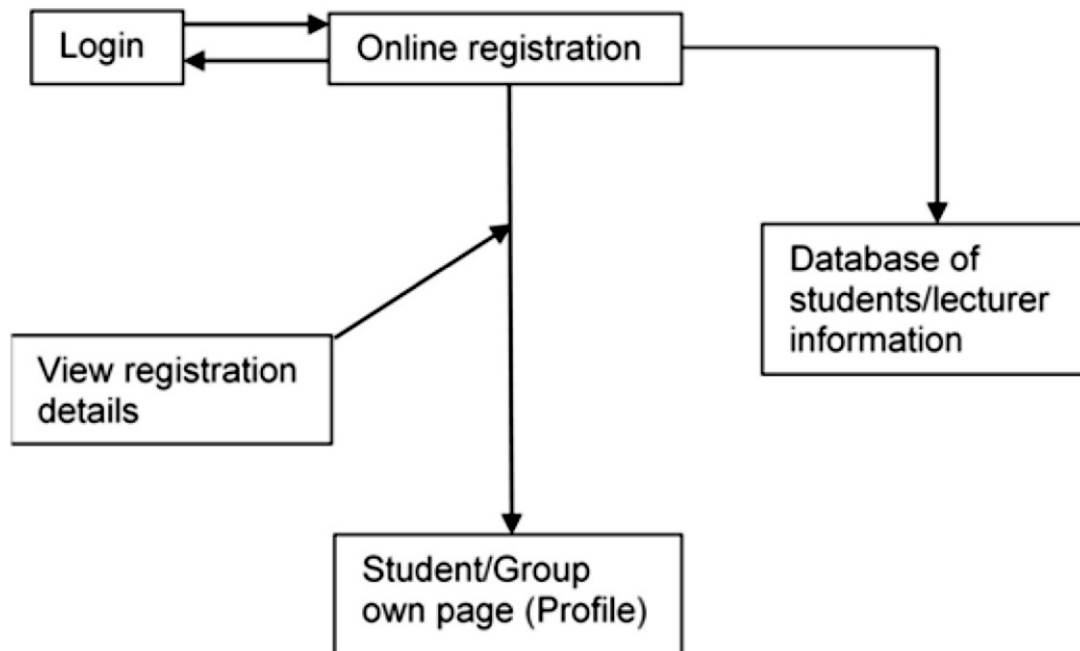


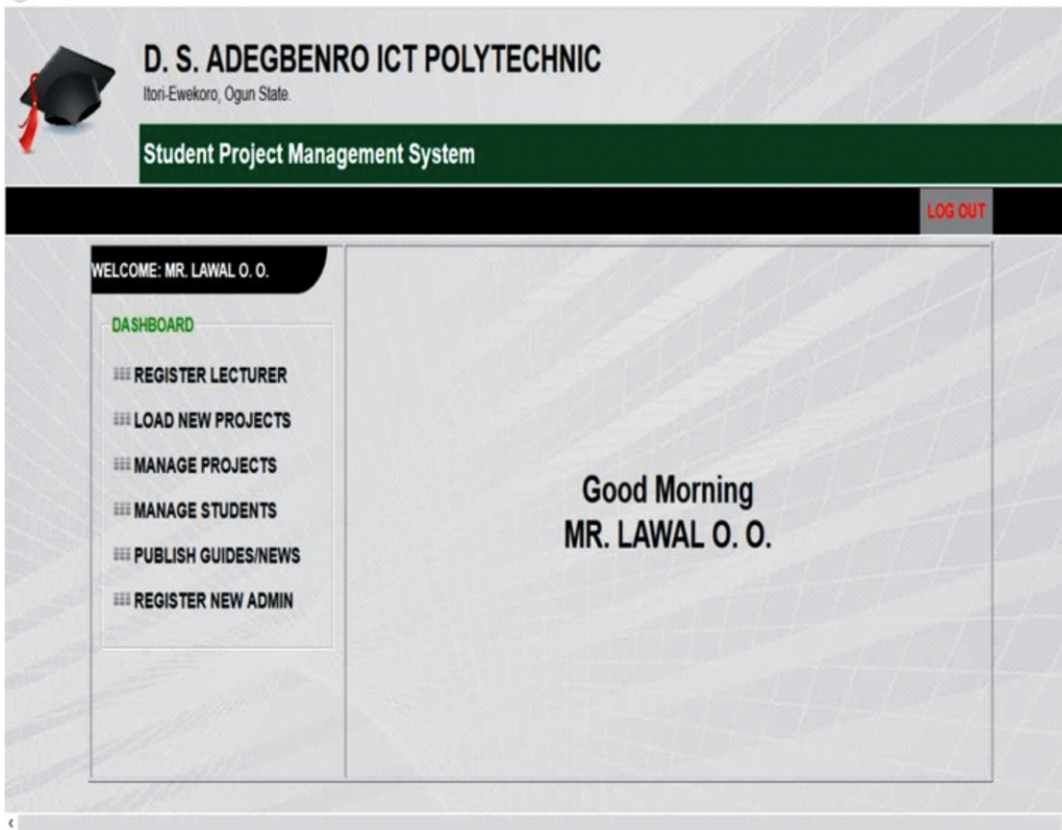
Fig. 1: System Flowchart

1.1 System Implementation

Implementation of the new system involves:

- (1) Training of staff
- (2) System testing
- (3) System changeover
- (4) System review and maintenance

3.6. Database Table Structure



3.7 System Implementation

Implementation of the new system involves:

- (1) Training of staff
- (2) System testing
- (3) System changeover
- (4) System review and maintenance

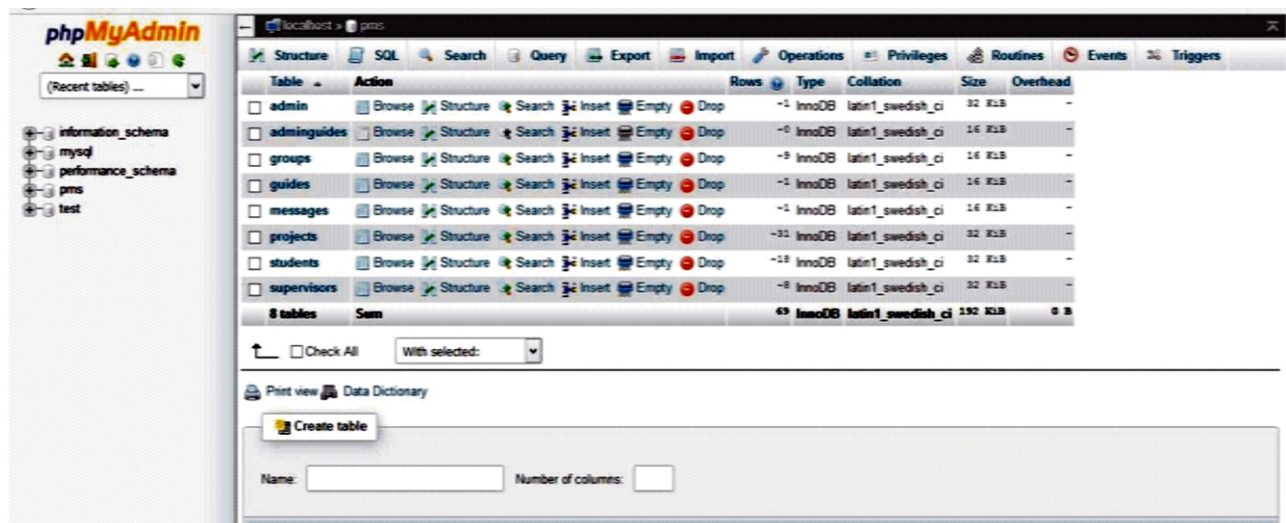


Fig. 2 Administrative Control Platform

1. DOCUMENTATION

The administrator controls the logging-in process in such a way that unauthorized users do not log in, add new lecturer/supervisor to the list, update lecturer/supervisor's profile, determine if a student should be given project supervisor after students' assessment, add and delete student or supervisor below requirement.

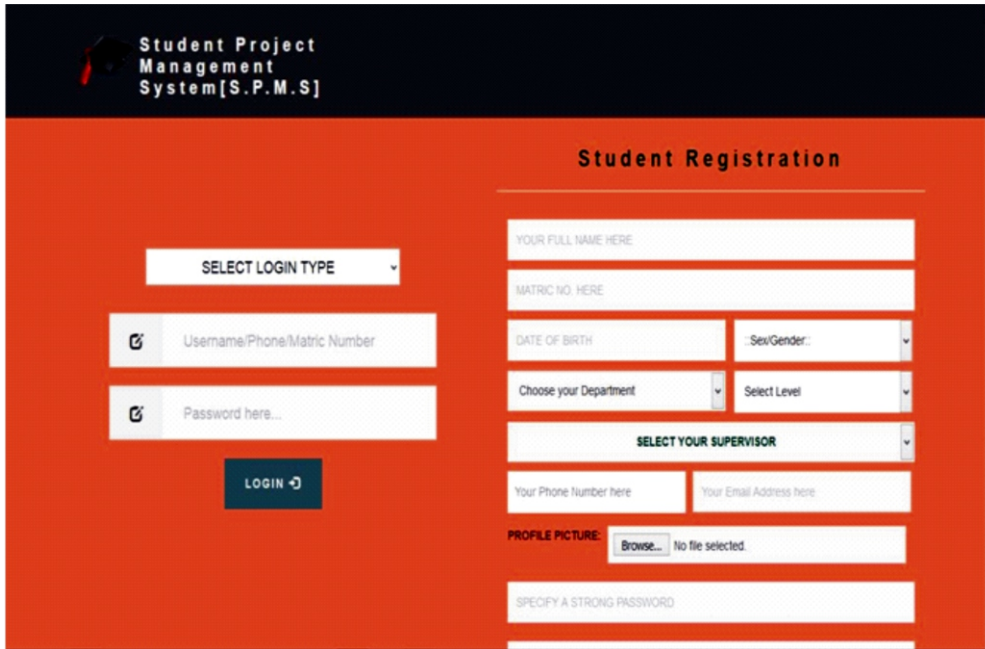


Fig 3: Login/Registration Platform

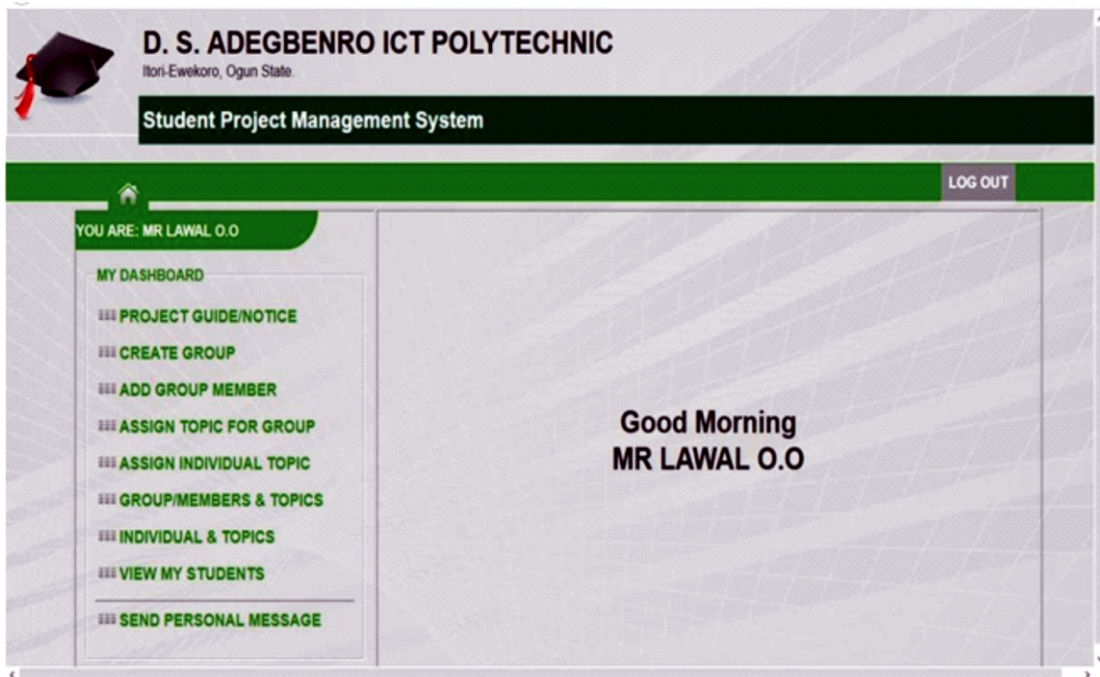


Fig 3: Supervisor Control Platform




| EDIT PROFILE | PROJECTS ARCHIVE | PROJECT GUIDES | INBOX (0) | LOGOUT

SEARCH PROJECT NAME **SEARCH**

PAST PROJECTS & DETAILS

MICROPROCESSOR	DETAILS
ONLINE SCHOOL PAYMENT MACHINE	DETAILS
COMPUTERIZED PERSONNEL INFORMATION MANAGEMENT SYSTEM	DETAILS
CUMULATIVE GRADE POINT AVERAGE AUTOMATION	DETAILS
A COMPUTERIZED BIRTHRATE MONITORING INFORMATION SYSTEM	DETAILS
THE ANALYSIS AND DESIGN OF INFORMATION SECURITY SYSTEM	DETAILS
PERSONAL COMPUTER (PC) SYSTEM	DETAILS
SALES INVENTORY SYSTEM	DETAILS
BIRTH AND DEATH REGISTRATION SYSTEM	DETAILS
1KVA SOLAR POWERED UNINTERRUPTED POWER SUPPLY INVERTER SYSTEM FOR ELECTRONIC DEVICE	DETAILS

Fig 4: Project Archive

 **D. S. ADEGBENRO ICT POLYTECHNIC**
Itori-Ewekoro, Ogun State.


Student Project Management System

< HOME | EDIT PROFILE | PROJECTS ARCHIVE | PROJECT GUIDES | INBOX (0) | LOGOUT

Welcome: NCS/13/EP/01159

GENERAL NEWS FROM SUPERVISOR

:: My Profile ::



Name: ADEDIRAN MATTHEW .

Matric: NCS/13/EP/01159

D.O.B.: SEPTEMBER 25

Sex: Male

Dept: Computer Science

Level: ND II

Phone: +234-8163149452

E-mail: mattex442@yahoo.com

Supervisor: MR LAWAL O O

[CHANGE PROFILE PICTURE](#) [EDIT PROFILE](#)

:: PROJECT DETAILS ::

Fig. 5: Student Profile

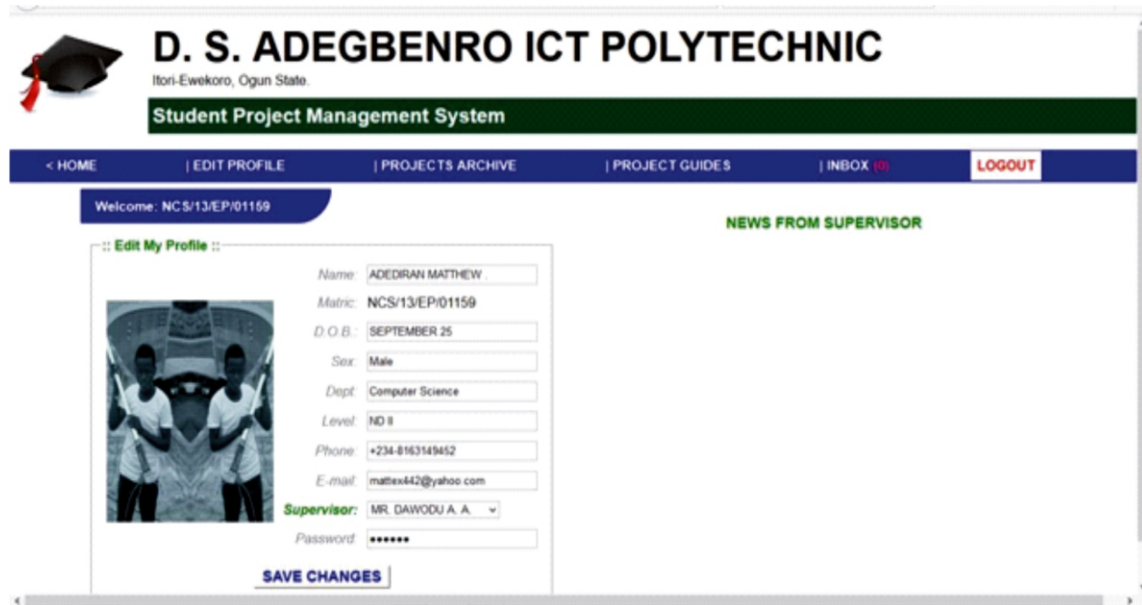


Fig. 6: Edit Student Profile

1. CONCLUSION

The traditional way of allocating projects is associated with many problems ranging from overcrowding of students on one project topic to the departmental record of the history of the project topic. However, we have been able to research and develop measures through which this shortcoming can be overcome with fewer problems.

Therefore, we have been able to develop a solution, if this system is adopted this problem can be addressed. The development of a web application that can administer student projects should be a welcoming development in our institution of various learning.

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ENHANCING TECHNICAL VOCATIONAL ENTREPRENEURIAL TRAINING (TVET) THROUGH SOFT SKILLS AMONG NIGERIAN GRADUATES.

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Abstract

Skill acquisition in addition to paper qualification is very important to be self-reliant and globally employable. Technical Vocational Entrepreneurial Training (TVET) on the other hand, produces graduates with technical skills for employability. The study focused on how to revitalize TVET graduates through soft skills in addition to technical skills for global employability. The research hypothesis stated that TVET graduates are not adequately equipped with soft skills in addition to technical skills. Data for the study were sourced from the primary source through a structured questionnaire designed to test the research hypothesis. The research population is the 2021/2022 Higher National Diploma graduates of Osun State College of Technology Esa-oke. The Higher National Diploma graduates of TVET programmes were taken as the sample size. The reason for this decision is that HND graduates will be going to the National Youth Service Corps. And the focus is the TVET graduates. Data analysis was done using descriptive statistics using grouped average mean. The result revealed that 70% of TVET graduates are not adequately equipped with soft skills. The reason was that the pedagogy of TVET placed more emphasis on the technical aspect of the curriculum. The study, therefore, recommended that provisions must be made for the acquisition of soft skills among TVET students since it is an added advantage among their colleagues in the global market and most especially opportunities come from interpersonal relationships before technical competency.

KEYWORDS: Soft skills, TVET, Global Employability, Revitalizing.

Background

The world had been linked together by information and communication technology (ICT) and this enables countries to source skilled workers anywhere in the world. For our graduates to be employable Technical, Vocational Entrepreneurial Training (TVET) was introduced into the curriculum.

(TVET) refers to all forms, levels of education, and training that provide understanding and skills related to occupations in various sectors of the economic and social life through formal, non-formal, and informal learning methods in both school-based and work-based learning contexts (UNESCO 2015). The curriculum of TVET focuses on the learning and mastery of expert techniques and the scientific principles that are essential to those techniques as well as general understanding, skills, and values (Njenga 2020).

Globally there is a higher rate of unemployment which are as a result of the economic recession, the effect of covid-19 pandemic, population increase, technological advancements, lack of skills underdeveloped labour market, and the natural rate of unemployment. In the developed world, mostly Europe Northern America, and the Asian Tigers, emphasis has shifted from Hard skills/technical provided by (TVET) to soft skills. Research findings have shown that graduates with soft skills and technical skills in the workplace are very mobile than their colleagues that are technically sound but deficient in soft skills (Billing 2003).



The evaluation of TVET graduates has shown that the majority of them are not equipped with the soft skills needed for competition and progress in the industries this therefore affects them and made some of them not employable (Robinson and Gorton 2007). Also, some research finding reveals that developing countries have improved the level of education attainment whereas the gap between formal education and the available work are on the increase.

Apart from the shortage of jobs, that affects the employability of our graduates, there is a changing world that is characterized by higher technology, resilience in the developed world, incorporated organizations, and global connectivity.

Being employable in the current world requires soft skills. What are soft skills? Soft skills are a set of skills, knowledge, and traits that likely assist the individual to excel, maintain, and achieve in an organization, employment mobile; charge roles in an organization and get promoted without delay. (Candy and Crebert 1991).

The soft skills include problem-solving and adaptability skills, professionalism, lifelong learning, teamwork skills, communication skills, information communication technology skills, initiative and enterprise skills, leadership skills, personal organization skills, Time management skills, Goal setting skills, and self-awareness skills, self-learning skills.

Unfortunately, our curriculum is obsolete to accommodate such skills. Instead, emphasis is focused on core courses, foundation courses, student industrial work experience general courses, and recently entrepreneurial courses with a focus on vocational skills.

Developing soft skills requires exposure of students to new ideas and characters, which requires self-determination, challenging practices, feedback, and reflections for efficient knowledge, therefore, requires instructors that will provide support, instructions, encouragement, and instruction to our students (Nagaoka 2015).

The world has become a global village given the rapid drive for technological advancements. Today's world of globalization implies that more people with the capacity are required to function effectively in a global context. Onwuachu (2014) defined a global worker as a person who can operate in different countries, cultures, and languages. Sirkin (2014) on his part opined that a global worker is a worker who can compete with everyone from everywhere for everything. The implication of the above is that such a worker should be able to operate effectively in different countries, cultures, and languages. It is also important to emphasize that to be a Global worker, one needs to be proficient in at least one other language; such as French, Arabic, Spanish, and/or the language of the environment and as well as possess a holistic knowledge and skills that are offered by TVET. Thus, a global worker is someone who has acquired the necessary knowledge, skills, and competencies for global competitiveness. Such an individual can compete effectively within the national and international markets.

Bhat (2013) observed that organizations need employees who have the required skills to fit into the global work arena and value those individuals who are flexible, courageous, and prepared to explore the world and take challenges head-on. Thus, producing a global worker simply implies preparing individuals with the knowledge, skills, and character necessary to be successful when working with people from varied cultural backgrounds, irrespective of location.

The driving forces of globalization and interdependence have made it crucial that students received the type of training that has a foreign outlook that includes global knowledge and skills.

Global employability requires TVET skills and soft skills. This is in response to submissions of Afeti (2006) which concluded that TVET skills are important skills in addition to soft skills. TVET



institutions therefore must equip graduates with the technical knowledge and soft skills needed to make them globally employable.

Statement of the Problem.

Revitalizing TVET through soft skills is a problem of the pedagogy and the curriculum of the training institutions. Nigeria's economy is not buoyant enough to accommodate the volume of graduates produced by tertiary institutions. Therefore, the issue of employability is primarily the challenge of economic growth and job creation in Nigeria. This, therefore, requires a concerted effort to stimulate economic growth and development.

The majority of our graduates are unemployable going by the feedback received from the industries. This is because they lack the appropriate skills needed for the declared vacancies (Bank, 2010). On the contrary, big companies and multinationals have decided to request expatriates to fill their vacancies since they possess the required technical and soft skills for the post declared indirectly, this has led to job loss among our graduates because the limited opportunities have been taken over by the alien.

Simon and Nale (2010) Massaro, Maurizio Roland, and Andrea (2016); Nilsson (2010) in their findings concluded that the development of soft skills among the graduates of tertiary institutions will enhance their and boost their chances of global employability.

Unfortunately; there is no empirical backup to determine how it affects the chance of global employability the study therefore aim at revitalizing TVET graduates and equipping them with soft skills to make them global workers.

Hypothesis

TVET graduates are not adequately equipped with soft skills in addition to technical skills.

Research Methods

Data for the study were sourced from the primary source. The Higher National Diploma graduates of Osun State College of Technology Esa-oke 2021/2022 academic session were the study group. The research population is two thousand nine hundred and seventy-five students which comprises all the Higher National Diploma graduates of the 2021/2022 academic session. The sample size was purposively determined using the TVETS programmes as the sample frame. The sample size is therefore one thousand nine hundred and thirty students.

The research instrument is a questionnaire; this was administered online through the WhatsApp platform, specifically created for the study. This was anchored by the group administrators who are the presidents of the TVETS departments. A total of one thousand five hundred and forty feedbacks were obtained from the respondents which is about 80% of the sample size were returned.

The questionnaire was administered to elicit information on the research questions of whether the graduating students were adequately equipped with soft skills in addition to technical skills. This was designed using the Likert scale adapted on five-point scales of 'very good', 'Good', 'indifference' 'poor' and 'very poor'. The graduating students were asked about the rate of acquisition of soft skills contents.

Findings

Table 1: Graduate / Respondent on the possession of soft skills.

S/N	Soft skills	Very good	Good	Indifferent	Poor	Very poor
1	Solving and adaptability skills	182	368	3	580	407
2	Teamwork / long-life learning skills	278	518	38	382	324
3	Communication skills	243	459	10	494	334
4	Information communication technology	316	557	76	430	161
5	Initiative and enterprise skills	188	405	20	542	385
6	Leadership skills	249	388	33	497	373
7	Personnel organization skills	231	340	8	618	343
8	Time management skills	313	410	43	303	471
9	Goals setting skills	216	442	10	544	328
10	Self-awareness and self-learning skills	302	537	14	373	314

Source: Author's 2023

Table 2: Percentage of Graduate / Respondent on the possession of soft skills.

S/N	Soft skills	Very good	Good	Indifferent	Poor	Very poor
1	Solving and adaptability skills	12%	24%	0%	38%	26%
2	Teamwork / long-life learning skills	18%	34%	2%	25%	21%
3	Communication skills	16%	30%	1%	32%	22%
4	Information communication technology	21%	36%	5%	28%	10%
5	Initiative and enterprise skills	12%	26%	1%	35%	25%
6	Leadership skills	16%	25%	2%	32%	24%
7	Personnel organization skills	15%	22%	1%	40%	22%
8	Time management skills	20%	27%	3%	20%	31%
9	Goals setting skills	14%	29%	1%	35%	21%
10	Self-awareness and self-learning skills	20%	35%	1%	24%	20%

Source: Authors 2023

Regarding the Solving and adaptability skills, 12% stated that they are “Very Good”, 24% stated they are “Good”, 0% stated they are “Indifference”, 38% stated they are “Poor” and 26% stated they are “Very poor”. These indicate that a cumulative percentage of 36% is good at this skill, which is generally low, while a larger percentage of 64% is poor at the skill. The result concurred with Di Fabio(2014); Jayaram and Engman(2017)Mwanga(2015) that soft skills content is not adequately incorporated into Nigerian graduates.

Regarding the Teamwork/long-life learning skills, 18% stated they are "Very good", 34% stated they are "Good", 2% stated they were "Indifference", 25% stated they are "Poor" and 21% stated they are "Very poor". These indicate that a cumulative percentage of 52% is good at this skill, which is generally high, while a smaller percentage of 48% is poor at the skill. The result is in contrast with the study of Leung and McGrath(2010) and Wheelan and Carter(2001) where it was stated that TVETgraduates lacked teamwork, due to the conventional ways of doing things. But in contrast to this, it was revealed that TVET graduates worked together as a team for their final project making it compulsory to have the interpersonal skills required for a team player.

Regarding Communication skills, 16% stated they are "Very good", 30% stated they are "Good", 1% stated they are "Indifference", 32% stated they are "Poor" and 22% stated they are "Very poor". This indicates that a cumulative percentage of 46% is good at this skill, which is generally low, while a larger percentage of 54% is poor at the skill. The result is in agreement with Hui and Cheung(2015) and Ismail and Mohammed (2015) where it was stated that communication skills are not adequately imparted to the graduates of TVET simply because the emphasis was placed on technical skills. Consequently, this will become a major impediment for the graduates to acquire further skills.

As regards Information Communication Technology, 21% stated they are "Very good", 36% stated they are "Good", 5% stated they are indifferent, 28% stated they are "Poor" and 10% stated they are "Very Poor". This indicates that a cumulative percentage of 57% is good at this skill, which is generally high, while a smaller percentage of 43% is poor at the skill. This is in concord with the findings of Shuaib (2013) and Mohammed and Buntat (2013) where it was stated that TVETS graduates are gradually acquiring information and communication technology(ICT) due to the technical nature of the machines and the need for the internet facilities for training and troubleshooting.

Concerning the Initiative and enterprise skills, 12% stated they are "Very good", 26% stated they are "Good", 1% stated they are indifferent, 35% stated they are "Poor" and 25% stated they are very "Poor" This indicates that a cumulative percentage of 38% are good at this skill, which is generally low, while a larger percentage of 62% is poor at the skill. the result agreed with Hampton,(2002), and Ongaro (2015) where it was stated that TVET graduates lacked leadership skills because they were taught through a demonstration process, similarly, the equipment is very expensive thereby making them fearful to relate well with them which later affect their decision-making skills.

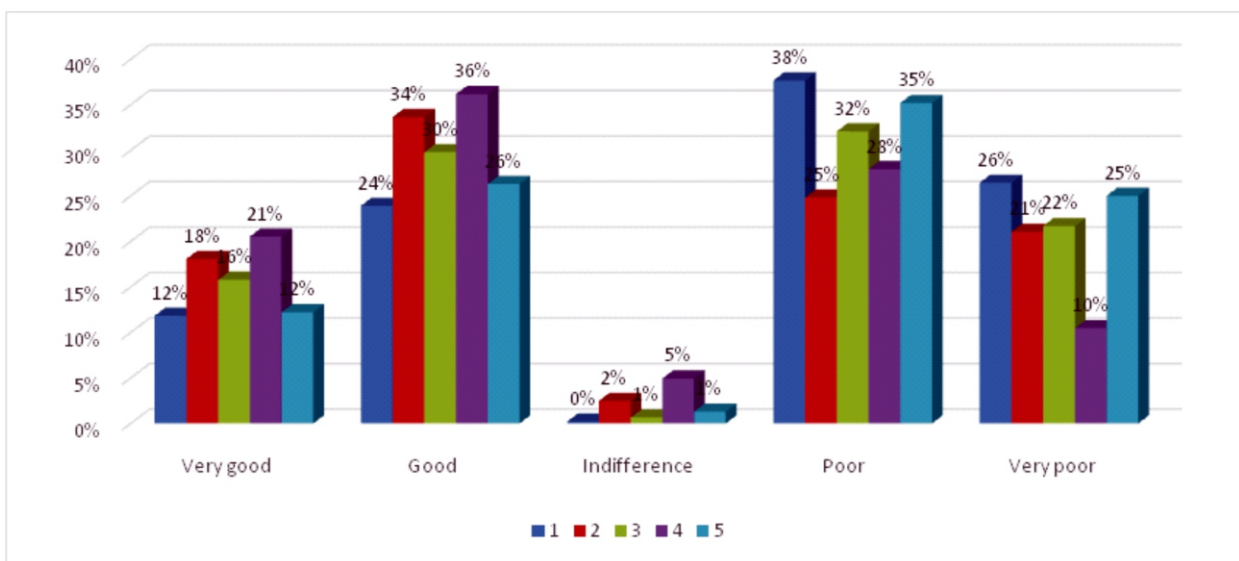


Figure 1: Statistics showing the distribution of soft skills

About the Leadership skills, 16% stated they are "Very good", 25% stated they are "Good", 2% stated they are indifferent, 32% stated they are "Poor" and 24% stated they are very "Poor". This indicates that a cumulative percentage of 41% is good at this skill, which is generally low, while a larger percentage of 59% is poor at the skill. TVET graduates are poor in leadership skills because they were trained with theories and science. Models and empirical findings were tested and results were published. This is in agreement with (Daud2013; Hadi2015; and Montage2013).

On the Personnel organization skills, 15% stated they are "Very good", 22% stated they are "Good", 1% stated they are indifferent, 40% stated they are "Poor" and 22% stated they are very "Poor". This indicated that a cumulative percentage of 37% is good at this skill, which is generally low, while a larger percentage of 63% is poor at the skill. TVET graduates are low in personnel organization simply because their curriculum is deficient in behavioral science.

Concerning Time management skills, 20% stated they are "Very good", 27% stated they are "Good", 3% stated they are indifferent, 20% stated they are "Poor" and 31% stated they are very "Poor". This indicates that a cumulative percentage of 47% is good at this skill, which is generally low, while a larger percentage of 53% is poor at the skill. TVET graduates are poor time managers simply because they focus more on the acquisition of technical skills, not minding the allotted time. The finding agreed with (Boahin et al 2014)

Regarding the Goals setting skills, 14% stated they are "Very good", 29% stated they are "Good", 1% stated they are "Indifference", 35% stated they are "Poor" and 21% stated they are "Very poor". These indicate that a cumulative percentage of 43% is good at this skill, which is generally low, while a larger percentage of 57% is poor at the skill. TVET graduates preferred to work under the supervision of a manager and left the supervision and goal-setting skills to his hand.

On the Self-awareness and self-learning skills, 20% stated they are "Very good", 35% stated they are "Good", 1% stated they are "Indifference", 24% stated they are "Poor" and 20% stated they are "Very poor". This indicates that a cumulative percentage of 55% are good at this skill, which is generally high, while a larger percentage of 45% is poor at the skill. The result is at variance with (Sira 2016) where it was opined that TVET graduates worked together, but the findings are on the contrary simply because there is competition just to outsmart one another.

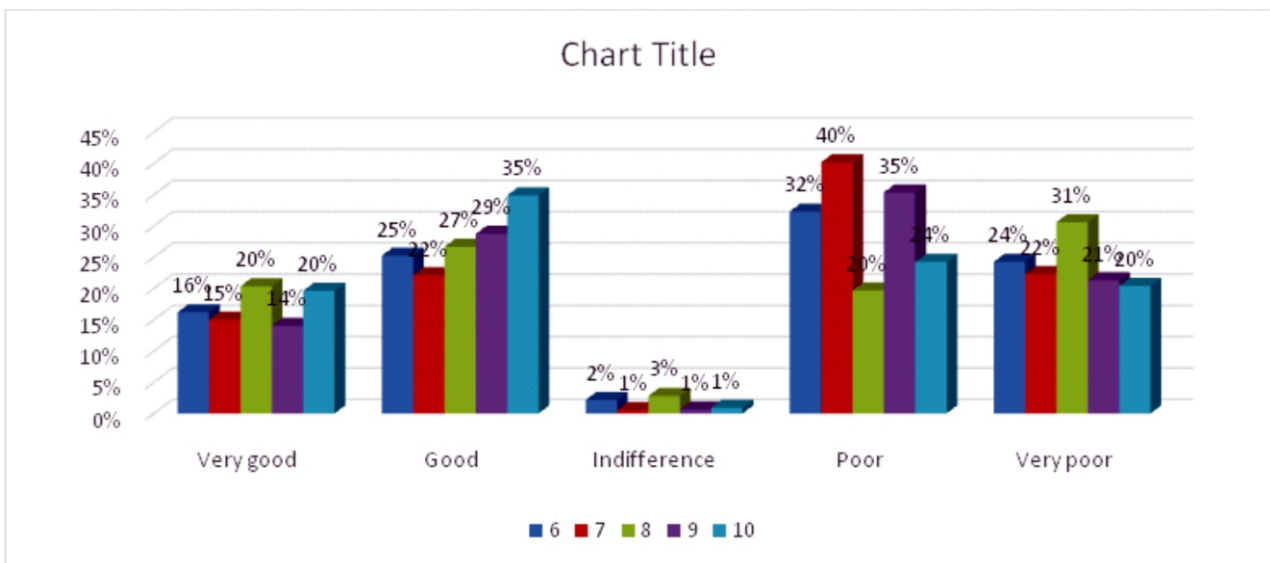


Figure 2: Statistics showing the distribution of soft skills

Using the weighted average mean, the study will test the null hypothesis

Ho: TVET graduates are not adequately equipped with soft skills in addition to technical skills.

H1: TVET graduates are adequately equipped with soft skills in addition to technical skills

The weighted average mean is obtained by finding the total and the average of the skills that are captured in the TVET curriculum

$$\text{WeightedAverageMean} = \frac{\sum_{i=1}^N \bar{X}}{N}$$
$$\text{WeightedAverageMean} = \frac{28.582}{10}$$
$$\text{WeightedAverageMean} = 2.85$$

In the decision column in the table below, every skill that has a mean less than the overall average mean is considered as not being effectively used or well-equipped among students.

Table 3.0: Mean and Standard Deviation of the questionnaire

S/N	Soft skills	Mean	SD	Decision
1	Solving and adaptability skills	2.57012987	2.44869	Low
2	Teamwork / long-life learning skills	3.02857143	2.87939	High
3	Communication skills	2.85909091	2.72268	Low
4	Information communication technology	3.28376623	3.04938	High
5	Initiative and enterprise skills	2.65519481	2.52571	Low
6	Leadership skills	2.76818182	2.65164	Low
7	Personnel organization skills	2.67402597	2.5462	Low
8	Time management skills	2.86428571	2.79657	Low
9	Goals setting skills	2.78831169	2.64477	Low
10	Self-awareness and self-learning skills	3.09090909	2.94032	High

Considering the result of the above analysis, the result shows that 70% of the students are not adequately equipped with the necessary TVET skills, which shows that the null hypothesis is true and it is accepted based on the statistical

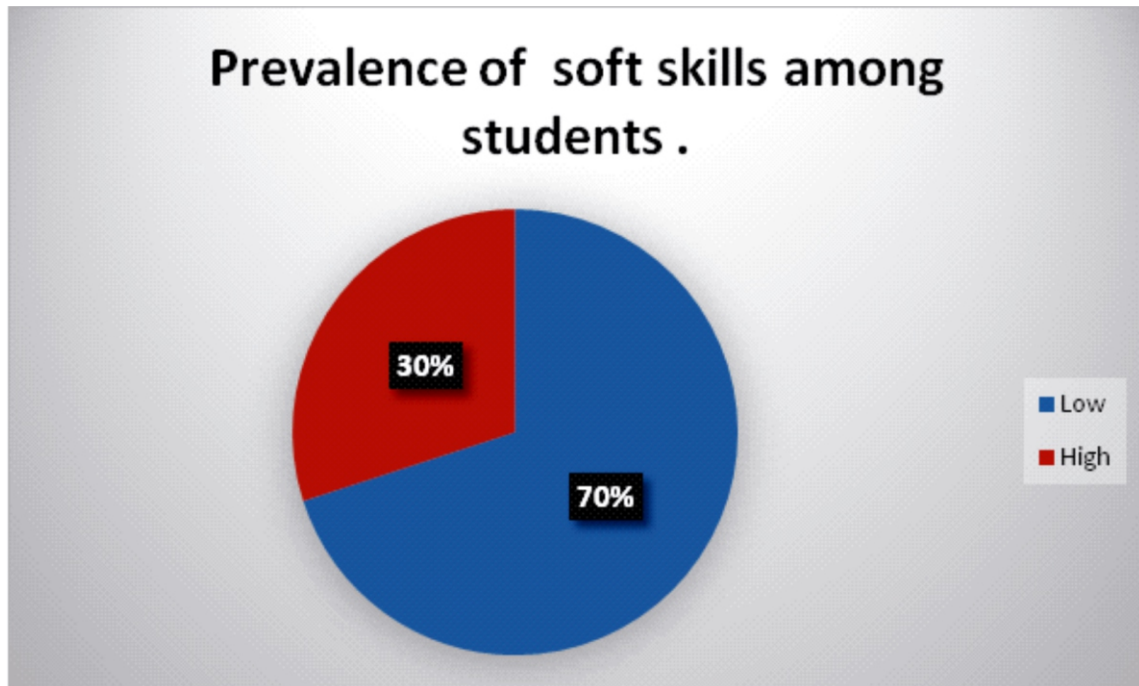


Figure 3: Prevalence of skills among students

Conclusion and Recommendations

From the empirical findings, the null hypothesis which stated that our TVET graduates are not adequately equipped with soft skills is accepted. However, revitalizing our graduates with soft skills, for global employability is a task for everybody. To conclude each of the highlighted skills requires different approaches which were highlighted as follows:

On solving and adaptability skills, the student must be made to engage in a task that is beyond their scope to task their brain and adapt quickly to different challenges modeling real-life challenges will be an example of the task to test the solving and adaptability skills of the students.

Concerning teamwork, practical tasks must be in groups and scored individually and each of them must be made to participate in each of the stages. On communication skills, instructions must be passed in the English language with emphasis on diction and syntax. Attempts must also be made by the management and the directorate of general studies to introduce a foreign language for TVETS students.

As regards information and communication technology skills, lecturing must be hybrid. i.e. virtual and physical lecturing methods. This should be adopted. Learning applications and platforms should be introduced to the students' physical interaction should be limited and lecturing, grading, and interaction should be through the Internet.

To acquire leadership skills, students must be encouraged to engage in other activities like student association, students' unionism, etc and courses like leadership skills and personnel psychology should be introduced in their general studies curriculum. On personnel organization, students must be made to realize that TVET is a collective effort where various technical people are involved therefore personnel skills in human relation management should be taught.

Time management is very crucial that is why emphasis must be placed on timing for class work, assignments, and class tests so that the habit will be incorporated into the students at the training



stages 'Goal setting is very important and the students must be taught the ability to set a target within a time frame and available resources that is why courses on administration should be introduced,

TVET students should be made to realize that discipline is the watchword and they should be self-made and self-reliant. To revitalize TVET through soft skills, the TVET colleges must be made to realize the need for curriculum review to incorporate relevant soft skills and also need to train and retrain the lecturers on the importance of soft skills to teach the student adequately. Soft skills training should be in market demand where the emphasis will be on the employers' feedback and rating. Linkages with experts and professional bodies on collaborations to impact knowledge will be an added advantage.

Programme support skills from corporate organizations, Alumni, etc must be introduced to train students on market demand-driven skills. Experimental learning should also be encouraged, this will be an added advantage for the students.

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PHYSICOCHEMICAL AND HEAVY METAL EVALUATION OF DRINKING WATER FROM VARIOUS SOURCES IN ESA-OKE COMMUNITY IN OBOKUN LOCAL GOVERNMENT, OSUN STATE, NIGERIA.

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Abstract

Water is essential to life and it is most abundant in nature. All living organisms including man and animals need water for survival and growth, hence the quality of drinking water is of great importance to Man because of water-related diseases such as dysentery, diarrhoea, etc. This study is aimed at evaluating the quality of drinking water available to students and indigents of Esa-Oke. Fourteen water samples were collected from different sources in esa-oke, physiochemical properties, and heavy metals determination were carried out on the water samples using standard methods. The test includes organoleptic tests such as odour, taste, and colour. Physiochemical parameters such as conductivity (EC), turbidity, ORP, TDS, NO_3^- , Cl^- , pH, etc. Zinc and Manganese were determined for heavy metals. The result shows that the majority of the water samples complied with the W.H.O standard and hence they are safe for human consumption, the Mn and Zn found in the water samples are within the acceptable limits of WHO. This study has confirmed that the majority of the sources of drinking water in Esa-Oke are safe for drinking and free from toxic heavy metals.

Keywords: Water, water quality, toxic heavy metals, physiochemical evaluation

Introduction

Water is one of the most important and abundant compounds in the ecosystem. All living organisms on the earth need water for their survival and growth. The earth is made up of 70% water bodies; the effect of the increased use of fertilizers in the agricultural sector, increase in industrialization, human population, and man-made activities has led to increasing pollution of water bodies. Hence, it is difficult to ascertain the quality of water if not regularly checked. This is because the drinking water can be contaminated periodically and the human population can suffer from various forms of waterborne diseases. (Basavaraja simpil *et al.*, 2011).

The population increase and the inability of the government to meet-up up basic responsibilities such as the provision of quality water for the citizens, people resort to other sources of water such as hand-dug wells, boreholes, streams, groundwater, and shallow wells, especially during the dry season (LAWMA, 2000).

The parameters that govern the quality of water depend on various water constituents (chemical, biological & environmental) which are mostly derived from the geological data of the particular region. Waste from industries and solid waste from the environment has emerged as one of the leading causes of pollution of ground and surface water. The extent of heavy metals in water from these sources has exceeded the acceptable limit by W.H.O., therefore rendering the water in the environment non-portable and non-drinkable. The situation is worsened in the dry season due to scarcity of water and the little water available is unfit for drinking. Contamination of water sources available for household and drinking purposes with heavy elements, metal ions, and harmful microorganisms is one of the serious major health problems. A recent study has shown that the lack of strict enforcement of the law on inappropriate dumping of solid and liquid wastes is the major cause of poor water quality (Gupta, 2009).

Esa-Oke is a town located in Obokun Local Government Area of Osun State. It is an Ijesa community and shares boundaries with other towns. The people of Esa-Oke were predominantly peasant

farmers. The farmers drink water from streams and hand-dug wells especially when they are on the farm. The majority of the people who reside in the town drink untreated water such as streams, hand-dug wells, and Sachet water. Therefore, the essence of this research is to determine the quality of water that is accessible to the people who reside in the town.

Materials and Methods

Esa-Oke is a small town located in Osun State, South West Nigeria. It covers hundreds of kilometers of different land units. In this study 14 samples were collected from various sources; the sample name and descriptions are listed below:

Table 1:

S/No	SAMPLE NAME	DESCRIPTION
1	EP – STW	STW
2	AF- STW	STW
3	AK – STW	STW
4	FB – SW	SW
5	CB – SW	SW
6	GK – SW	SW
7	OSCO – SW	SW
8	HL – HDW	HDW
9	PL – HDW	HDW
10	MQ – HDW	HDW
11	FL - HDW	HDW
12	M 99 – HDW	HDW
13	CL – HDW	HDW
14	AWG – HDW	HDW

STW = Stream Water; SW = Sachet Water; HDW = Hand Dug Well

The samples were collected from various sources into 2.5L plastic containers and at each point of collection; the containers were rinsed with the water sample before collecting the samples.

The freshly collected samples were refrigerated in a cooler packed with ice blocks to avoid microbial action and kept away from sunlight. The physicochemical properties of the water samples were determined according to standard methods and were done in triplicates. The test includes organoleptic tests such as odour, taste, and colour. Physiochemical parameters such as conductivity (EC), turbidity, Oxidation Reduction Potential (ORP), Total Dissolved Solids (TDS), Nitrate (NO_3^-), Nitrite, free chlorine (Cl), total chlorine, chloride, total hardness, Total alkalinity, fluoride, pH, and temperature.

The heavy metal concentrations were estimated with a flame photometer using the direct aspiration method (APHA 1985). The data generated were compared with World Health Organization (W.H.O) standards for drinking water.



Results

Table 2: Results of Organoleptic Parameters of Drinking Water collected from various Sources in Esa-Oke

Samples	Odour	Colour	Taste
W.H.O	Odourless	Colourless	Tasteless
EP – STW	Odour	Coloured	Tasted
AF- STW	Odourless	Colourless	Tasteless
AK – STW	Odourless	Colourless	Tasteless
FB – SW	Odourless	Colourless	Tasteless
CB – SW	Odourless	Colourless	Tasteless
GK – SW	Odourless	Colourless	Tasteless
OSCO – SW	Odourless	Colourless	Tasteless
HL – HDW	Odourless	Colourless	Tasteless
PL – HDW	Odourless	Colourless	Tasteless
MO – HDW	Odourless	Colourless	Tasteless
FL - HDW	Odourless	Colourless	Tasteless
M 99 – HDW	Odourless	Coloured	Tasted
CL – HDW	Odourless	Coloured	Tasted
AWG – HDW	Odourless	Coloured	Tasteless

Table 3b: Mean values of heavy metals and physicochemical parameters in various water sources from Esa-Oke

Sites	Cl ⁻ (mg/L)	Total hardness	TA	Fluoride	Zn (mg/L)	Mn (mg/L)
EP - STW	48.67 ± 1.04	101.67 ± 6.02	38.33 ± 1.55	1.45 ± 0.23	2.92 ± 0.56	0.03 ± 0.01
AF- STW	ND	108.17 ± 2.53	32.20 ± 2.10	ND	0.16 ± 0.91	ND
AK - STW	180.03 ± 7.22	100.00 ± 5.12	34.00 ± 1.05	1.49 ± 0.12	2.32 ± 0.46	0.07 ± 0.01
FB - SW	61.33 ± 0.57	91.90 ± 1.38	40.00 ± 1.42	ND	0.15 ± 0.04	ND
CB - SW	77.67 ± 1.25	44.00 ± 1.13	57.67 ± 0.32	1.09 ± 0.61	0.13 ± 0.02	ND
GK - SW	101.33 ± 16.94	37.67 ± 4.22	36.33 ± 1.53	0.02 ± 0.01	0.93 ± 0.11	0.03 ± 0.00
OSCO - SW	22.67 ± 2.22	112.33 ± 12.53	101.33 ± 0.49	0.02 ± 0.01	0.64 ± 0.02	0.01 ± 0.00
HL - HDW	17.67 ± 0.45	52.33 ± 3.21	56.23 ± 0.93	1.24 ± 0.55	0.13 ± 0.1	0.01 ± 0.00
PL - HDW	52.17 ± 1.15	66.33 ± 7.02	52.10 ± 0.24	0.92 ± 0.05	0.19 ± 0.03	0.01 ± 0.00
MQ - HDW	20.00 ± 0.56	74.53 ± 1.56	104.47 ± 6.32	0.03 ± 0.01	0.75 ± 0.04	0.01 ± 0.00
FL - HDW	17.33 ± 3.91	34.33 ± 2.61	52.40 ± 3.20	ND	0.44 ± 0.01	0.03 ± 0.01
M99 - HDW	46.67 ± 2.46	46.33 ± 1.14	42.33 ± 0.94	ND	1.43 ± 0.08	0.05 ± 0.02
CL - HDW	270.67 ± 18.54	40.67 ± 0.91	22.67 ± 1.03	ND	0.86 ± 0.14	0.07 ± 0.03
AWG - HDW	105.00 ± 3.66	56.33 ± 3.45	44.33 ± 0.63	ND	0.73 ± 0.12	0.07 ± 0.02
Mean ± sd	72.94 ± 19.76	69.04 ± 7.62	51.03 ± 6.43	0.45 ± 0.17	0.84 ± 0.23	0.03 ± 0.01
CV	101.36	41.29	47.16	140.04	101.40	96.71
ANOVA < 0.05	42.69	0.70	0.60	0.36	0.49	0.02
WHO	250 mg/L	150 mg/L	250 mg/L	1.5 mg/L	3.00 mg/L	0.03 mg/L

TA = Total Alkalinity; CV = Coefficient of Variation

CV = Coefficient of Variation, ORP = Oxidation Reduction Potentials; EC = Conductivity; TDS = Total Dissolved Solids

TA = Total Alkalinity; CV = Coefficient of Variation

Table 5: Two-Tailed Pearson's Correlation Coefficient of Physicochemical Parameters

	Temp	pH	ORP	Cond	TDS	Nitrate	Nitrite	F-Cl ₂	T-Cl ₂	Cl ⁻	T-H	C-H	M-H	Flu	TA	Zn	Mn
Temp	1																
pH	-0.55*	1															
ORP	0.105	0.206	1														
Cond	0.050	-0.099	-0.227	1													
T.DS	0.125	-0.051	-0.163	0.94**	1												
Nitrate	-0.166	0.040	-0.389	-0.396	-0.419	1											
Chlo	0.148	-0.084	0.322	0.023	0.008	-0.164	-0.073	-0.255	0.105	1							
T-H	-0.204	0.338	-0.241	-0.269	-0.267	0.689*	0.481*	0.399	-0.284	-0.240	1						
Flu	0.161	-0.204	-0.392	0.440	0.356	-0.106	0.168	0.288	0.027	-0.507*	0.200	0.251	0.045	1			
TA	-0.603*	0.254	-0.308	-0.031	0.027	0.371	0.304	-0.119	-0.264	0.066	0.187	0.289	0.127	-0.137	1		
Zn	0.043	-0.359	-0.366	-0.325	-0.340	0.605*	0.756*	0.284	0.222	0.292	0.291	0.211	0.348	-0.232	0.425	1	
Mn	0.351	-0.372	0.279	-0.354	-0.354	-0.005	0.140	-0.114	0.761*	0.731*	-0.256	-0.283	-0.109	0.846*	-0.018	0.545*	1

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

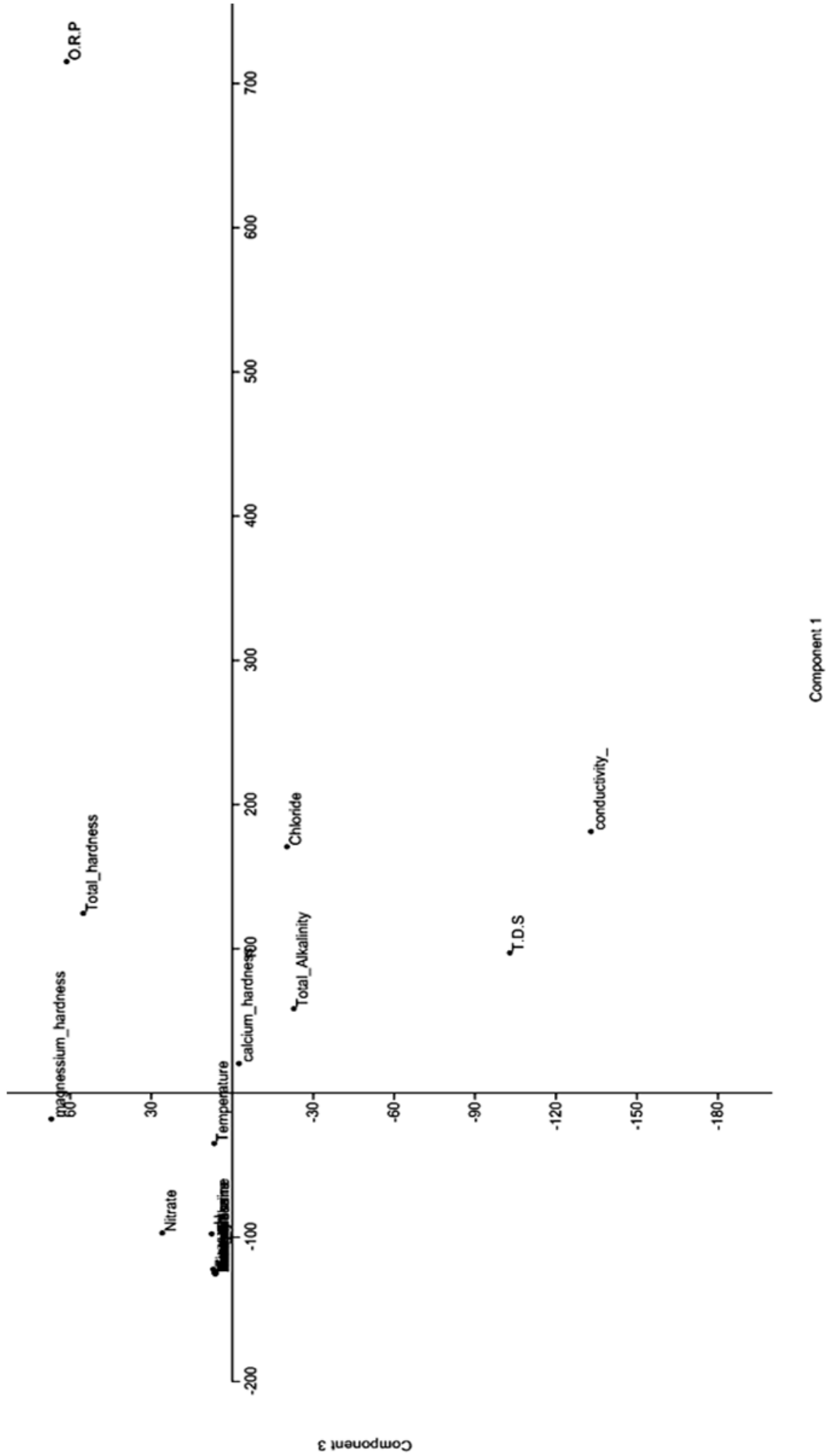


Fig. 1: Principal Component Loadings of Physicochemical Parameters

DISCUSSION

4.1 Physicochemical Parameters

Average values of the heavy metals and physicochemical parameters of various sources of water samples from the sites studied in Esa-Oke, Osun State are presented in Table 3 and Table 4.

Change in Temperature

Temperature changes affect many physical, biological, and chemical characteristics of an aquatic ecosystem: the amount of oxygen that can be dissolved in water, the rate of photosynthesis of plants, metabolic rates of animals, and the sensitivity of organisms to toxic wastes, parasites, and diseases (McNeill and Edwards, 2000). The result showed the highest mean values in the samples FL-HDW and AWG-HDW respectively with 25.33°C. The overall mean value of water temperature ranged between 22.00°C and 25.33°C (Table 3).

The ANOVA result showed that the temperature was significantly different in all locations at 95% confidence levels. Temperature played a significant role in the corrosion of iron pipes in drinking water distribution systems. Temperature impacts many parameters that are critical to pipe corrosion including physical properties of the solution, thermodynamic and physical properties of the corrosion scale, chemical rates, and biological activity (McNeill and Edwards, 2000).

4.1.2 Total Alkalinity

The results of the mean concentrations of total alkalinity are presented in Table 3. The phenolphthalein alkalinity for this study was evaluated to be zero, which implied that the samples had little or no acid-neutralizing power anions such as hydroxide and carbonate. The highest alkalinity level was observed in MQ-HDW with a mean value of 104.47 ± 6.32 mg/L while the lowest was in CL-HDW with a mean value of 22.67 ± 1.03 mg/L. The variation in the results was a result of increased dilution and influx of fresh water during sampling as the underground aquifer is replenished with fresh water. The overall mean concentration of TA was 51.03 ± 6.43 mg/L. When subjected to one-way ANOVA, there was a significantly different at $p < 0.05$ in the levels of alkalinity of the water samples.

The mean value of total alkalinity obtained was lower when compared with the WHO safety limit set at 250 mg/L. This result is in agreement with the report of Yisa, *et al.*, (2013) who recorded lower total alkalinity in underground water in the Doko Community, Niger State Nigeria. Alkalinity has little or no public health significance (Radojevic and Baskin, 1999). However, highly alkaline water is unpalatable and not good for domestic water supply.

4.1.3 pH

The result in Table 3 shows the physicochemical properties of various water sources at Esa-Oke with World Health Organization (WHO, 2003) standards for drinking water. The hydrogen ion concentration of pH was both acidic and slightly basic with a ratio of 60:40 percent respectively. The mean value of pH was found with the lowest value at EP-STW at 5.23 ± 0.42 mg/L and the highest pH value was observed at AF-STW with 10.30 ± 0.22 mg/L with an overall mean value was 7.41 ± 0.43 mg/L. pH variations were statistically different at a 5% level ($P < 0.05$) across the sites.

4.1.4 Total Dissolved Solids (TDS)

The results of total dissolved solids were presented in Table 3 with the mean values ranging from 16.73 ± 1.26 mg/L (AF-STW) and 129.10 ± 12.48 mg/L (PL-HDW). The overall mean was 59.35 ± 8.90 mg/L. However, the variations across the samples were not by different significant ($P > 0.05$). All the results of TDS were far lower when compared with -WHO standard maximum permissible limits in drinking water. Another evidence of pollution is the high level of TDS (Amadi *et al.*, 2006). A low level of total solids shows good quality river waters, while the very high value of TDS confirms the observed high conductivity value of the potable water samples. The above result agrees with the reports of other researchers (Amadi *et al.*, 2006; Adekunle *et al.*, 2007) in polluted water samples.

4.1.5 Conductivity (EC)

The result from Table 3 shows a low mean value of 25.00 ± 4.01 ($\mu\text{S}/\text{cm}$) while the highest mean value was observed at 136.67 ± 17.85 ($\mu\text{S}/\text{cm}$) with an overall mean value of 82.20 ± 11.12 ($\mu\text{S}/\text{cm}$). The differences in means were not significant across the stations. The high conductivity level of the potable water samples indicates electrolyte contaminants but, does not give information of a specific chemical (Adekunle *et al.*, 2007). The high conductivity level may also explain the high level of total hardness which may be due to the appreciable high concentration of calcium and magnesium in the water sample sources.

4.1.6 Hardness

The total hardness values ranged between 34.33 ± 2.61 mg/L (FL-HDW) and 112.33 ± 12.53 mg/L (OSCO-SW) with an overall mean value of 69.04 ± 7.62 mg/L. The result shows variations in hardness, however, they were not significantly different ($P > 0.05$) across the samples. The total hardness values were within the recommended value of 150 mg/L by World Health Organization for potable water (WHO, 2003). It was recorded that the high conductivity level of the potable water samples indicates electrolyte contaminant but, does not give information of a specific chemical (Adekunle *et al.*, 2007). The high conductivity level may also explain the high level of total hardness which may be due to the appreciable high concentration of calcium and magnesium in the potable water sources. Calcium and magnesium have been reported to be consistent with total hardness. A very high level of total hardness makes water unfit for domestic use.

4.1.7 Nitrate

The result (Table 3) obtained shows that the level of nitrate ranged from 0.27 ± 0.05 mg/L (CL-HDW) to 33.97 mg/L (EP-STW) with an overall mean value of 8.50 ± 3.00 mg/L. The mean differences were not significant across the sampling points. Nitrate values obtained were below the World Health Organization's recommended value of 50 mg/L for potable water (WHO, 2003). The level of non-metallic ions such as nitrate and chloride in the potable waters may be traced to the dissociation of their metallic compounds, oxidation of other forms of the compound, high degree of organic pollution, and type of minerals in the bedrock, eutrophication, agricultural activities, and use of detergents (Osibanjo and Adie, 2007). Nitrate concentration above 10 mg/L is dangerous to pregnant women and poses a serious health threat to infants less than three to six months of age because of its ability to cause methemoglobinemia or blue baby syndrome in which blood loses its ability to carry sufficient oxygen (Burkart and Kolpin, 1993).

4.1.8 Fluoride

The mean Fluoride level in water samples (Table 4) ranged between ND (AF-STW, FB-SW, FL-HDW, M99-HDW, CL-HDW, and AWG-HDW) and 1.49 ± 0.23 mg/L (AK-STW), with overall mean values of 0.45 ± 0.17 mg/L. Fluoride values were lower than the WHO maximum permissible level of 1.5 mg/L. High fluoride levels in drinking water may lead to a reduction in total erythrocyte, hemoglobin percentage, hematocrit value, protein content, and then fluorosis (Sharma *et al.*, 2004). This implies that the water samples are polluted with organic and inorganic substances and therefore fit for drinking at their present state.

4.2 Heavy Metal Contents

The mean values of some heavy metals in water from various sources from Esa-Oke are presented in Table 5. The overall results of water samples showed variations in the distributions of Zn and Mn. The mean value of Zn ranged between 0.13 mg/L (CB-SW and HL-HDW) and 2.92 mg/L (EP-STW). In this study, Zn is the most concentrated metal of interest. The values of Zn were below the recommendation of WHO's maximum permissible limit of 3.00 mg/L (WHO, 2003). The CV values (Table 4) indicate that CV values of Zn were far higher ($CV \geq 10$), it could be that their presence in the water samples was due to a sudden addition in large quantities from either natural or anthropogenic sources (Oyekunle *et al.*, 2012), which also means that they might be present not as a result of slight changes factors. Zinc is present in large amounts in natural water. The relatively high Zn level observed in this study is suggestive of the influence of refuse dumps and domestic sewage sources. It could also be attributed to industrial effluents discharged into the water source. The

variations were significantly different across the experimental sites (Table 5). This suggests the intense anthropogenic influence due to industrialization and urbanization within the sampling area. Zn is an enzyme co-factor in several enzyme systems including carbonic anhydrase found in red blood cells. The chance of being poisoned with Zn is rare because salts of alkaline earth elements reduce the toxicity of Zn. High temperature and low dissolved oxygen concentration lead to an increase in the toxicity of Zn. Its toxicity to fish according to Alabaster and Lloyd (1982) and Everall *et al.* (1989) can be greatly influenced by both water hardness and pH. It is one of the earliest known trace metals and a common environmental pollutant, which is widely distributed in the aquatic environment. Studies have also shown that it could be toxic to some aquatic organisms such as fish. It has been found to have a low toxicity effect in men. However, the prolonged consumption of large doses can result in some health complications such as fatigue, dizziness, and neutropenia.

The mean Mn concentration in water in this study ranged from not detected (ND) at AF-STW, FB-SW, and CB-SW respectively to 0.07 mg/L (AK-STW, CL-HDW, and AWG-HDW) with an overall mean value of 0.03 mg/L, though there were variations across the stations that were not significantly different ($P > 0.05$). The coefficient of variation (CV) values (Table 4) shows that CV values of Mn were very high ($CV \geq 10$), it could be that their presence in the water samples was due to a sudden addition in large quantities from either natural or anthropogenic sources (Oyekunle *et al.*, 2012). Most results of Mn from this study were above the recommended or acceptable level for drinking potable water of 0.03 mg/L set by the World Health Organization (WHO, 2003). Mn in nature is found in the form of oxides, silicates, and carbonates. It functions as a co-factor in the synthesis of urea from ammonia, amino acid and fatty acid metabolism, and glucose oxidation. Inhalation of a high dose of Mn leads to death. The health-based guideline value is 0.03 mg/L (WHO, 2003). The symptoms in men include problems with the central nervous system, euphoria, insomnia, serious headache, and palsy of feet.

Mn is an element of low toxicity having considerable biological significance and one of the more biogeochemical and active transition metals in aquatic environments. It occurs in surface waters that are low in oxygen and often does so with Fe. It accumulates in certain species of fish.

4.3 Interrelationship between Physicochemical Variables

A linear regression correlation test was performed to investigate correlations between two or more variables. All data were subjected to statistical analysis and correlation matrices were produced to examine the interrelationships between the investigated physicochemical parameters. The positive correlation shows that as one variable is increasing the other is also increasing while the negative correlation shows that as one variable is increasing the other variable is decreasing and vice versa (Asubiojo *et al.*, 2010). The correlation coefficient (r) values of the physicochemical parameters in the water samples are presented in Table 2. The correlation revealed that Temperature was significantly positively correlated with pH and total chlorine and significantly negatively correlated with pH, total chlorine and total alkaline at 0.05 level; conductivity correlated positively with TDS at 0.01 level and significantly negatively correlated with magnesium hardness at 0.05 level; pH was significantly correlated negatively with total chlorine at 0.05 level; total chlorine was significantly positively correlated with and significantly negatively correlated with Mn Ca hardness depth at 0.05 level; chloride was significantly correlated positively with Mn and significantly negatively correlated with fluoride depth at 0.05 level; fluoride was significantly correlated negatively with Mn at 0.05 level; Zn was significantly correlated positively with Mn at 0.05 level; Nitrate was significantly correlated positively with Nitrite, total hardness, Mg hardness and Zn at 0.05 level; Nitrite was significantly correlated positively with total hardness, Ca hardness and Zn at 0.05 level; free chlorine was significantly correlated positively with total chlorine, Mg hardness and Zn at 0.05 level; total hardness was significantly correlated positively with Ca hardness and Mg hardness at 0.05 level; ORP was significantly correlated negatively with nitrite and Ca Hardness at 0.05 level; TDS was significantly correlated negatively with Mg hardness at 0.05 level.

4.3 Distribution Variation of Physicochemical Properties

The CV values with a mean value ranged from 3.77 for temperature and 140.04 fluoride Table 1 (a-b) were markedly different from one another. This conforms with the report by Oyekunle *et al.* (2012) for groundwater samples in Ile-Ife. This indicated, more or less, a steady rate of input of the metals into the groundwater either as a result of the gradual dissolution of the metals from the underlying parent rocks or steady leaching from the sites of contamination. In other words, the factors responsible for the presence of these parameters in the waters might not be sudden changes in anthropogenic activities or weather elements. Whereas pH 21.95 and ORP 19.16 showed a spatial variability than the other parameters, this could be that the source of these metals in the water sample may be as a result of the water serving as the main transporting medium of the dissolved minerals in secondary deposition process contain more of temperature than the other parameters. Comparing the CV mean value of the parameters, showed that they are spatially distributed; this could be the sudden changes in anthropogenic activities or weather elements due to rapid temperature changes that occur. Also, the water that replenished the water samples could dissolve higher minerals as the temperature increases with increasing depth.

4.4 Factor Analysis for Physicochemical Parameters

Factor analysis for the physicochemical parameters of the groundwater samples was represented in Fig 1. The figure showed that there is a linear relationship between ORP, total hardness and Ca hardness, total alkaline, chloride, TDS, and conductivity which means that they influence one another synergistically.

There is a linear relationship between nitrate, pH, temperature, nitrite, free chlorine, total chlorine, fluoride, Zn, and Mn which agreed with the fact that the parameters could be that they originate from the same source.

Conclusion.

In conclusion, the quality of water is of great importance to humans for survival and growth. Therefore, the factors that contribute to good quality water should be duly monitored to prevent frequent pollution of surface water and underground through Industrialization, mining activities, social engagements, and farming activities.

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ASSESSMENT OF RAINFALL VARIABILITY AND SUSTAINABLE ECONOMIC GROWTH IN OSUN STATE, NIGERIA

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Abstract

There are dynamics in the world climate shown by the inconsistencies of its element. Rainfall is one of the elements that is crucial in sustainable economic growth and development. Rainfall is a major factor of consideration in the economic activities of the State. The study assessed rainfall variability and its impact on sustainable economic growth in Osun State, Nigeria. Data for the study were from secondary sources. The rainfall data were from the Nigeria Meteorological Agency (Nimet) and the Gross Domestic Data (GDP) was from the National Bureau of Statistics. The study used descriptive and inferential statistical approaches to examine the relationship between rainfall patterns and Gross Domestic Product (GDP) within a specific range of years. Randomized data is used to carry out the analysis, ensuring unbiased and objective results. The findings provided empirical facts with a correlation value of (0.2212) on the potential implications of rainfall variability in the state's sustainable economic growth. Recommendations made for policymakers and stakeholders.

Keywords: GDP, Economic Growth, Rainfall, Sustainability, and Variability

Introduction:

The world is experiencing climate change, with severe consequences on its economy and this is a major concern of the world bodies. One of the elements of climate is rainfall, and it is the sum of rain that falls within a particular period. It is normal when its standard deviation is beneath or above the mean; otherwise, it varies (Ayoade, 2004)

Rainfall patterns decide the cropping pattern, sustainability, and productivity of agricultural plans. The intensity and frequency of rainfall can be considered a condition for the standard of human living. The knowledge about rainfall probability allows us to manage the severe conditions faced during the season, (Kumar, Pissal, Shukla, and (Patel 2015)

The change in rainfall characteristics deserves urgent and systematic attention because it affects water and food security thereby hindering sustainable economic growth. (Dore, 2005)

The variability of rainfall has been a major source of concern for the growth of the economy simply because the economy of the region is rain-fed. The variability, therefore, altered the sequence of events. As one of the determinants of the economy in the various sector in the region, the flora and the fauna in the zone derived their water from the rain thereby determining the survival of man in the environment.

Statistical evidence has shown that rainfall is varying. From the records of the Nigeria Meteorological Agency,(Nimet) it was revealed that rainfall is varying seasonally, annually, and even in decades. The variability alters the economic activities in the country.

The growth in the economy of a county is measured in the Gross Domestic Product. (GDP). Gross Domestic Product is the total monetary or market value of all the finished goods and services produced within a country's border in a specific period. It is a measure of the growth and sustainability of an economy.

The significance of those assumptions for understanding the estimated impact of rainfall variability on GDP has not yet been evaluated. The assumptions considerably influence and predicted economic losses from rainfall variability. The relationship between rainfall variability and economic growth is complex and tends to be significant in economies like Nigeria where apart from oil, agriculture is



very important in economic output and food security.

Adefolalu(2010) in his study using descriptive statistics concluded that the rainfall variability of the country has a significant effect on economic growth. Barn (2010) using cross-country panel data found out in his study that the sustainable economic growth of sub-Sahara Africa is affected by rainfall variability. Sustainable economic growth, therefore, implies growth maintaining without creating economic problems or complications, it is otherwise known as the practice of supporting long-term economic growth without depleting current resources.

The study reviewed the scholastic approaches used by researchers and comes up with descriptive and inferential statistics models for analysis to determine the relationship between rainfall variability and sustainable economic growth.

Osun state experiences significant rainfall variability, which has implications for the state's sustainable economic growth efforts. Understanding the relationship between rainfall patterns and GDP is crucial for informed decision-making and effective policy formulation. Previous studies on the relationship between rainfall and economic growth used a range of methods to examine the trends and observe the consequences, the fundamental assumption is based on the fact that sustainable economic growth can be influenced by rainfall and water availability(Brown, 2013). whereby droughts and floods impede agricultural, power, and industrial production and also impact physical infrastructures. The study aims to assess the impact of rainfall variability on sustainable economic growth in Osun state Nigeria.

Osun state is one the states in the southwest geopolitical zone of the country. It is located within Lat $07^{\circ}30'$ and $07^{\circ}56'N$ and Long $4^{\circ}30'E$ $4^{\circ}.52'E$ The climate is tropical; the annual rainfall ranged between 1500mm and 3000mm, there are two distinctive seasons the wet season and the dry season. The vegetation is tropical rainforest while the soil is deeply weathered and derived from the parent material the people are predominantly Yoruba.

The state is highly urbanized and densely populated. The economic activities include agriculture, mining, and commercial activities.

A comprehensive review of the literature reveals that rainfall variability has substantial socio-economic consequences, affecting agriculture, water resources, infrastructure, and overall economic growth. Sustainable economic growth in the state is highly dependent on the optimal utilization and management of water resources, making rainfall patterns a critical factor to consider.

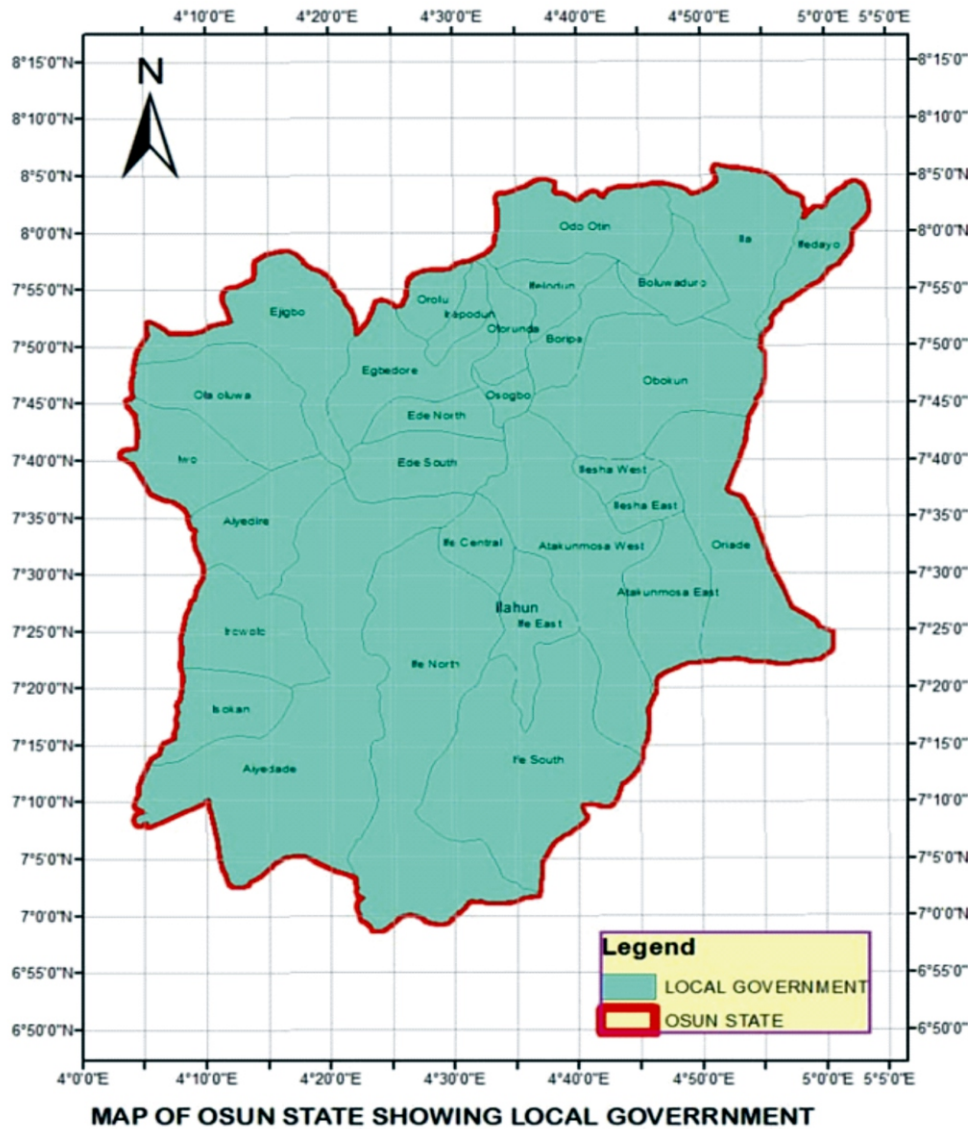


Figure 1: Map of Osun State

Methodology:

Data for the study were sourced from secondary sources. Rainfall data were sourced from the Nigeria Meteorological Agency (Nimet) while the data on the Gross Domestic Product were sourced from the National Bureau of Statistics. The study employed a descriptive and inferential statistical approach to analyze rainfall data and GDP data for Osun State, Nigeria. Both datasets were randomized to ensure objectivity in the analysis and inferential statistical methods like correlation analysis and regression modeling were used to examine the relationship between rainfall and GDP.

Discussions of Findings

The analysis revealed significant rainfall variability in Osun state Nigeria during the selected range of years. Statistical analyses indicated a moderate positive correlation between rainfall and GDP, suggesting that rainfall variability can influence sustainable economic growth in the state.

The pattern of rainfall was analyzed using the time series model, with a range from 1990 to 2022. The period with a relatively high volume of rainfall is usually between April and October across the entire

time series charts. The year with the highest annual rainfall is 2021. The least annual rainfall was experienced in 2005. This is shown in Figure 1

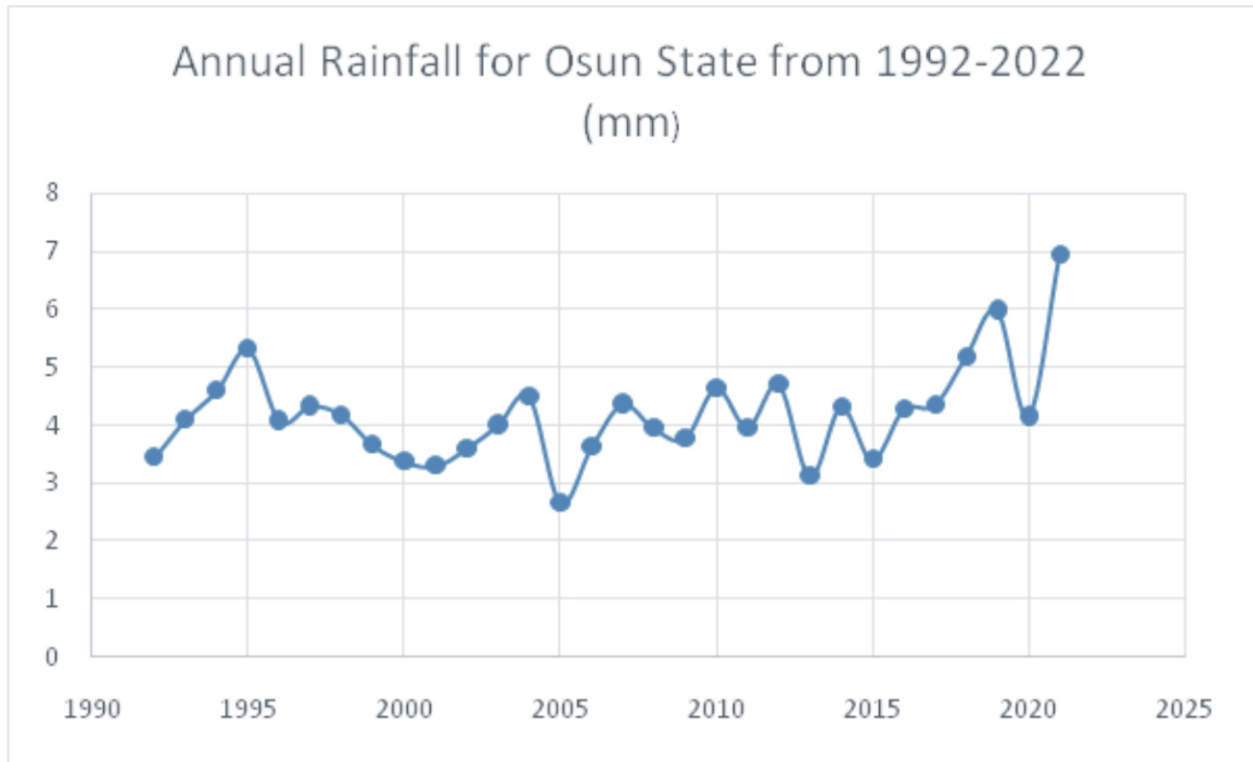


Figure 2: Time series analysis of annual rainfall in Osun State from 1990-2022

To understand the relationship between the sustainable economic growth factors adopted for the study, which are the GDP and the annual rainfall, descriptive analysis, Regression, and Correlation analysis were observed.

With a skewness value of 0.226426 which is near zero as shown in Table 1 and the evenly distributed box plot, the normal probability plot in Figure 2 also affirms that the distribution is approximately normal.

Table 1: Descriptive Analysis

Mean	1366.555
Standard Error	33.2815
Median	1361
Mode	#N/A
Standard Deviation	185.304
Sample Variance	34337.58
Kurtosis	-0.68804
Skewness	0.226426
Range	677.1
Minimum	1014.7
Maximum	1691.8
Sum	42363.2
Count	31

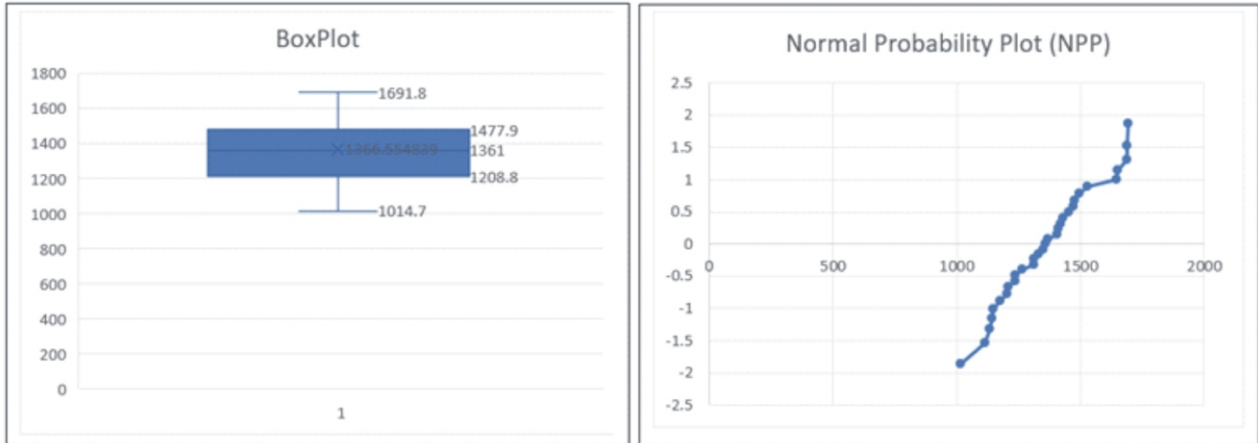


Figure 3: Normal distribution analysis for Osun State rainfall

As shown in Table 1, the dependent variable is the Gross Domestic Product (GDP), while the rainfall data for Osun state is the independent variable. Table 2 shows the regression model between the dependent and the independent variables and shows that there is an overall positive correlation between rainfall variability and sustainable economic growth in the years of study. With a correlation coefficient of (0.2212), there is a clear indication that rainfall variability is a major factor to be considered in achieving sustainable economic growth in the state.

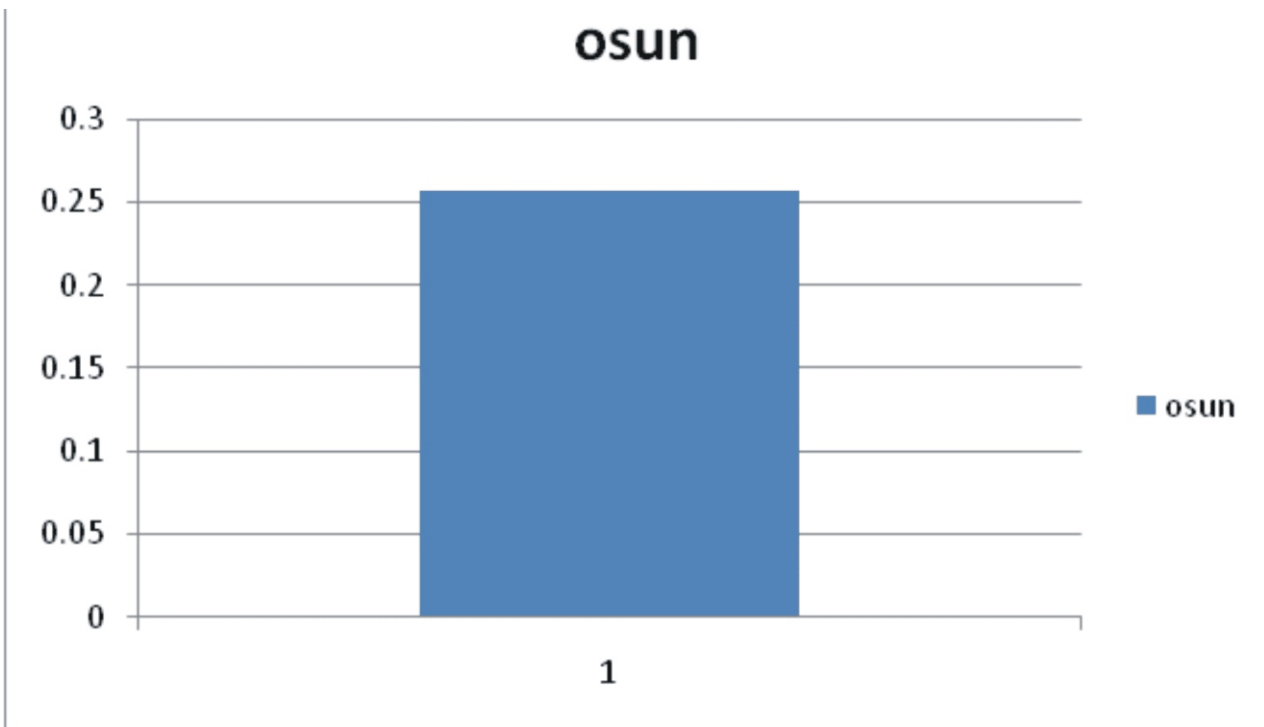


Figure 4: Correlation Analysis between Annual rainfall and GDP in Osun State

Table 2: Regression Analysis

	Osun
Multiple R	0.224986
R Square	0.050619
Adjusted R Square	0.01545
Standard Error	6
Observation	176.99
F	29
Significance F	1.43957
Intercept	0.240632
X Variable 1	-58.2561
	0.221231

The result shows that there is an overall positive correlation between GDP and Rainfall variability for the state. The result is in agreement with the submissions of Barrios, Bertineli, and Strobi (2010) during their review of the trends in rainfall and economic growth in Africa where they concluded that rainfall plays a dominant role in achieving sustainable economic growth in Africa simply because the economy is still within the primary stage and rainfall is the main source of water. The study also corroborated the findings of (Thornton and Gerber 2010; Hoffmann2010) where it was stated that with rainfall variability, the production system may be affected in various ways and there will be a change in productivity which will affect the sustainability of the growth in the economic sector.

Conclusion and Recommendations:

In conclusion, this study provided valuable insights into the relationship between rainfall variability and sustainable economic growth in Osun state Nigeria. The statistical analysis revealed the significance of rainfall patterns in shaping economic productivity. By understanding these relationships, policymakers and stakeholders can make informed decisions to ensure climate-resilient and sustainable economic growth practices in the state.

The study's findings have several implications for sustainable economic growth of the state, the identified correlation between rainfall and GDP highlights the importance of incorporating climate change adaptation measures into the economic growth policies of the state. Enhancing water management systems, promoting drought-resistant agriculture, and investing in climate-resilient infrastructure are key recommendations to mitigate the potential negative impacts of rainfall variability. Collaboration between policymakers, researchers, and local communities is essential for effective implementation.

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EVALUATION OF EXCESSIVE LIFETIME CANCER RISK DUE TO BACKGROUND IONIZING RADIATION LEVEL OF BLOCK-MOLDING INDUSTRIES IN OSOGBO, SOUTHWEST NIGERIA

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Abstract

Studies on radiation levels and radionuclide distribution in the environment provide important radiological baseline information. This type of information is necessary in understanding human exposure from natural and man-made sources of radiation. The natural terrestrial gamma radiation dose rate is an important contribution to the average dose rate received by the world's population. This study aimed to measure outdoor effective dose from gamma dose rates and to find out that workers and people around block industries are not exposed to unwanted and high ionizing radiation. In this study conducted in Osogbo, Osun State, the terrestrial gamma radiation dose rates were measured in 10 molding locations. Measurements were made with digilert200 a portable survey meter. The meter displays its reading in milliroentgen/hour (mR/h) which was later converted to absorbed dose rate in nGy/h and annual effective dose in mSv/h. The study discovered that the measured gamma dose rate with a mean of 190.00nGy/h ranged from 165.3nGy/h to 252.3nGy/h. The calculated annual effective dose ranged from 0.253mSv/y to 0.389mSv/y with a mean of 0.29mSv/y, relatively. Higher dose rates were recorded in three of the industries located under the high-tension transmission. The mean annual effective dose is found to be lower than the value of 1.0mSv/y averaged over five consecutive years according to the dose limit recommended by the International Commission on Radiological Protection (ICRP). Excess lifetime cancer risk measured from the annual effective dose ranged from 0.89 to $1.36 \times (10^{-3})$ in all the locations was higher than the world-weighted average of $0.29 \times (10^{-3})$. This result shows that there is a likelihood of cancer surfacing in the lifetime of people working at the locations.

Keywords: Cancer risk, Absorbed Dose, Ionizing radiation, Gamma, Environment

Introduction

Exposure of humans to natural background radiation is an everyday occurrence (UNSCEAR., 2000). Natural background radiation is of terrestrial and celestial origin. Terrestrial radiation is due to radioactive nuclides present in varying amounts in rocks, building materials, water, soils, and the atmosphere. The existence of Ra^{226} , Th^{232} , and K^{40} called primordial radionuclides in building materials results in internal and external exposure to the inhabitant (Meena and Rajendra., 2022). Facts of natural radiation released from building materials are of importance; as radiations from them are the major contributors to radiation exposure to man. The use of soil from different areas as constituents of building materials like molding bricks in other areas of Nigeria tends to increase the external exposure level to man if such soil deposits have high concentrations of radionuclides (Oni et al, 2011). Exposure to a high level of gamma radiation has several harmful effects, such as mutation and cancer of various types (Aziz et al. 2014). These radiations come from the soil, building materials, food, space, and even our bodies. Building materials comprise naturally occurring radionuclides, thus, they are likely sources of radiation contributing to extremes in external and internal radiation exposure due to their final uses in homes (G, Xhiha et al). Naturally occurring radionuclides in soil are the main contributors of outdoor gamma radiation (Vasconcelos et al., 2013). External radiation exposures due to gamma radiation emission from radionuclides depend on

the geographical and geological conditions which vary throughout the world. One of these building/construction materials is the building blocks. The major components of the building blocks are the soil i.e., sand and cement. These two components contain naturally occurring radionuclides like Ra^{226} , Th^{232} , and K^{40} (Khan et al, 1998). Sand/soil is formed as a result of rock deformation through complex physicochemical procedures, which include weathering decomposition and water movement. Erosion caused by rainfall also makes sand or soil deposits accumulate in a particular place. The soil/sand deposits are naturally radioactive because of their mineral content which in effect contributes to background gamma radiation.

In Osogbo, a town in the southwestern part of Nigeria, cement and soil/sand are major materials used in the construction of buildings. Building blocks are molded in different places or at locations where the building is to be built. Sand/soil that is brought from different places is usually mixed with cement. Since the radioactivity of soil/sand depends on geographical location and geological formation, soil/sand of high radioactivity may be brought to where building blocks are to be molded, which in turn contaminate or raise the level of ionizing radiation like gamma and invariably increase the risk of getting cancer in that vicinity. All over Nigeria particularly in Osogbo, the sand is brought from different places to individual block-making industries. In Nigeria, cement is one of the important and very expensive materials used in construction companies. The radiological content of cement varies in characteristics of the initial raw materials from which the cement is processed (Abdulrahman Kadum, et al, 2013). The mixture of sand and cement is also radioactive since both have radionuclides in them. This contributes to the natural background and terrestrial ionizing radiation of the block industries and their environment thus increasing the gamma dose rate and annual effective dose absorbed by the workers, plants, people, and any living organisms around the block industry. International Atomic Energy Agency (IAEA) 2003 published data for doses accumulated by human beings during their life activities. The exposure to terrestrial radiation is 0.45mSv/y which increases by nearly 20% for bricks and concrete buildings. Muneer et al 2013 carried out the assessment of natural radiation levels and associated dose rates from surface soils in the Pontian district; in Malaysia. The measurement showed that the mean external radiation dose rate, mean weighted dose rate, annual effective dose and the collective effective dose were 69nGy/h, 0.447mSv/y, 237 μ Sv, and 0.126 X 10manSv/y respectively. This study aimed to measure outdoor effective dose from gamma dose rates and to find out that workers and people around block industries are not exposed to unwanted and high ionizing radiation.

Methodology

Measurements of gamma background radiations were made in ten locations areas where we have clusters of building block molding industries of ten (10) block molding industries were randomly selected within Osogbo. All selected industries can produce at least five hundred blocks per day. A well-calibrated digilert200 radiation monitor was used for the measurements. The monitor measures alpha, beta, gamma, and x-ray radiations i.e., only ionizing radiation. Manufacture in the USA, by S.E International Incorporation, with a serial number 60152. It also uses a Geiger-Muller tube to detect radiation.

Gamma dose rates were measured by holding the monitor at a height of 1 meter above the ground. In each block industry, three (3) measurements were taken and recording were done only when readings were stable. The meter displays its reading in milliroentgen/hour. (mR/h).

Osogbo, the study area is the administrative capital of Osun State with a population of 156,694 people. It lies on coordinates 7^o46' North, 4^o34' East with an area of 47kmsq

Data Analysis

The exposure rates in mR/h were converted into dose rates in nGy/h using the conversion factor of
 $1\mu\text{R/h} = 8.7\text{nGy/h}$ (Anandaram et al; 1995)
i.e., $1\mu\text{R/h} = 0.001\text{mR/h}$

Therefore,

$$0.001\text{mR/h} = 8.7\text{nGy/h}$$

The Absorbed dose in nGy/h was converted to Annual Effective Dose (AED) in mSv/h by using the equation given by (Muhammad et al, 2014)

$$\text{Annual Effective Dose (AED)} = \text{Absorbed dose rate (nGy/h)} \times 8760 \times 0.7\text{Sv/Gy} \times 0.25 \times 0.001$$

The conversion coefficient (0.7Sv/Gy) is reported by UNSCEAR 1993 to change the absorbed dose in the air to the effective dose received by adults. 8760 is the value obtained when is converted from hour to year. 0.25 is the occupancy Factor which is the time spent outdoors.

Excess Lifetime Cancer Risk (ELCR)

Excess lifetime cancer risk deals with the likelihood of growing cancer over a lifetime at a specified exposure level. This parameter is calculated using the equation below;

$$\text{ELCR} = (\text{AED}) \times \text{Average Duration of life (DL)} \times \text{Risk Factor (RF)},$$

where DL value is 70years and RF is 0.05 (ICRP 60)

Results and Discussion

Table 1 contains the measurement of each block industry with their corresponding absorbed dose rate and annual effective dose

Table 1 below contains the means of the readings taken on a meter for each location, absorbed dose, annual effective dose, and excess life cancer risk

Location	Mean (mR/h)	Absorbed dose Rate nGy/h	Annual effective dose mSv/y	ELCR (10^{-3})
Onibueja	0.020 ± 0.0021	234.9	0.267	0.94
Dada Estate	0.028 ± 0.0082	243.6	0.373	1.31
Adetunji	0.019 ± 0.0022	165.3	0.253	0.89
Oke-ayepe	0.020 ± 0.0021	174.0	0.267	0.94
Ota-e fun	0.020 ± 0.0021	174.0	0.267	0.94
Baruwa	0.022 ± 0.0039	191.4	0.293	1.03
Ilesa motor park	0.022 ± 0.0039	191.4	0.293	1.03
Alekuwodo	0.027 ± 0.0026	235.0	0.360	1.26
Ido-Osun	0.029 ± 0.0084	252.3	0.389	1.36
Agunbelewo	0.023 ± 0.0037	200.1	0.307	1.07

The absorbed dose ranged from 165.3nGy/h to 252.3nG/y with an average of 190nGy/h. Also, the annual effective dose AED ranged from 0.253mSv/y to 0.389mSv/y with an average of 0.29mSv/y. The mean value of annual effective falls below 1.0mSv/y recommended by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR 2000). Relatively higher doses were recorded at Agunbelewo, Alekuwodo, and Ido-Osun in that order. The high doses recorded may be due to soils from different areas as constituents of building materials like molding bricks in the other areas of Nigeria tends to increase the external exposure level to the man if such soil deposits have a high concentration of radionuclides (Oni et al, 2011). The variations in the absorbed dose rate could also be attributed to the variations in the geological origin of the materials used in different locations.

Excess lifetime cancer risk measured from the annual effective dose ranged from 0.89 to $1.36 \times (10^{-3})$. from all the locations were higher than the world-weighted average of $0.29 \times (10^{-3})$.

This investigation is a Primary study of measuring the excess lifetime cancer risk in the block



molding industries. Further study, which is already ongoing, involved taking soil samples from each block industry for assessment of natural radioactivity levels.

Conclusion

This study assessed the annual effective dose and absorbed dose rates in ten selected block molding locations in Osogbo, Osun State Nigeria. The average measured external absorbed dose rate is 190nGy/h. Also, the average value of the annual effective dose is approximately 0.29mSv/y. The result also shows that natural background radiation increases depending on the level of contamination of the block molding location by the materials (sand i.e., soil and cement) used. The annual effective dose obtained in this study was below the recommended by UNSCEAR 2000. The result indicates that workers and people living in the environments are safe. However, there are concerns and worries after the calculated excess lifetime cancer risks were far above the recommended value of $0.29 \times (10^{-3})$. This shows that there is a high probability of developing cancer-related illnesses in the locations.

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A SURVEY OF THE USE OF CONTRACEPTIVES AMONG TERTIARY INSTITUTION STUDENTS IN OSUN STATE, NIGERIA

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ABSTRACT

Unprotected sex and unplanned pregnancy among Students in Osun State tertiary institutions are major concerns of this study. Sample sizes of 1051 respondents were used, of whom 575 were males and 476 were females. The population was divided into clusters and sample clusters were selected from Osun State College of Technology. Generally, in the test of hypothesis for research questions one, two, and three; the chi-square test revealed that there is no association between all the variables of interest i.e, gender and contraceptive usage, accessibility and usage of contraceptives, and age of students' visa viz usage of contraceptive. The chi-square test revealed that the p-values (0.000) are lesser than the level of significance, $\alpha = 0.05$, hence, the null hypothesis would be rejected. Therefore, it is said that there is an insignificant association between all the variables of interest. Finally, it was concluded that insufficient understanding of the idea and use of contraceptives exist among the respondents both male and female which resulted in unwanted pregnancies. To this end, enlightening programs and training on contraceptive use generally need to be incorporated into the curriculum of tertiary education in Nigeria.

Keywords: Unprotected sex, unplanned pregnancy, Contraception, Students, Tertiary Institution

1. Introduction

Around the world, female students are more open to the danger of unplanned pregnancies for non-use of contraceptives (Dreyer 2012; Maja and Ehlers 2004). This may bring about the inability to finish their learning in school, unable to keep up beneficial work, and settling on free conjugal choices (Maja and Ehlers 2004). The age range of 15 to 24 years is a period when the vast majority starts to effectively engage in sexual activities. All around, many people become explicitly dynamic before their twentieth birthday celebration, and in sub-Saharan Africa, 75 percent of young ladies detailed having engaged in sexual relations by age 20. Research shows that young people who start early sexual activity are in high danger of having high-hazard sex. Having different accomplices, taking part in unprotected sexual activity, and testing sex with liquor and different medications (2010(Ca lsyn , along these lines expands their hazard for unplanned pregnancy and explicitly transmitted diseases including HIV/Aids (Adeomi, 2011).

As indicated by the United Nations, youth is made up of people between the age of 15 and 25 years (World youth report, 2018). In this work, youth is conceptualized as those people who had finished secondary school or are in tertiary institutions, for example, Colleges, Polytechnics, and Universities. Over the years, Nigeria has recorded a high rate of sexually transmitted diseases due to unsafe abortion in response to unwanted pregnancy and this is majorly associated with the youths.

According to the World Health Organization (WHO), an estimated 24.4 million women globally resort to abortions annually, with youths accounting for about 50% of abortion-related mortality in the African region (WHO, 2004).

Unwanted pregnancies have been identified with unprotected sex as well as contraceptive failure, also referred to as 'contraceptive accident' (Bankole et al, 2008).

Unprotected sex and preventative mishaps have been observed to be responsible for an expected 498 million instances of STIs every year among youthful couples (WHO, 2011). Over the years, Nigeria has contrasted with developed countries and recorded a high rate of both explicitly transmitted diseases (STIs) and maternal mortality as a result of risky premature births in light of undesirable pregnancies. Unsafe abortions and the increase in STIs are one of the great challenges to youths' reproductive health in Nigeria (Abubakar et al, 2015).

This research paper is then carried out to assess students' understanding of the concept and use of contraceptives among students of tertiary institutions in Osun State.

Aim of the Study

This work aimed to study youths' understanding and use of contraceptives in Osun State Tertiary Institution. In pursuit of this aim, the following are the specific objectives:

Objectives of the Study

1. To ascertain the level of usage of contraceptives in Osun State College of Technology, Esa – Oke, Osun State, Nigeria.
2. To understand the impact of demographic and socio-economic factors on the usage of contraceptives in Osun State College of Technology, Esa – Oke, Osun State, Nigeria.
3. To ascertain if accessibility to contraceptives has a significant impact on their usage in Osun State College of Technology, Esa – Oke, Osun State, Nigeria.

2. Methodology

The data for this study is obtained from a primary source. The questionnaire was designed and administered to the students of Osun State College of Technology, Esa-Oke. The survey contains two areas. The principal area is on the attributes of respondents in the study, while the subsequent part is on data on the use of contraceptives among the students in Osun State College of Technology, Esa-Oke.

This research work adopted a descriptive procedure. SPSS (Statistical Package for Social Sciences) was used to analyze the data from the questionnaire. Frequency distribution tables and descriptive statistics like percentages, mean and standard deviation were used to describe the characteristics of the study subjects. This statistical package helped for clearness and a simple understanding of raw data. Chi-square

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

χ^2 = Chi-square

Σ = Summation

O = Observed value

E = Expected value

The Chi-Square Distribution

A variable has a chi-square distribution if the shape of its distribution follows the shape of a right-skewed curve called the chi-square χ^2 curve.

Basic Properties of χ^2 Curves

1. The total area under a χ^2 the curve is equal to 1.
2. A χ^2 curve starts at 0 on the horizontal axis and extends indefinitely to the right, approaching, but never touching, the horizontal axis as it does so.
3. A χ^2 the curve is right-skewed.
4. As the number of degrees of freedom becomes larger, χ^2 curves look increasingly like normal curves.

3. Results and Discussions

A total of one thousand and fifty-one (1,051) questionnaires were distributed, interestingly, all questionnaires were successfully administered.

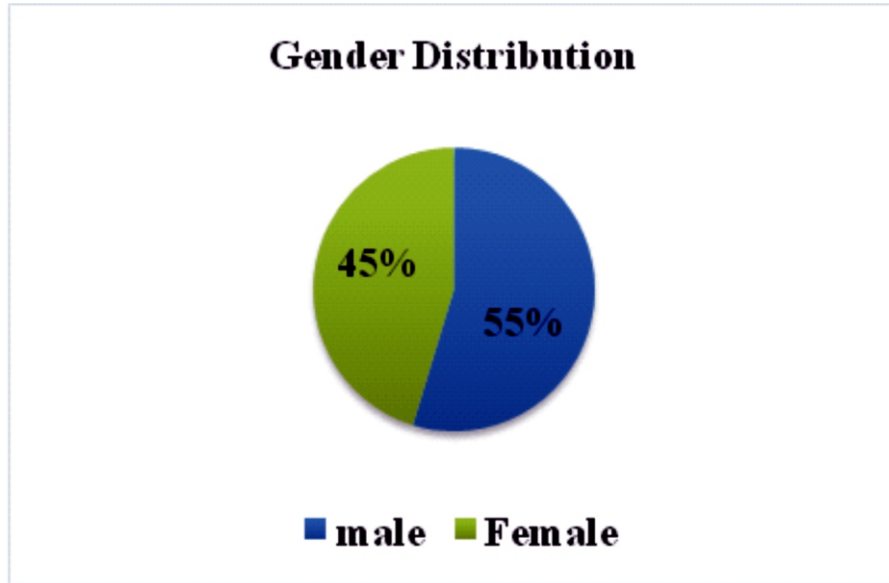


Figure 1: Gender distribution

Figure 1 reveals that the majority of the respondents are male with 54.7% and female respondents are about 45.3%.

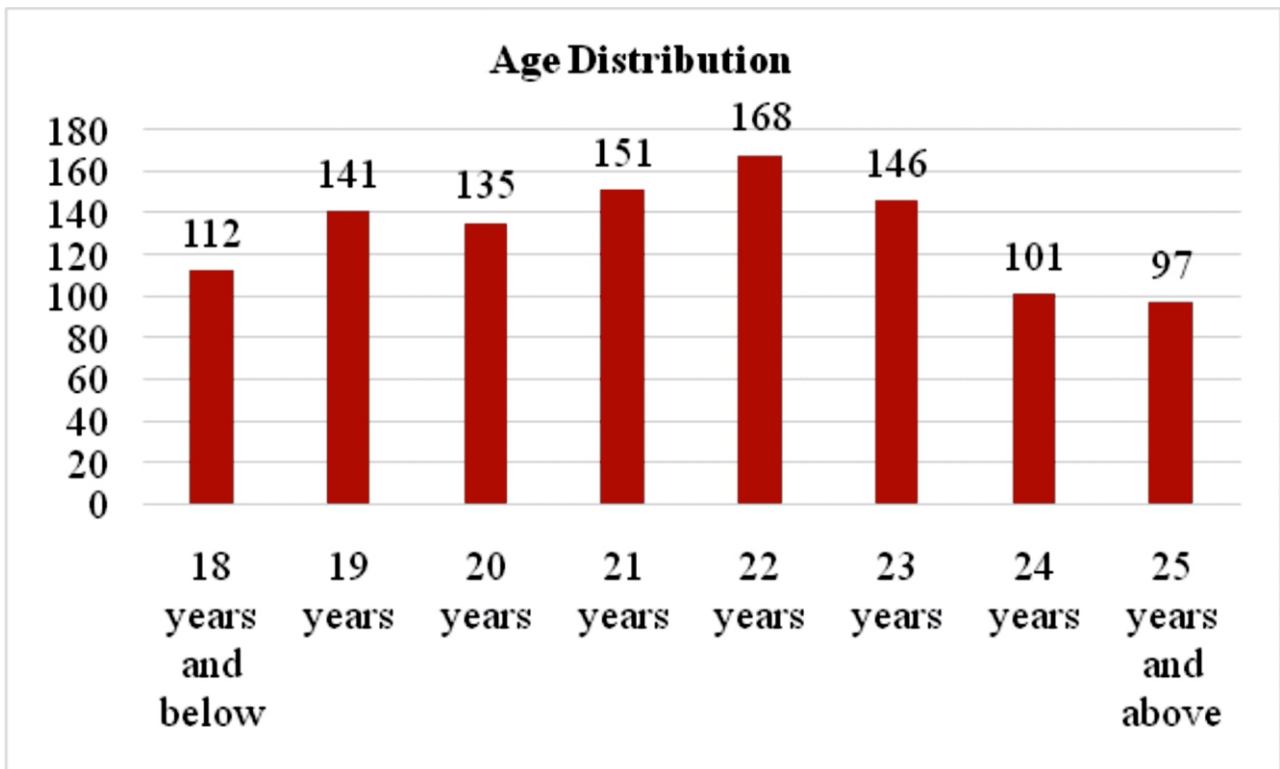


Figure 2: Age Distribution

Figure 2 reveals that 112 (10.7%) of the respondents are 18 years and below, 141 (13.4%) of the respondents are 19 years old, 135 (36.9%) of the respondents are 20 years, 151 (14.4%) are 21 years, 168 (16%) are 22 years, 146 (13.9%) are 23 years, 101 (9.6%) are 24 years and 97 (9.2%) are of the respondents are 25 years and above. This distribution shows that the majority of the respondent is 22 years old.

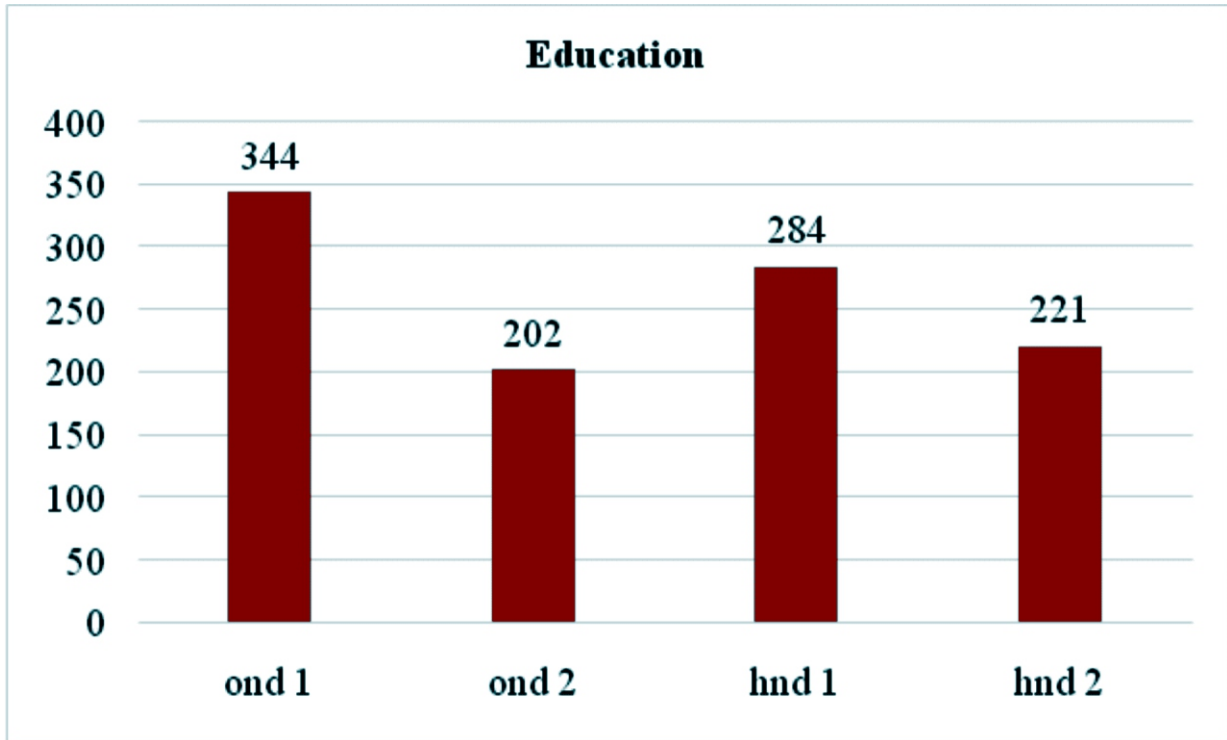


Figure 3: Level of Education

Figure 3 shows that 344 (32.7%) of the respondents are in OND 1, 202 (19.2%) of the respondents are in OND 2, 284(27%) of the respondents are I HND 1, while 221 (21%) are in HND 2. This distribution shows that the majority of the respondent are in OND 1.

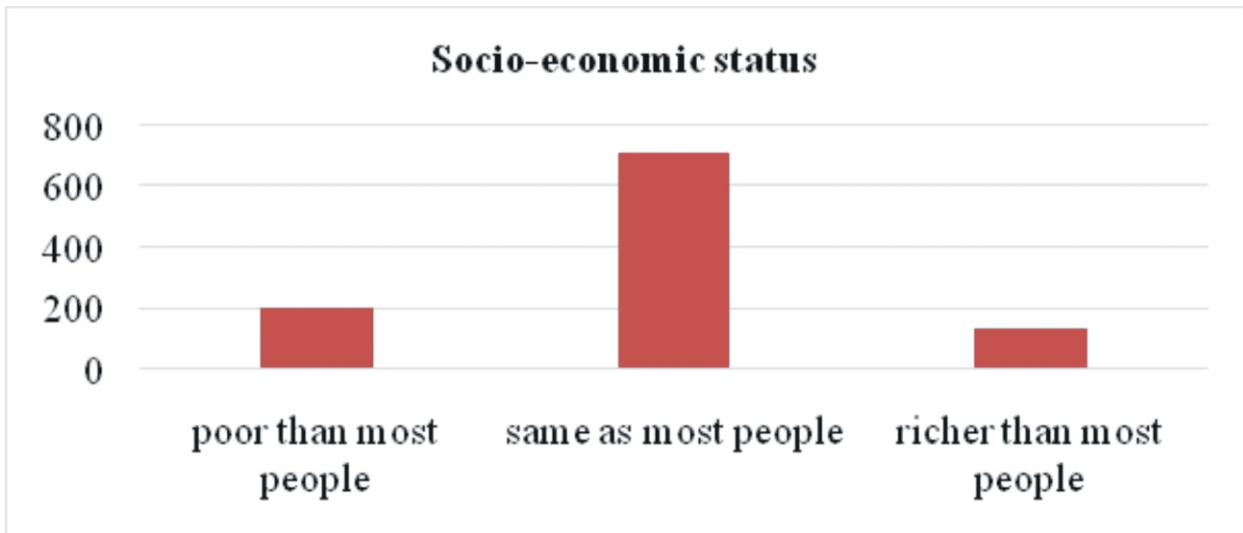


Figure 4: Socio-economic status

Figure 4 shows that 204 (19.4%) of the respondents are poor than most people, 713 (67.8%) are the same as most people and 134 (12.7%) are richer than most people.

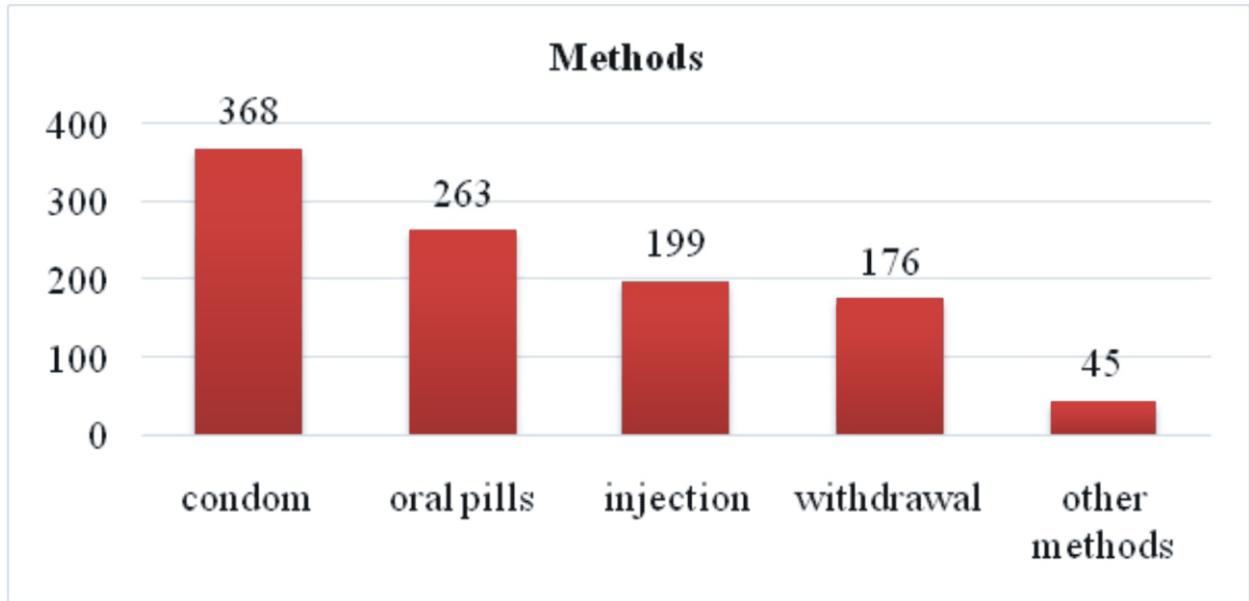


Figure 5: Methods of contraceptive awareness

Figure 5 shows that 368 (35%) know that condoms as a method of contraception, 263 (25%) know oral pills, 199 (18.9%) know injection, 176 (16.7%) know of withdrawal method and 45 (4.3%) know of other methods. This distribution shows that the majority of the respondents know of condoms as method of contraception.

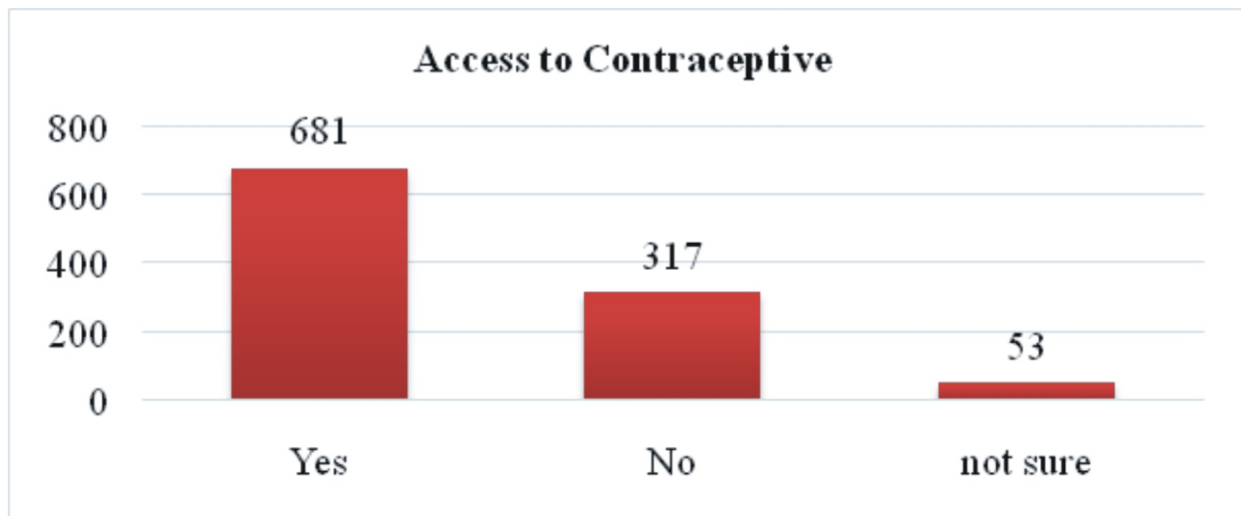


Figure 6: Accessibility

Figure 6 shows that 681 (64.8%) respondents have access to contraceptives, they know where to purchase them, 317 (30.2) lack access to contraceptives and 53 (5%) respondents are

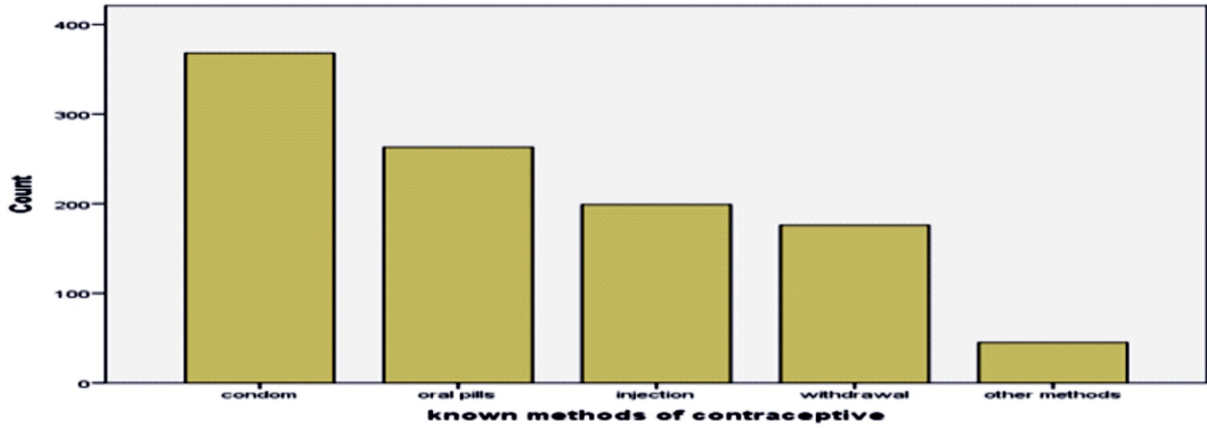


Figure 7: Types/Methods of contraceptives used

Figure 7 shows that condom (20.7%) was the most frequently used method. Oral pills (17.3%) were the second most frequently used method, followed by injection (13.2%), and withdrawal (11.0%). at the period of administration of the questionnaires.

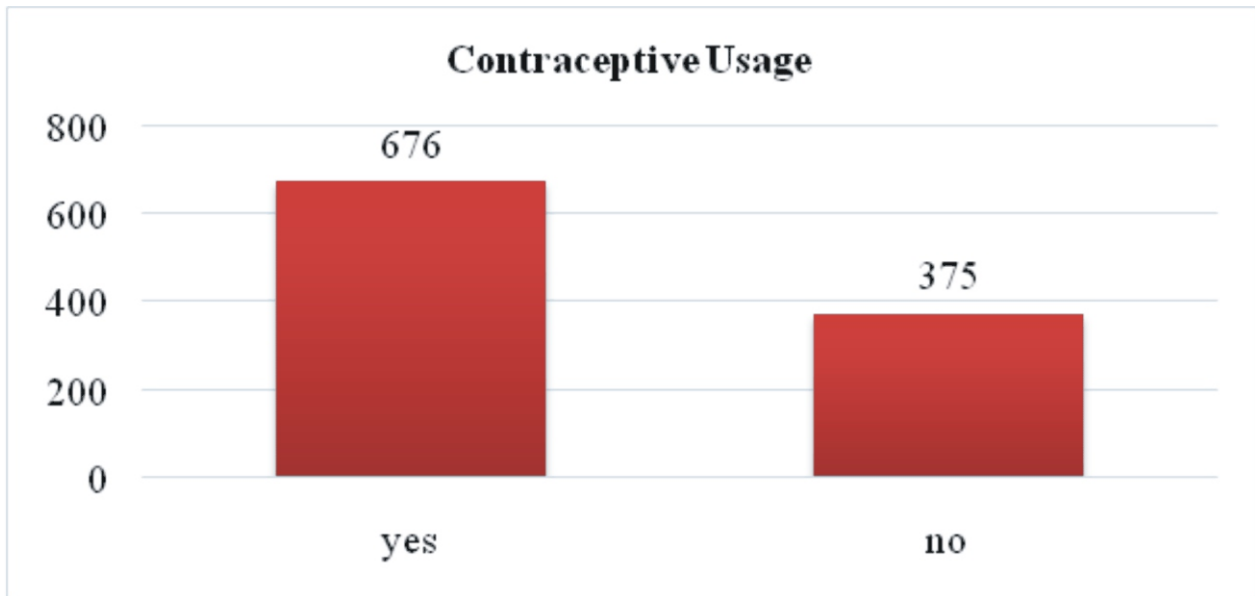


Figure 8: Contraceptive Usage

Figure 8 reveal 64.3% of the respondents have used contraceptives or into the use of contraceptives, while 35.7% of the respondents noted that they have never used contraceptive before. Based on the above statistics, we can conclude that the majority of the people in the institution of focus are familiar with contraceptive usage.

Data Analysis

Test of Hypothesis

Three hypotheses were formulated and tested as shown below

Hypothesis One

Hypothesis one states that there is no relationship between gender and contraceptive usage. Chi-square test was used to test the existence of an association between gender and contraceptive usage.

H_0 : There is no significant association between gender and contraceptive usage.

H_1 : There is a significant association between gender and contraceptive usage.

Table 1: Cross-Tabulation (Gender and Contraceptive Usage)

		Contraceptive Usage		Total
		yes	no	
Gender	Male	372	203	575
	Female	304	172	476
Total		676	375	1051

Table 1 shows Gender and Contraceptive Usage

The cross-tabulation reveal male gender uses more contraceptive than females, however, this is mainly because the populations of the males are more than the females in this study.

Table 2: Chi-square Table showing the association between Gender and Contraceptive Usage)

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	0.078	1	0.780
Continuity Correction	0.046	1	0.830
Likelihood Ratio	0.078	1	0.780
Linear-by-Linear Association	0.078	1	0.780
No Valid Cases	1051		

The chi-square test revealed that the p-value (0.780) is greater than the level of significance, $\alpha = 0.05$, hence, the null hypothesis cannot be rejected. Therefore, it is said that there is an insignificant association between the two variables. Hence, the conclusion is made that there is an association between gender and contraceptive usage. In other words, the usage of contraceptives has no dependency on gender among the students of Osun State College of Technology, Esa – Oke, Osun State.

Hypothesis Two

Awareness of contraceptives is associated with education level. The Chi square test was used to test the existence of an association between educational level ad contraceptive awareness.

H_0 : There is no significant association between educational level and contraceptive awareness.

H_1 : There is a significant association between educational level and contraceptive awareness.

Table 3: Cross-Tabulation (Education and Contraceptive knowledge)

Level		contraceptive knowledge		Total
		Yes	no	
Level	ND I	344	0	344
	ND II	38	164	202
	HND I	255	29	284
	HND II	44	177	221
Total		681	370	1051

The cross-tabulation reveals students in OND 1 and HND 1 that have a greater proportion of awareness of contraceptives than others as revealed in Table 3.

Table 4: Chi-square table (Education and Contraceptive knowledge)

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	647.115	3	0.000
Likelihood Ratio	760.356	3	0.000
Linear-by-Linear Association	196.988	1	0.000
No Valid Cases	1051		

The Chi-Square test revealed a significant association between the two variables. With a Pearson chi-square value of $\chi^2=647.115$ and a significance value of 0.00 as shown in table 4. The null hypothesis would be rejected, and the conclusion is made that there is an association between educational level and contraceptive awareness. In other words, OND 1 and HND 1 students are significantly more aware of contraceptives than OND 2 and HND 2 students in Osun State College of Technology, Esa-Oke, Osun State,

Hypothesis Three

Hypothesis 3 is testing the existence of an association between accessibility (knowledge of where to purchase contraceptives) and its usage. The chi-square test was used to test the existence of an association between the two variables

H_0 : There is no significant association between accessibility (knowledge of where to purchase contraceptives) and its usage.

H_1 : There is a significant association between accessibility (knowledge of where to purchase contraceptives) and its usage.

Table 5: Cross-Tabulation (accessibility (knowledge on where to purchase contraceptives) and contraceptive usage)

	have you used		Total
	Yes	No	
Do you know where to buy contraceptives?	585	203	788
	91	126	217
	0	46	46
Total	676	375	1051

The cross-tabulation revealed students who are knowledgeable about where to purchase contraceptives have a higher rate of usage than those who are not knowledgeable on where to purchase contraceptives as revealed in Table 5.

The chi-square test revealed a significant association between the two variables. With a Pearson chi-square value of $\chi^2=164.082$ and a significance value of 0.00 as shown in table 14. The null hypothesis would be rejected, and the conclusion is made that there is an association between accessibility (knowledge of where to purchase contraceptives) and contraceptive usage. In other words, students of Osun State College of Technology, Esa-Oke will use contraceptives if they are aware of where it can be purchased.

Table 6: Chi-square Test (accessibility (knowledge on where to purchase contraceptives) and contraceptive usage)

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	164.082	2	0.000
Likelihood Ratio	175.234	2	0.000
Linear-by-Linear Association	162.951	1	0.000
N of Valid Cases	1051		

4. Conclusion and Recommendations

Conclusion

The collected data revealed that 64.8% of the respondents are aware of where to purchase contraceptives, and this factor has a significant influence on the usage of contraceptives amongst the respondents.

In addition, contraceptive awareness has a direct association with the educational level, students of ND1 and HND1 are more aware of the usage of contraceptives than their counterparts of other levels.

Finally, it was concluded that insufficient understanding of the idea and use of contraceptives exists among the respondents both male and female. To this end, enlightening programs and training on contraceptive use generally need to be incorporated into the curriculum of tertiary education in Nigeria.

Recommendation

Based on the findings, the following recommendations were proffered:

- The analysis reveals a non-usage of contraceptives due to unawareness of where they can be purchased; a proper awareness campaign will encourage its usage.
- In addition, the study revealed that students from wealthy families seldom use contraceptives, therefore, effort must be made to direct these awareness campaigns to these groups of students to encourage the usage of contraceptives among them.

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