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### **About**

Oil and Gas Journal of Engineering, Applied Sciences, Management, and Art Research (OGJEASMAR) is a multi-disciplinary journal published quarterly. Its publication policy is designed to ensure that all published articles meet the highest standards of quality, integrity, and ethical conduct. The Journal is committed to promoting and disseminating original research and scholarly work in various fields, and to providing a platform for researchers to publish their work in a timely and transparent manner. Our aim is to educate and connect the global Engineering, Sciences, Management Science and Art community. Gas Journal of Engineering, Applied Sciences, Management, and Art Research is an open access International Journal emphasizing on Engineering, Applied Sciences, management sciences, Art and its Sub Topics. Authors can submit the manuscript in the form of a Research Paper, Review Paper, Informative Article, Comparative Studies, Case Studies, Dissertation Chapters, Research Proposals, and Synopsis.

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## LEADERSHIP CORE VALUES AND GOAL ATTAINMENT IN PUBLIC UNIVERSITIES IN RIVERS STATE

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### Abstract

*The study examined the relationship between leadership core values and goal attainment of public universities in Rivers State. Three research questions and three hypotheses guided the study. The study employed correlational research design. The population of the study consisted of all 2,457 teaching staff members of public universities in Rivers State. That is, Rivers State University (RSU) 547, Ignatius Ajuru University of Education (IAUE) 438 and University of Port Harcourt (UNIPORT) 1472. The sample size of the study is 491 teaching staff representing 20% of the total population. The instrument for data collection is a questionnaire tagged "Leadership Core Values and Goal Attainment of Public Universities Questionnaire (LCVGAPQ)". The items on the instrument were structured after 4-point modified Likert scale ranging from 1 = Very Low Extent (VLE), 2 = Low Extent (LE), 3 = High Extent (HE) and 4 = Very High Extent (VHE). The instrument was validated by two experts in Educational Management. The Cronbach Alpha reliability index of 0.74 guaranteed the instrument's usage of the instrument at 0.05 0.08 level of significance. Pearson Product Moment Correlation (PPMC) was used to address the research questions, while regression analysis was employed to test hypotheses at 0.05 Alpha level. All the statistical analysis was aided by Statistical Package of the Social Sciences (SPSS) version 25. The finding reveals that self-discipline, honesty/integrity and empathy as leadership core values to a very high extent determine the goal attainment of universities in Rivers State, based on the results of the data analysis which shows that the three variables were significantly related to goal attainment of university leaders. Hence, the researcher recommends that university leaders should ensure acquisition of self-discipline as it has been found indispensable for effective goal attainment.*

**Key words:** Leadership, Core values, Goal attainment, Public Universities and Education.

### Introduction

University education is the highest level of education anyone can acquire. University education is vital for the development of any given society as there is no nation that can function effectively without university education. This is true because university education prepares citizens for future leadership, foster economic, social, scientific and political advancements.

This philosophy of Nigeria education is based on the development of the individual into a sound and effective citizen and the provision of equal opportunities for all citizens of the nation at the basic, secondary and tertiary levels both inside and outside formal school system (Wu et al., 2006). Based on the above, University management requires strategic leadership that can reconcile the challenges of education with its goals attainment, translate its potential to good performance and productivity. Some scholars believe that leadership is a kind of relationship to apply power and influence to make people work together and accomplish common goals (Wu et al., 2006). Leadership is a social influence process in which the leader seeks the voluntary participation of subordinates in an effort to reach organization goals (Omolayo, 2000).

Leadership intrinsic motivation portrays certain core values that are indispensable for staff to believe in their capabilities in the organisation. The core value in an organisation is the guiding principles. It determines the difference between right and wrong. The core values of a leader spell out their fundamental belief.

Hence, Leader's core values are the attribute of the leaders that spell out their fundamental beliefs. It is also the guiding principles that help them judge between what is accepted and what is not accepted within the organization. These core values are too numerous however they also include integrity/honesty, moral values, self-discipline, ethics, empathy, transparency, accountability, dependability, flexibility, confidence, humility, creativity, trustworthiness, decisiveness, vision, innovativeness, intelligence, truthfulness, optimism, assertiveness, communicativeness and

unselfishness. University leaders are seen as managers who are very important, influential, and responsible, with a leadership spirit and acts as the main liaison between the educational challenges and goal attainment.

### **Statement of the Problem**

Leadership characteristics are inevitable qualities that influence staff commitment and general goal attainment of the university. It is expected of a university leader to develop qualities and core values that will earn his followers' loyalty such as integrity, discipline, empathy, honesty. A leader who exhibits these values is believed to create influence on his subordinate and the entire system at large. Lack of integrity among university leaders will transmogrified into disobedience among the staff. For instance, a leader who supposed to demonstrate integrity in the face of challenges but fail will end up suggesting to his/her subordinates that integrity does not account in certain situations. Also it will be a reference point for the staff whenever issues arise. Discipline among leaders is to be considered in two ways; it may mean self-restrain, when a leader restrain himself from certain behaviours or action that may result in misbehaviours and abuse of privileges.

It is based on this view that the researcher intends to examine the relationship existing between leadership core values and goal attainment of public universities in Rivers State.

### **Aim and Objectives of the Study**

The aim of this study is to examine the relationship between leadership core values and goal attainment of public universities in Rivers State. In terms, the study will find out:

1. To identify the extent integrity as a leadership core value enhances goal attainment in public universities in Rivers State.
2. To identify the extent self-discipline as a leadership core value enhances goal attainment in public universities in Rivers State.
3. To identify the extent empathy as a leadership core value enhances goal attainment in public universities in Rivers State.

### **Hypotheses**

The following hypotheses were tested at 0.95 level of significance.

- Ho1.** There is no significant relationship between integrity as a leadership core value and goal attainment in public universities in Rivers State?
- Ho2.** There is no significant relationship between self-discipline as a leadership core value and goal attainment in public universities in Rivers State?
- Ho3.** There is no significant relationship between empathy as a leadership core value and goal attainment in public universities in Rivers State?

### **Theoretical Framework**

The study was anchored on Thomas Carlyle's Trait Theory of Leadership (Menel & May, 2009). The trait theory of leadership suggests that certain inborn or innate qualities and characteristics make someone a leader. These qualities might be personality factors, physical factors, intelligence factors, and so on. In essence, trait theory proposes that the leader and leaders' traits are central to an organisation's success. The assumption here is that finding people with the right traits will increase organisational performance. Trait theory focuses exclusively on the leader and neglects the follower although the trait theory of leadership focuses on five major leadership traits of intelligence, self-confidence, determination, integrity, and sociability, however in the recent times it also relates to other factors.

This study adopted the theory because the researcher believes that if the university leaders possess these attributes and qualities, it will foster university goal attainment. Also, the university leaders will be balanced physically, mentally and socially to carry out any responsibility given to them. These qualities will make them develop skills that will encourage their subordinate to believe in their capabilities and strength.

## **Conceptual Review**

### **A Leader**

Leadership is the ability to continuously influence a team of individuals and encompasses many important traits, principles of different approaches to managing a team of employers. Leadership focuses on the ongoing motivation, engagement and productivity of a team.

Additionally, leadership concepts drive the creation of theories of standard management styles and behaviors, and are often inclusive of traits such as personality and character, initiative, motivation, influence, decision-making abilities and other principles that form the basis of many integrated leadership styles.

### **Self-discipline**

Simply put, self-discipline is the ability to do what one has to do to succeed regardless of your emotional state. In life it is one of the core virtues that enables a person to excel, or as Joseph Addison has said that “self-discipline is that which, next to virtue, truly and essentially raises one man above another.” For instance, a student who lacks self-discipline will perform poorly. In other words, self-discipline is a habit. A habit in itself what the sages say ‘we make our habits, then our habits make us’. This means that it is what a particular person has to obtain by regular training and whenever a person masters it, it can be most invaluable because it paves way to all successes.

Self-discipline is “the ability to make yourself do things you know you should do even when you do not want to” (Cambridge Dictionaries Online, 2016), “the ability to control one’s feelings and overcome one’s weaknesses” (Oxford Dictionaries, 2016). It is emphasized that “self-discipline appears in various forms, such as perseverance, restraint, endurance, thinking before acting, finishing what you started doing, and as the ability to carry out one’s decisions and plans, in spite of inconvenience, hardships or obstacles. Self-discipline also means a self-control, the ability to avoid unhealthy excess of anything that could lead to negative consequences (Sasson, 2016).

### **Empathy**

The term “empathy” is used to describe a wide range of experiences. Emotion researchers generally define empathy as the ability to sense other people’s emotions, coupled with the ability to imagine what someone else might be thinking or feeling. Empathy is defined as a skill of understanding others’ feelings, predicaments, and challenges better (Marques, 2010). Empathy also defined as the skill of sensing other people’s emotions, allows for understanding beyond someone’s apparent surface behaviour by putting oneself in another’s shoes and taking an active interest in their concerns (Goleman, 2000; Mencl & May, 2009).

According to Voss, Gruber, and Reppel (2010), empathy skills allow leaders to understand better other peoples’ perspectives and opinions, making the work environment more enjoyable and productive. Marques (2010) states that, to achieve leadership effectiveness, leaders must develop empathy skills to their fullest potential since empathy enhances a sense of leadership by providing leaders with the awareness to listen, serve their followers, and have greater understanding of interrelationships within the group. Thus, followers may be more likely to invest energy and commitment in their performance to the group.

Gardner and Stough (2002) point out that by placing themselves in the same position as their employees, leaders are using empathy to help motivate their employees by earning their trust. Goleman, Boyatzis and McKee (2002) note that empathy helps leaders to increase their capacity and willingness to understand situations, and accept proposed changes and opinions of others. Empathy enables leaders to be sensitive towards others so that they can create an atmosphere of openness, making these leaders more flexible and open to new ideas and perspectives that lead to effective leadership (Goleman, 2001). Empathy has become increasingly important to the success of leadership because empathic leaders are more likely to have an appropriate degree of openness about diversity and the differences between cultures (Atwater & Waldman, 2008; Choi, 2006). According to Martinovski, Traum, and Marsella, (2007), empathy also plays an important role in developing trust in leader-employee -relationships.

### **Integrity**

Integrity is the practice of being honest and showing a consistent and uncompromising adherence to strong moral and ethical principles and values (Kaptein, 2014). In ethics, integrity is regarded as the honesty and truthfulness or accuracy of one's actions. Integrity can stand in opposition to hypocrisy, in that judging with the standards of integrity

involves regarding internal consistency as a virtue, and suggests that parties holding within themselves apparently conflicting values should account for the discrepancy or alter their beliefs (John, Celeste, & Sally, 2009). The characteristics of integrity involve a specific code of conduct that people subscribe to live by in their day-to-day life based on morality. Integrity is characterized by honesty, grace, respect, responsibility, hard work, accountability.

### **Empirical Review of Related Studies**

Study by Wachira, Gitumu, and Mbugua (2017) on effect of principals' leadership styles on teachers' job performance in Public Secondary Schools in Kieni West Sub-County. Descriptive survey design was adopted for the study. 284 respondents (22 principals and 262 teachers) were selected for the study using stratified random sampling technique. The result showed that there was a significant relationship ( $\chi^2 = 35.611$ ,  $p=0.00$ ) between leadership styles and teachers' job performance. The researcher concluded principals practice various leadership styles. The researcher also concluded that supportive leadership style affects teachers' performance.

Jay (2014) worked on the principals' leadership style and teacher's performance in secondary schools of Gambella regional state. Descriptive survey design was adopted for the study. A total of 190 individuals (170 teachers and 20 principals) have participated in the study selected using simple random sampling technique. The finding indicates that there is a positive relationship between leadership styles and teachers' performance ( $r=0.980$ ) the relationship is significance (Sign=0.000 at 0.05 level). The findings revealed that the independent variable (democratic was the most practiced leadership styles in general secondary schools of Gambella region.

Mohan (2015) worked on study of relationship between leadership styles of principal and teacher effectiveness. The present study employed quantitative method survey design using questionnaire as a tool. Simple random sampling technique was used in the present study. A total of 128 Principals and teachers from schools affiliated to U.P. Board. Data was analyzed using frequency, percentage; mean value, standard deviation, Correlation Pearson Product Moment, and multiple regression Stepwise method. Findings showed that there are two types of leadership styles of school Principal, namely supportive leadership and participative leadership styles which have significantly affecting teacher effectiveness. In conclusion, in order to increase teachers' working effectiveness, administrators should promote, practice, and improve these two leadership styles, namely supportive leadership and participative leadership styles.

### **Methodology**

The study employed correlational research design. The population of the study consisted of all the teaching staff of public universities in Rivers State. The study comprised of Rivers State University (RSU), Ignatius Ajuru University of Education (IAUE) and University of Port Harcourt (UNIPORT). At the time of the study, the total number of teaching staff in Rivers State University is 547, Ignatius Ajuru University of Education 438 and the University of Port Harcourt was 1472, making a total of 2,457 teaching staff of the universities. Twenty percent (20%) of the total population was used to represent the sample of the study. The sample size of the study is 491 representing 20% teaching staff. After the administration of the research instrument, the researcher was able to retrieve 425 copies of the questionnaire, and used same for data analysis. Descriptive statistics (mean, standard deviation) was employed to answered all the research questions while regression analysis was used to test hypotheses at 0.05 Alpha level. All the statistical analysis was aided by Statistical Package of the Social Sciences (SPSS) version 25.

## Result and Discussion of Findings

**Research Question One:** To what extent do integrity as a leadership core value enhance goal attainment in public universities in Rivers State?

**Table 1: Summary of descriptive statistics on extent do integrity as a leadership core value enhance goal attainment in public universities in Rivers State**

S/N	Integrity as a leadership core value	Mean	SD	Remark
1.	My head of department shows integrity in the area of financial transaction/resource management	3.54	0.78	High Extent
2.	My head of department shows integrity against bribery and corruption.	3.17	0.85	High Extent
3.	My head of department shows integrity against examination malpractice.	3.14	0.92	High Extent
4.	My head of department shows integrity against extortion of illegal fees from the students and the staff	3.09	0.87	High Extent
5.	My head of department shows integrity against harassment on students and staffs	3.28	0.88	High Extent
<b>Grand Mean</b>		<b>3.24</b>	<b>0.86</b>	<b>High Extent</b>

The data on table 1 showed the extent integrity as a leadership core value enhance goal attainment in public universities in Rivers State is high (Mean=3.24, SD=0.86). The table revealed that head of departments shows integrity in the area of financial transaction/resource management (Mean=3.54, SD=0.78), shows integrity against bribery and corruption (Mean=3.17, SD=0.85), shows integrity against examination malpractice (Mean=3.14, SD=0.92), shows integrity against extortion of illegal fees from the students and the staff (Mean=3.09, SD=0.87) and shows integrity against harassment on students and staffs (Mean=3.28, SD=0.88) are the extent of integrity as a leadership core value being express by HODs to enhance goal attainment in public universities in Rivers State is high.

**Research Question Two:** To what extent do self-discipline as a leadership core value enhance goal attainment in public universities in Rivers State?

**Table 2: Summary of descriptive statistics on extent do self-discipline as a leadership core value enhance goal attainment in public universities in Rivers State**

S/N	Self-discipline as a leadership core value	Mean	SD	Remark
6.	My head of department is self-disciplined in the management of school finance	3.41	0.56	High Extent
7.	My head of department is self-discipline in emotional/sexual relationship with the staff	2.99	1.04	High Extent
8.	Drug abuse and alcohol are not issues with my head of Department.	2.91	1.24	High Extent
9.	My head of department is self-discipline in managing school resources.	2.81	1.06	High Extent
10.	My head of department is self-disciplined in managing time.	3.04	0.84	High Extent
<b>Grand Mean</b>		<b>3.03</b>	<b>0.95</b>	<b>High Extent</b>

The data on table 2 showed the extent self-discipline as a leadership core value enhance goal attainment in public universities in Rivers State is high (Mean=3.03, SD=0.95). the table revealed that HODs are self-disciplined in the management of school finance (Mean=3.41, SD=0.56), are self-discipline in emotional/sexual relationship with the staff (Mean=2.99, SD=1.04), drug abuse and alcohol are not issues with HODs (Mean=2.91, SD=1.24), are self-discipline in managing school resources (Mean=2.81, SD=1.06) and HODs are self-disciplined in managing time (Mean=3.04, SD=0.84) are the extent self-discipline as a leadership core value being express by HODs to enhance goal attainment in public universities in Rivers State is high.

**Research Question Three:** To what extent do empathy as a leadership core value enhance goal attainment in public universities in Rivers State?

**Table 3: Summary of descriptive statistics on extent do empathy as a leadership core value enhance goal attainment in public universities in Rivers State**

	Empathy as a leadership core value	Mean	SD	Remark
11.	My head of department delegates job/assignments that are appropriate to other workers.	3.04	0.87	High Extent
12.	My head of department shows concern for workers' salary delay	2.71	1.00	High Extent
13.	My head of department shows concern for bereaved staff as well as those going through pains.	3.12	0.80	High Extent
14.	My head of department shows concern for staff who are sick/disease	3.32	0.78	High Extent
15.	My head of department shows concern for enforcement of discipline on the erring staff	3.10	0.96	High Extent
	<b>Grand Mean</b>	<b>3.06</b>	<b>0.88</b>	<b>High Extent</b>

The data on table 3 showed the extent empathy as a leadership core value enhance goal attainment in public universities in Rivers State is high (Mean=3.06, SD=0.88). The table revealed that HODs delegate job/assignment that are appropriate to other workers (Mean=3.04, SD=0.87), HODs show concern for workers' salary delay (Mean=2.71, SD=1.00), HODs show concern for bereaved staff as well as those going through pains (Mean=3.12, SD=0.80), HODs show concern for staff who are sick/disease (Mean= 3.32, SD=0.78) and HOD show concern for enforcement of discipline on the erring staff (Mean=3.10, SD=0.96) are the extent empathy as a leadership core value being express by HODs to enhance goal attainment in public universities in Rivers State is high.

### Testing of Hypotheses

**Hypothesis One:** There is no significant relationship between integrity as a leadership core value and goal attainment in public universities in Rivers State?

**Table 4: Summary of regression analysis on the relationship between leadership integrity and goal attainment of public universities in Rivers State**

#### Part A: Model Summary

Model	R	R Square	Adjusted Square	R Durbin Watson
1	.787 <sup>a</sup>	.620	.619	1.74819

a. Predictors: (Constant), Leadership Integrity

#### Part A: ANOVA<sup>a</sup>

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	2106.783	1	2106.783	689.356	.000 <sup>b</sup>
	Residual	1292.756	423	3.056		
	Total	3399.539	424			

a. Dependent Variable: Goal Attainment

b. Predictors: (Constant), Leadership Integrity

#### Part B: Coefficients<sup>a</sup>

Model		Unstandardized Coefficients	Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	
1	(Constant)	11.039	.726		15.207 .000
	Leadership Integrity	.423	.016	.787	26.256 .000

a. Dependent Variable: Goal Attainment

The result from Table 1 shows the summary of linear regression on the relationship between leadership integrity and goal attainment of public universities in Rivers State. It shows that leadership integrity has positive and strong relationship with goal attainment of public universities in Rivers State ( $r=0.787$ ). The r-squared (0.620) shows that the leadership integrity contributed roughly 62% to the observed changes in goal attainment of public universities in Rivers State. The data in table 4 shows that leadership integrity has significant relationship with goal attainment of public universities in Rivers State ( $F_{1,423}=689.356$ ,  $p=0.00$ ). The null hypothesis one was rejected at .05 level of significance. The regression equation indicated that any increase in the value of leadership integrity/honesty will lead to a concomitant increase in the value of goal attainment of public universities in Rivers State. The regression equation  $Y = 11.04+0.423X$  showed that the more leaders demonstrate more of integrity/honesty the more the goal attainment of the university in Rivers State.

**Hypothesis Two:** There is no significant relationship between self-discipline as a leadership core value and goal attainment in public universities in Rivers State?

**Table 5: Summary of regression analysis on the relationship between leadership self-discipline and goal attainment of public universities in Rivers State**

**Part A: Model Summary**

Model	R	R Square	Adjusted Square	R Durbin Watson
1	.582 <sup>a</sup>	.339	.338	2.30466

a. Predictors: (Constant), Leadership Self Discipline

**Part A: ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1152.799	1	1152.799	217.041	.000 <sup>b</sup>
	Residual	2246.740	423	5.311		
	Total	3399.539	424			

a. Dependent Variable: Goal Attainment

b. Predictors: (Constant), Leadership Self-Discipline

**Part B: Coefficients<sup>a</sup>**

		Unstandardized Coefficients		Standardized Coefficients	t	
Model		B	Std. Error	Beta		Sig.
1	(Constant)	11.731	1.243		9.439	.000
	Leadership Self-Discipline	.402	.027	.582	14.732	.000

a. Dependent Variable: Goal Attainment

The result from Table 2 shows the summary of linear regression on the relationship between leadership self-discipline and goal attainment of public universities in Rivers State. It shows that leadership self-discipline has positive and strong relationship with goal attainment of public universities in Rivers State ( $r=0.582$ ). The r-squared (0.339) shows that the leadership self-discipline contributed roughly 33.9% to the observed changes in goal attainment of public universities in Rivers State. The data in table 5 shows that leadership self-discipline has significant relationship with goal attainment of public universities in Rivers State ( $F_{1,423}=217.041$ ,  $p=0.00$ ). The null hypothesis one was rejected at .05 level of significance. The regression equation indicated that any increase in the value of leadership self-discipline will lead to a concomitant increase in the value of goal attainment of public universities in Rivers State. The regression equation  $Y = 11.731+0.402X$  showed that the more leaders demonstrate more of self-discipline the more the goal attainment of the university in Rivers State.

**Hypothesis Three:** There is no significant relationship between empathy as a leadership core value and goal attainment in public universities in Rivers State?

**Table 6: Summary of regression analysis on the relationship between leadership empathy and goal attainment of public universities in Rivers State**

**Part A: Model Summary**

Model	R	R Square	Adjusted Square	R Durbin Watson
1	.581 <sup>a</sup>	.338	.336	2.30652

a. Predictors: (Constant), Leadership Empathy

**Part A: ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1149.158	1	1149.158	216.005	.000 <sup>b</sup>
	Residual	2250.380	423	5.320		
	Total	3399.539	424			

a. Dependent Variable: Goal Attainment

b. Predictors: (Constant), Leadership Empathy

**Part B: Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.738	1.245		9.425	.000
	Leadership Empathy	.402	.027	.581	14.697	.000

a. Dependent Variable: Goal Attainment

The result from Table 3 shows the summary of linear regression on the relationship between leadership empathy and goal attainment of public universities in Rivers State. It shows that leadership empathy has positive and strong relationship with goal attainment of public universities in Rivers State ( $r=0.581$ ). The r-squared (0.338) shows that the leadership empathy contributed roughly 33.8% to the observed changes in goal attainment of public universities in Rivers State. The data in table 4.6 shows that leadership empathy has significant relationship with goal attainment of public universities in Rivers State ( $F_{1,423}=216.005$ ,  $p=0.00$ ). The null hypothesis one was rejected at .05 level of significance. The regression equation indicated that any increase in the value of leadership empathy will lead to a concomitant increase in the value of goal attainment of public universities in Rivers State. The regression equation  $Y = 11.738 + 0.402X$  showed that the more leaders demonstrate more of empathy the more the goal attainment of the university in Rivers State.

**Summary of Findings**

1. The extent integrity as a leadership core value enhances goal attainment in public universities in Rivers State is high.
2. The extent self-discipline as a leadership core value enhances goal attainment in public universities in Rivers State is high.
3. The extent empathy as a leadership core value enhances goal attainment in public universities in Rivers State is high.

**Discussion of Findings**

**The relationship between leadership integrity and goal attainment of public universities in Rivers State**

The data in table 4.1 showed that leadership integrity has positive and strong relationship with goal attainment of public universities in Rivers State. Also, the data in table 4.4 showed that an increase in the value of leadership integrity/honesty will lead to a concomitant increase in the value of goal attainment of public universities in Rivers State. This finding supports (Dahlsgaard, Peterson & Seligman, 2005) Honesty is a facet of moral character that



connotes positive and virtuous attributes such as integrity, truthfulness, straightforwardness, including straightforwardness of conduct, along with the absence of lying, cheating, theft, etc. Honesty also involves being trustworthy, loyal, fair, and sincere. Honesty is valued in many ethnic and religious cultures. Integrity is the practice of being honest and showing a consistent and uncompromising adherence to strong moral and ethical principles and values.

#### **The relationship between leadership self-discipline and goal attainment of public universities in Rivers State**

The data in table 4.2 showed that leadership self-discipline has positive and strong relationship with goal attainment of public universities in Rivers State. Also, the data in table 4.5 showed that an increase in the value of leadership self-discipline will lead to a concomitant increase in the value of goal attainment of public universities in Rivers State. This finding supports (Sasson, 2016) It is emphasized that “self-discipline appears in various forms, such as perseverance, restraint, endurance, thinking before acting, finishing what you start doing, and as the ability to carry out one’s decisions and plans, in spite of inconvenience, hardships or obstacles. Self-discipline also means a self-control, the ability to avoid unhealthy excess of anything that could lead to negative consequences.

#### **The relationship between leadership empathy and goal attainment of public universities in Rivers State**

The data in table 4.3 showed that Leadership empathy has positive and strong relationship with goal attainment of public universities in Rivers State. Also, the data in table 4.6 showed that an increase in the value of leadership empathy will lead to a concomitant increase in the value of goal attainment of public universities in Rivers State. This finding supports (Goleman, 2000; Mencl & May, 2009) Empathy also defined as the skill of sensing other people’s emotions, allows for understanding beyond someone’s apparent surface behaviour by putting oneself in another’s shoes and taking an active interest in their concerns.

#### **Conclusion**

The study investigated leadership core values and goal attainment of public universities in Rivers State. The finding reveals that self-discipline, honesty and empathy as leadership core values to a very high extent determine the goal attainment of universities in Rivers State, this is reflected the result of the data analysis as the three variables were found significantly related to goal attainment of university leaders. Although, there are numerous attributes/qualities such as vision, decision-making, moral values, ethics, transparency, and flexibility are underline values determine the leaders’ effectiveness. It was also observed that these values are indispensable for effective administration, management and actualization of university goal attainment.

#### **Recommendations**

Based on the findings of the study, the researcher recommends the following among others that:

1. University leaders ensure acquisition of self-discipline as it has been found indispensable for effective goal attainment.
2. University managements should train their key officers on human relation skills as some of the core values of leaders fall within the domain of relationship with humans and follow staff members. Thereby to develop more empathy in their key officers.
3. Integrity is very vital in every organization setting as no organization can thrive on dishonest climate or environment. Hence, leaders should be truthful to themselves and the organization they are serving at large.

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## ASSESSMENT OF THE RELATIONSHIP BETWEEN DIGITAL FINANCIAL SERVICES AND ECONOMIC GROWTH IN NIGERIA

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### Abstract

*This study strives to detect the short and long run relationship and as well the causal link between digital financial services and economic growth in Nigeria from 2013Q1 to 2021Q4. The study employed descriptive statistics, ADF unit root test, ARDL test and Pairwise Granger causality test. Real gross domestic product (RGDP) was used as explained variable, while point of sale volume (POSV), automated teller machine volume (ATMV), mobile banking services volume (MOBPAYV) and web banking services volume (WEBPAYV) were used as explanatory variables. The results from the ARDL test reveals positive and significant relationship between RGDP and the various explanatory variables employed in the study for both short and long run. The Granger causality test reveals bidirectional causal link between RGDP and the various explanatory variables employed in the study. Based on the evidence from the results, the study concluded that, there is a positive and significant relationship between economic growth and digital financial services, and bidirectional causal link also exists between economic growth and provision of digital financial services. The study thus recommended that, Government in Nigeria in formulating policies to boost economic growth should take cognizance of the trend of digital financial services; in the same vain, government in formulating policies to boost digital payment system should also take cognizance of the trends of the economic activities.*

**Keywords:** RGDP, mobpayv, webpayv, posv, atm and ARDL

### Introduction

The channels through which provision of financial services spur economic growth draw more attention, starting from Patrick, (1966). Patrick (1966) argued that, provision of efficient financial services contributes significantly to economic growth. Results from several scholars have supported this supply-leading hypothesis postulation (Akintola, Oji-Okoro, & Itodo, 2020; Obi, 2022; Ehiedu, Onuorah, & Owonye, 2022). Uppal and Mangla, (2018) also supported the supply-leading hypothesis by affirming that, “a well-functioning financial sector will definitely spur economic activities, that it is a precondition for efficient and effective allocation of resources for the attainment of full economic potential for growth”. Prior to the supply-leading hypothesis, Schumpeter, (1911) observed that, the effect is demand-following; meaning, it is the growth of the real economic activities that influence the demand for financial services which in turn leads to the development of financial activities.

To attain and sustain desirable economic growth has been one of the key objectives of government over time (Johnny, Timipere, & Markjackson, 2018). Appah, Tebepah, and Newstyle, (2023) described economic growth as the expansion rate in total output, which must be higher than the population growth rate, thereby leading to the improvement of the standard of living of the people. Economic growth could be described as a gradual and sustained quantitative increase in income or per capita output which is accompanied by the growth in its capital, volume of trade, consumption and the population.

The central bank of Nigeria has done much to transform the traditional system of payment which has brought about a gradual change from the old cash system of payment to digital payment platforms. Some of the digital financial services channels for electronic financial transactions include web transfer, point of sales (POS), mobile money transfers and automated teller machine (ATM) (Zwingina, Onoh, & Chukwu, 2023). Digital financial services have been confirmed by some recent studies as channels responsible for improving the nation's economy.

Austin-Olowo, Ailemen, Oladipo, and Monday, (2023) observed that, utilizing electronic means of payment in the financial intermediation process has assisted households and firms to gain access to cost effective and useful financial products and services that meet their needs; such as payments, information, credit and insurance. Akinrinola, Omojola, and Audu, (2023) stated that, digital financial technology for service delivery enhances savings which results to more investments and output. Digitalization of financial transactions assists increase productivity, convenience, stability and growth of the economy in the long-run (Gupta & Arya, 2020). Digitalization of financial transactions has saved cost and time for customers and bank staff, in the same vain, the country has witnessed improved efficiency and

accessibility in financial service delivery due to the emergence of digital financial service technology which has resulted to financial inclusion greatly (Iwedi, Kocha, & Wike, 2022). Digitalization of the financial sector has improved the growth of the world economy through hardware, software and infrastructures that aid easy electronic transfer between individuals, firms and government (Anane & Nie, 2022). Digital financial services assist overcome the barriers to assessing financial services, reduce cost, enhance savings through automated deposits, improve risk management and speed up transaction delivery and these aid investment activities that translate to economic growth (Zwingina, Onoh, & Chukwu, 2023). Telukdarie and Mungar, (2023) identified digital financial services as a potential catalyst for economic growth; that it assists the unbanked population gain access to financial services which improve their standard of living.

Pazarbasioglu, et al., (2020) described digital financial services as technology employed for effective financial service delivery. Customers employed such technologies for easy access to financial services and such technology reduce cost of transactions and accelerate transaction speed and assist in security, transparency and financial inclusion (Appah, Tebepah, & Newstyle, 2023).

Studies have affirmed that, digital financial services impact positively on economic growth (Akinrinola, Omojola, & Audu, 2023; Appah, Tebepah, & Newstyle, 2023; Igoni, Nwadioha, & Ogiri, 2022; Iwedi, Kocha, & Wike, 2022). While Ishioro, (2023) confirmed a negative relationship between digital financial services and economic activities, whereas others established mix results; some digital financial technology channels revealing positive relationship with economic growth and some are negatively related with economic growth (Austin-Olowo, Ailemen, Oladipo, & Monday, 2023; Ailemen, Enobong, Osuma, Evbuomwa, & Ndigwe, 2018; Ekong & Ekong, 2022).

The direction of causality between the provision of digital financial services and economic growth has received less attention from scholars. This study seek to ascertain the impact of digital financial services on economic growth, as well as the causal relationship between the provision of financial services and economic growth in Nigeria with updated data.

To achieve the above objective, this study will:

1. Investigate the effect of ATM services on economic growth
2. Evaluate the impact of POS services on economic growth
3. Ascertain the impact of mobile payment services on economic growth
4. Investigate the impact of web payment services on economic growth
5. Evaluate the causal relationship between ATM services, POS services, mobile payment services, web payment services and economic growth.

The remaining part of this research is structured to show extant literature review, methodology, presentation of results, discussion of findings and conclusion.

### **Concept of Digital Financial Services**

Mobile phones and other computerized devices that are connected to internet, connect businesses and individuals to a digitalized payment system which enables seamless transactions across all channels. Appah, Tebepah, and Newstyle, (2023) described digital financial services as financial services employed by customers via digital technology, including ATM, POS, mobile payment and webpayment. Digital financial services refer to the application of digital technology for financial operations; including online financial services, electronic money, branchless banking, mobile financial services either through banking or non-banking institutions which encourages deposits, transfer, receiving and withdrawal of money, as well as other financial products or services, such as credit, insurance and pension (CBN, 2020). Digital financial services are financial services that are accessed and deliver through digital channels, including established instruments such as debit and credit cards offered primarily by licensed financial institutions, as well as new solutions built on cloud computing, digital platforms, distributed ledger technologies, spanning mobile payments and peer to peer applications (Agur, Peria, & Rochon, 2020).

Austin-Olowo, Ailemen, Oladipo, and Monday, (2023) defined digital financial services as accessing needed financial services through digital channels. Gupta and Arya, (2020) described digital financial services as a platform of implementing digital infrastructure by individuals and institutions for numerous financial services such as savings,

withdrawals, transfer, investmentor credit and insurance. Digital financial services include those technologies, services, products and infrastructureswhich assist individuals and organizations to gain access to financial services such as savings, credit facilities and payments through internet platforms thereby lowering the cost of service and at the same time encouraging financial inclusion (Okoroeze, 2022). Digital financial services could refer to the broad range of technologies employed in delivering financial services such as savings, payment, credit, remittances and insurance. The use of point of sales (POS), automated teller machine (ATM), web banking services and mobile banking services for deposits and withdrawals, as well as other financial transactions is referred to as digital financial services (Austin-Olowo, Ailemen, Oladipo, & Monday, 2023).

**Automated teller machine (ATM):** It is a machine that dispense cash and allows a customer to make other transactions such depositing money, transferring funds, balance enquiry and airtime purchase via the personal identification number (PIN) (Adu & Williams, 2023). It is a computerized telecommunication device that aids financial institution's customers with access to various forms of financial transactions in a place provided for the public by the bank without the need of a bank official which dispenses cash and provides other financial services to customers through the personal identification number as a means of identification.

**Point of Sales (POS):** It is an electronic device that enables balance enquiry, payments, airtime purchase, provides receipts, electronic transfer and executes other financial transactions at a specific point of sale. POS is electronic device used at a retail outlet for payments and transfer between a money receiver and cardholder (Adu & Williams, 2023). POS technology is used to perform various financial services, including account balance enquiry, cashback, mini-statement printing and payment for purchases (Appah, Tebepah, & Newstyle, 2023).

**Mobile banking:** This is technology implemented by financial institutions to render financial services with the aid of customer's smart-phones or other computerized mobile devices for accessing and making financial transactions. With mobile banking technology, financial institution customers are given access to carryout financial transactions through computerized mobile devices that are connected to internet. The technology uses mobile devices such as cell phones and other electronic devices for making financial transactions, which could be in the form of unstructured supplementary service data (USSD), short message service (SMS) banking and app-based banking. Financial institutions employed mobile banking technology to enable customers to gain access to financial services through mobile electronic devices (Konte & Tetteh, 2023).

**Web banking:** This is a platform that provides customers to gain access to their bank accounts and carryout financial transactions with computers and smartphones which are connected to internet. It is the system which assists customer of a financial institution to carryout financial transactions through the internet (Mohammed, A.Ibrahim, & Muritala, 2022).

**Real GDP:** Whether total output of goods and services of a nation is shrinking or rising is always a concern for government and the entire society. GDP is taken at either in nominal or current prices and the two periods cannot be compared without making adjustment for inflation. To know the real GDP, its nominal value has to be adjusted in order to reckon with the change of prices which shows if the value of output is rising since more is produced due to increase in the prices of goods or services. Here price deflator is employed as a statistical tool to adjust GDP from its nominal state to constant prices. If the real GDP is rising, it is an indication that the overall economy is doing well. Real GDP is the measure that reflects the value of economic outputs produced by an economy, adjusted for price changes (deflation or inflation) in a given period (Johnny, Timipere, Ayunku, & Peter, 2018).

### Empirical Review

Akinrinola, Omojola, and Audu, (2023) examined the interactive link between digital financial inclusion technology and the level of household savings in Nigeria from 2009 to 2019. The explanatory variable; digital financial services was measured using automated teller machine, point of sales, mobile payment system and web payment system, whereas the explained variable; savings was measured using savings. The collated secondary data were analyzed using multiple regression technique. The output from the regression technique revealed that, automated teller machine, web payment system and mobile payment system have a significant impact on savings, whereas point of sales system has a significant negative impact on the level of savings for the period. The study concluded that improvement in the delivery of digital financial services will lead to the improvement of savings in Nigeria.

Akintola, Oji-Okoro, and Itodo, (2020) conducted a research on the relationship between financial sector development and economic growth in Nigeria between 2000 and 2019 on quarterly basis. The independent variable; financial sector development was measured employing all share index, market capitalization, monetary policy rates, interbank call rates, exchange rate and broad money while the dependent variable; economic growth was measured using real gross domestic product. The major analytical technique utilized in the study was the co-integrated ARDL model. The results from the employed technique shows that all the independent variables employed in the research revealed positive and significant relationship with the real GDP except exchange rate that has a negative relationship with the real GDP.

Similar study was conducted by Obayori and George-Anokwuru, (2020) to ascertain the link between financial inclusion and economic growth in Nigeria for a data set spanning from 1981 to 2018. The study also utilize the services of the ARDL technique on the collected data. Deposits from the deposit money banks, number of branches of deposit money banks and per capita income were used as independent variables while gross domestic product (GDP) was used as a dependent variable. The results from the ARDL technique shows that, deposits from the deposit money banks, number of branches of deposit money banks and per capita income have significant positive impact on the GDP for the period.

Appah, Tebepah, and Newstyle, (2023) studied the impact of digital financial services on economic growth in Nigeria between 2006 and 2021. The authors employed Vector error correction model (VECM) to analyze the set of collated data. The exogenous variable; digital financial services were measured utilizing automated teller machine services, point of sales services, mobile banking services and web banking services while the endogenous variable; economic growth was measured utilizing GDP. The test outcome revealed that all the exogenous variables indicated positive relationship with GDP except ATM, which was positive but was not significant. A similar research was conducted by Zwingina, Onoh, and Chukwu, (2023). The research investigated the impact of electronic payment system on economic growth in Nigeria. The author used Automated teller machine services, point of sales services and web payment as explanatory factors and used real GDP as explained factor from 2009 to 2018 by utilizing the ARDL model. The result from the research also indicated that, all the explanatory variables employed in the study influenced real GDP positively and the influence was significant for the period under review.

Austin-Olowo, Ailemen, Oladipo, and Monday, (2023) concertedly ascertained the role of digital financial services on the Nigerian economic growth with the application of ARDL technique by using ATM services, POS services, mobile payment services and web payment services as independent variables and real GDP as dependent variable. The result in a similar way revealed that, only web payment services indicated negative relationship with real GDP but the remaining variables indicated positive relationship with real GDP. But the study conducted by Ishioro, (2023) revealed a negative relationship between automated teller machine services which represents digital financial services and financial inclusion between 1990 and 2020 with the application of the same ARDL model.

Obi, (2022) in his study evaluated the impact of financial inclusion on economic growth with the application of regression technique. The study used ATM, depositors with commercial banks as independent variables and real GDP as dependent variable. It was revealed that, depositors with commercial banks and automated teller machine were all positive and significantly related with real GDP. Multiple regression was employed by Ehiedu, Onuorah, and Owonye, (2022). The study employed rural bank depositors, loan of rural branches, loans and advances to SMEs, bank branches spread ATM and financial inclusion as explanatory variables and used real GDP as explained variable from 1981 to 2020. The multiple regression result reveals that rural bank deposits, loans and advances to SMEs and financial deepening indicated positive relationship with real GDP whereas, loans to rural branches and ATM services have negative relationship with real GDP.

Igoni, Nwadioha, and Ogiri, (2022) employed ANOVA technique and investigated the evolution of e-naira for re-engineering the Nigerian growing economy. The outcome from the ANOVA technique revealed that, e-naira positively and significantly improve financial inclusion and the revenue base in the Nigerian economy. Okoroeze, (2022) carried out an empirical research on the role of digital finance on the Nigerian economy. The research used volume of digital financial services and the value of digital financial services as independent variables and real GDP as a dependent variable. The result from the regression model revealed that the two independent variables have a positive and significant connection with real GDP. In another similar study by Passion, Chiadika, and Obi, (2022) also

employed regression model to analyze data set from ATM services, POS services and real GDP. It was revealed that ATM impacted positively and significantly on real GDP while POS impacted negatively on the real GDP. In another study by Salisu, (2022), generalized method of movement was utilized to ascertain the relationship between financial inclusion on economic growth in selected developing countries. Using automated machine as explanatory variable and real GDP as dependent variable, the GMM result shows that, ATM has a positive but insignificant influence on real GDP.

Ekong and Ekong, (2022) evaluated the linkage between digital currency and financial inclusion in Nigeria on quarterly basis from 2006 to 2020. The weighted stepwise forward regression technique was employed in the research. Automated teller machine services, point of sales services, mobile payment services and web payment services were adopted as explanatory variables while financial inclusion was used as explained variable. The weighted stepwise forward regression results revealed that ATM, POS and mobile payment have positive link with financial inclusion, whereas web payment services indicated a negative link with financial inclusion for the period. Iwedi, Kocha, and Wike, (2022) also conducted a similar study by using OLS on the collated data from 2009 to 2020 and revealed that web payment and mobile payment as independent variables have positive and significant relationship with real GDP.

### Methodology

This section explained the technique that was employed in testing the theories that were adopted in regards the subject matter. The study employed auto-regressive distribution lag (ARDL) model. The choice was premised on the stable nature of the series at the level and first difference. Also, the technique is relevant since it has capacity to detect both short-run and long-run impact of the explanatory variables on the explained variable. The Granger causality test was also explored to identify the causal link between the explanatory variables and the explained variable. Meanwhile, the descriptive statistics and unit root test preceded the ARDL technique in order to ascertain both the features and stability of the time series data. The E-view software (version 10) will be employed for data analysis.

### Model specification

The model was specified in line with the supply-leading hypothesis, that efficient provision of financial services influence economic growth. Therefore economic growth is a function of digital financial services. The model is therefore expressed as follows:

$RGDP = f(ATMV, MOBPAYV, POSV, WEBPAYV)$ .

Given that, the theory does not specify the mathematical form of the model, this study evaluate by assuming, the link between RGDP, ATMV, MOBPAYV, POSV AND WEBPAYV is linear.

$RGDP_i = \beta_0 + \beta_1 ATMV_i + \beta_2 MOBPAYV_i + \beta_3 POSV_i + \beta_4 WEBPAYV_i \quad (i = 1, 2, 3, 4, \dots, n)$

This is the exact link, meaning the variation in the RGDP is fully explained by the changes in ATMV, MOBPAYV, POSV AND WEBPAYV. But due to other omitted factors and errors which need to be given consideration;

$RGDP_i = \beta_0 + \beta_1 ATMV_i + \beta_2 MOBPAYV_i + \beta_3 POSV_i + \beta_4 WEBPAYV_i + \mu$

Where RGDP = real gross domestic product; ATMV = automated teller machine volume; MOBPAYV = mobile payment volume; POSV = point of sales volume and WEBPAYV = web payment volume.

### Descriptive Statistics

	RGDP	ATMV	MOBPAYV	POSV	WEBPAYV
Mean	17399.25	1.14E+08	53062355	1.00E+08	2.83E+08
Median	17019.31	1.10E+08	59811177	51456264	3.01E+08
Maximum	20670.11	1.91E+08	90139553	2.68E+08	7.99E+08
Minimum	14715.33	60803325	12402234	25778644	5856819.
Std. Dev.	1388.993	41348726	20087791	81641039	2.39E+08
Skewness	0.329932	0.344173	0.657485	0.872690	0.369088
Kurtosis	2.447245	1.759429	2.519870	2.118494	2.227350
Jarque-Bera	1.111437	3.019255	2.939505	5.735108	1.712839
Probability	0.573660	0.220992	0.229982	0.066838	0.424680
Sum	626372.9	4.12E+09	1.91E+09	3.60E+09	1.02E+10
Sum Sq. Dev.	67525557	5.98E+16	1.41E+16	2.33E+17	1.99E+18
Observations	36	36	36	36	36

The above table display the measurement for the various variable's mean, median, standard deviation, skewness. The mean values for RGDP, ATMV, MOBPAYV, POSV and WEBPAYV are 17399.25, 1.14E+08, 53062355, 1.00E+08 and 2.83E+08 respectively. Their corresponding standard deviations are 1388.993, 41348726, 20087791, 81641039 and 2.39E+08 respectively. The error term in the specified model of the study is normally distributed, as indicated by the insignificant probability values of the Jarque-Bera statistics for each variables in the above table, which are all more than the 5% level of significance. All the variables are positively skew.

### ADF Unit Root Test for Stationarity

Conducting a unit root test is essential when employing the ARDL method to ensure its application to variables with integrated orders of one, zero, or both. Nevertheless, if the variables are integrated to 1(2) or beyond, it may be futile. Hence, the ADF test was conducted to verify that none of the variables were integrated to a higher order. The table below presents and discusses the findings of the ADF test.

Vari.	Sig. level	ADF @ levels			ADF @ 1 <sup>st</sup> Diff.			Order of int.
		T. stat.	Crit. T. Val.	Pro. Val.	T. stat.	Crit. T. Val.	Pro. Val.	
RGDP	5%	-3.562882	-3.899416	0.0242				1(0)
ATMV	5%	-3.544284	-2.176064	0.4875	-3.548490	-6.637646	0.0000	1(1)
MOBPAYV	5%	-3.544284	-2.798928	0.2071	-3.552973	-6.044529	0.0001	1(1)
POSV	5%	-3.544284	-2.010433	0.5756	-3.548490	-6.289755	0.0000	1(1)
WEBPAYV	5%	-3.544284	-1.687509	0.7355	-3.548490	-5.855232	0.0002	1(1)

Source: Author's computation

The mixed integration order implies a fundamental long-term relationship, which justifies the application of the ARDL technique.

### ARDL bound test result for cointegration

F-Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	10.05323	10%	2.45	3.52
K	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

The long-run features of the employed variables in the given model are displayed in the above table. The outcome displayed that the variables exhibits joint convergence over prolonged period of time. In different term, variables in the model have long-term linkage, since the value of ARDL F-statistic of 10.05323 is higher than the 1(1) value of 4.01 for the 5% upper bound. As a result, the alternative hypothesis is accepted and the null hypothesis of "no level relationship" or "no long-run relationship exists" is rejected. The above is a sufficient reason for chosen ARDL error correction model as the best method to apply.

### ARDL-ECM Regression Result for short run impact

ARDL Error Correction Regression

Dependent Variable: D(RGDP)

Selected Model: ARDL(4, 3, 1, 4, 3)

Case 3: Unrestricted Constant and No Trend

Date: 06/27/23 Time: 08:27

Sample: 1 36



Included observations: 32

# ECM Regression

## Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20125.07	2399.234	8.388124	0.0000
D(RGDP(-1))	0.643092	0.053747	11.96507	0.0000
D(ATMV)	0.650206	2.28E-06	2.851433	0.0146
D(ATMV(-1))	1.58E-05	2.00E-06	7.892573	0.0000
D(ATMV(-2))	-3.75E-06	1.97E-06	-1.904330	0.0811
D(MOBPAY)	0.427662	0.202678	2.110052	0.0455
D(POSV)	0.695016	1.88E-06	3.697547	0.0030
D(POSV(-1))	0.397738	0.175304	2.268839	0.0309
D(POSV(-2))	-9.43E-07	4.89E-06	-0.192767	0.8504
D(WEBPAYV)	0.166205	3.10E-06	5.371112	0.0002
D(WEBPAYV(-1))	4.44E-06	5.72E-07	7.766223	0.0000
CointEq(-1)*	-0.683122	0.160226	-4.263488	0.0001
R-squared	0.614696	Mean dependent var	104.7406	
Adjusted R-squared	0.588123	S.D. dependent var	1658.152	
S.E. of regression	202.3106	Akaike info criterion	13.76434	
Sum squared resid	654873.1	Schwarz criterion	14.49721	
Log likelihood	-204.2294	Hannan-Quinn criter.	14.00726	
F-statistic	137.7629	Durbin-Watson stat	2.027601	
Prob(F-statistic)	0.000000			

\* p-value incompatible with t-Bounds distribution.

F-Bounds Test		Null Hypothesis: No relationship	No levels	levels
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	10.05323	10%	2.45	3.52
K	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

t-Bounds Test		Null Hypothesis: No relationship	No levels	levels
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-8.186668	10%	-2.57	-3.66
		5%	-2.86	-3.99
		2.5%	-3.13	-4.26
		1%	-3.43	-4.6

From the estimated ARDL error correction model, it is clear that the model displays a remarkable explanatory capacity of 59 percent. It implies that, 59 percent of the changes in real GDP for the period is attributed to the combine influence of ATMV, MOBPAYV, POSV and WEBPAYV. The remaining 41 percent is attributed to factors that are not captured in the model. The ECMt displays the speed of adjustment from the short-term deviation to the long-term equilibrium. The ECMt coefficient is negative (0.683122), which is consistent with the cointegration test result from the ARDL bounds. It indicates that after a period, 68% of the previous year's deviation from the long-term equilibrium will be restored.

Furthermore, the result shows that, there is no serial correlation, as the Durbin-Watson statistic produced 2.027601. Looking at the long-run, all the explanatory variables are positively and significantly related with the explained variable. The outcome from the above result shows that if ATMV increase by one unit, it will lead to RGDP increase by 0.6502 units in the positive direction. The statistical significance of the ATMV and its positive influence on the real GDP is confirmed by the probability value of 0.0146 which is significant at the 5 percent level of significance. If MOBPAYV increase by one unit, it will lead to RGDP increase by 0.4277 units in the positive direction. The statistical significance of the MOBPAYV and its positive influence on the RGDP is confirmed by the probability value of 0.0455 which is significant at the 5 percent level of significance. If POSV increase by one unit, it will lead to RGDP increase by 0.6950 units in the positive direction.

The statistical significance of the POSV and its positive influence on the RGDP is confirmed by the probability value of 0.0030 which is significant at the 5 percent level of significance. If WEBPAYV increase by one unit, it will lead to RGDP increase by 0.1662 units in the positive direction. The statistical significance of the WEBPAYV and its positive influence on the RGDP is confirmed by the probability value of 0.0000 which is significant at the 5 percent level of significance. The outcome implies that, whenever financial institutions improve in their effort on the provision of explanatory variable; digital financial services, there will be significant improvement in the growth of the economy. The study finding here corroborates with the findings of Zwingina, Onoh, and Chukwu, (2023) that digital financial services positively and significantly influence economic activities but negates the findings of Ishioro, (2023) who posited, the explanatory variable; ATM services has a negative relationship with economic activities.

### Granger Causality Test

Pairwise Granger Causality Tests

Date: 06/30/23 Time: 06:14

Sample: 1 36

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ATMV does not Granger Cause RGDP	34	4.42862	0.0195
RGDP does not Granger Cause ATMV		3.84592	0.0312
MOBPAY does not Granger Cause RGDP	34	8.06065	0.0016
RGDP does not Granger Cause MOBPAYV		4.20944	0.0238
POSV does not Granger Cause RGDP	34	7.32752	0.0027
RGDP does not Granger Cause POSV		5.88614	0.0067
WEBPAYV does not Granger Cause RGDP	34	8.37605	0.0012
RGDP does not Granger Cause WEBPAYV		5.04982	0.0020

*Source: Author's computation*

From the above result, bidirectional causality link exists between RGDP and all the other explanatory variables employed in the study.

## Diagnostic Test

### LM test for Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.197731	Prob. F(2,10)	0.8237
Obs*R-squared	1.217337	Prob. Chi-Square(2)	0.5441

*Source: Author's computation*

The result from the above table shows that, the formulated model is free from the issues of serial or auto-correlation as evident from the Prob. Chi-Square (2) of 0.5441, which is not statistically significant at the 5 percent level. Therefore, the hypothesis of no sequential correlation is concluded. This also validates the estimated model's outcome for forecasting and policy choice.

## Heteroscedasticity Test

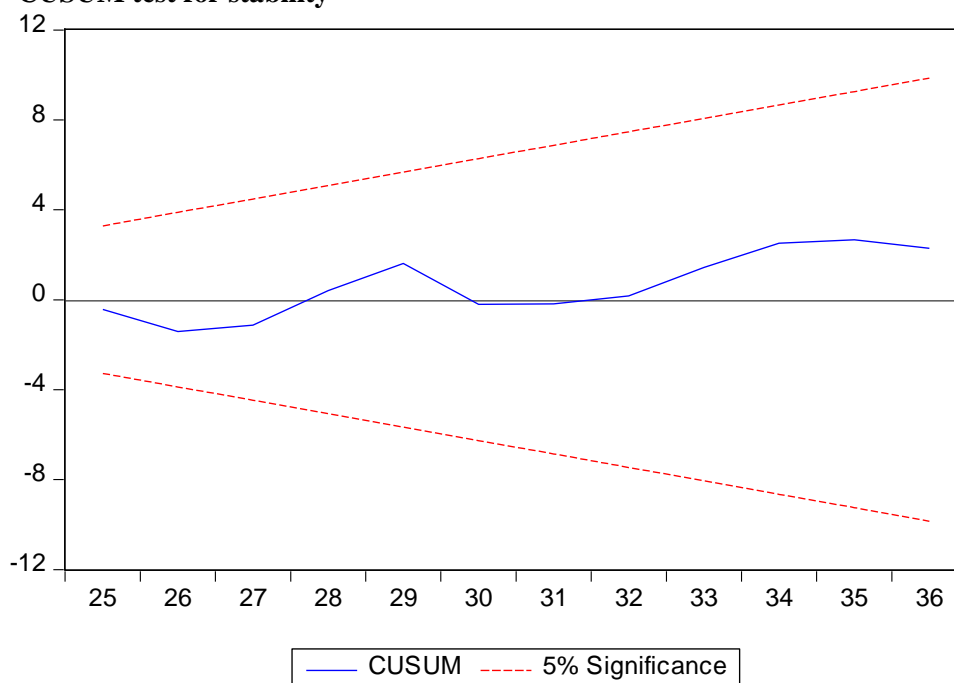
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.278433	Prob. F(19,12)	0.9936
Obs*R-squared	9.790913	Prob. Chi-Square(19)	0.9579
Scaled explained SS	4.247518	Prob. Chi-Square(19)	0.9998

*Source: Author's computation*

The outcome from the above table shows that has identified homoscedasticity. This is supported by the Prob. Chi-Square (19) of 0.9579, which is not statistically significant at the 5 percent level. Consequently, the study rejects the null hypothesis of non-constant variance in the residuals and accept the alternative hypothesis of constant variance.

## CUSUM test for stability



The diagram above shows that, the deviations of the calculated ARDL model are consistent, because the cumulative sum of square chat falls within the 5 percent significance region below and above. The study thus infers that, the model is dependable and suitable for policy making.

## Summary

This study assessed the link between digital financial services and economic growth in Nigeria from 2013Q1 to 2021Q4. The following findings were inferred from the research.

1. That economic growth represented by RGDP was positive and significantly influenced by digital financial services represented by automated teller machine volume.
2. That economic growth represented by RGDP was positive and significantly influenced by digital financial services represented by mobile payment services volume.
3. That economic growth represented by RGDP was positive and significantly influenced by digital financial services represented by point of sales services volume
4. That economic growth represented by RGDP was positive and significantly influenced by digital financial services represented by web payment services volume
5. That bidirectional causality link exists between RGDP and all the other explanatory variables employed in the research.

## Conclusion

This study strives to detect the short and long run relationship and as well the causal link between digital financial services and economic growth in Nigeria from 2013Q1 to 2021Q4. The study employed descriptive statistics, ADF unit root test, ARDL test and Pairwise Granger causality test. Real gross domestic product (RGDP) was used as explained variable, while point of sale volume (POSV), automated teller machine volume (ATMV), mobile banking services volume (MOBPAYV) and web banking services volume (WEBPAYV) were used as explanatory variables. The results from the ARDL test reveals positive and significant relationship between RGDP and the various explanatory variables employed in the study for both short and long run. The Granger causality test reveals bidirectional causal link between RGDP and the various explanatory variables employed in the study. Based on the evidence from the results, the study concluded that, there is a positive and significant relationship between economic growth represented by real gross domestic product and digital financial services represented by automated teller machine volume, mobile payment service volume, point of sales volume and web payment services volume; and that bidirectional causal link also exists between economic growth and provision of digital financial services.

## Recommendations

Based on the linkage found between digital financial services and economic growth;

1. Since digital financial services impacted positively and significantly on economic growth in Nigeria, monetary authorities in synergy with financial institutions should come up with policies that would enhance digital payment system
2. The central bank of Nigeria in synergy with the financial institutions should acquire the needed digital payment system infrastructures and enforce compliance of the cashless policy since digital payment system boasts economic activities
3. The central bank of Nigeria should implement policies that would encourage customers who are making use of the digital payment platforms
4. Government in Nigeria in formulating policies to boost economic growth should take cognizance of the trend of digital financial services; in the same vain, government in formulating policies to boost digital payment system should also take cognizance of the trends of the economic activities.

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## PART-TIME WORKING AND ORGANISATIONAL EFFECTIVENESS OF TELECOMMUNICATIONS COMPANIES IN PORT HARCOURT

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### Abstract

*Many organizations tend to disregard the importance of their employees, resulting in various negative consequences such as reduced productivity, lower employee performance, decreased customer patronage, and a drop in overall profits. In Port Harcourt, telecommunication firms have treated their employees like machines, causing them to become stressed, exhausted, and fatigued, which in turn has led to lower productivity levels. To address this issue, a study was conducted to examine the relationship between workplace flexibility and organizational effectiveness in six telecommunication companies in Port Harcourt, Rivers State. The study used a sample size of 86 managers out of a population of 117, and a structured questionnaire was used to collect data. Univariate analysis was done using mean and standard deviation, while bivariate and multivariate analyses were done using Spearman Rank Order Correlation Coefficient and Partial Correlation, respectively. The hypothesis was tested at a 0.05 level of significance. The study found that there is a significant positive relationship between workplace flexibility such as remote working, part-time working, and job sharing and organizational effectiveness measured by goal accomplishment, resource acquisition, and internal processes in telecommunication companies in Port Harcourt, Rivers State. Additionally, the study found that information and communication technology moderates the relationship between workplace flexibility and organizational effectiveness. In conclusion, the study recommends that telecommunication companies should prioritize their employees' flexibility to reduce stress by granting them flexible job hours, to maximize their potential and energy.*

**Keywords: Remote Working, Part-time Working, Organizational Effectiveness and Goal Accomplishment**

### Introduction

Many scholars think that an organization's success is dependent on its personnel being content, motivated, and creative in their efforts to fulfill the organization's goals; and that managers should be able to bring people's competencies from possibility to reality in this instance. One of the strategic responsibilities of organization is to adopt particular strategies to establish an atmosphere conducive to the development of employees' skills and abilities. According to studies, when senior management embraces change, low and middle managers' readiness to enact change and be persuaded of the necessity for transformation should be acknowledged. For the objective of achieving optimal performance, organizational efficiency is linked to the fulfillment of infinite demands from stakeholders, continuous sustainability within the industry, and sustained retaining of skilled employees. Jackson (2007) avers that the staff is the foremost valuable asset that organizations have in hand. These workers are however regularly burdened with the dilemma of distributing their time among several competing needs like visiting family issues, socio-political events, and many other activities that sometimes conflict with organizational goals. This instance often creates work-life conflict for some workers whose private life is threatened by the disparity within the time they invest in their work as against the clock spent reception. The resultant effect affects the organization, the individual employee, and society holistically (Fapohunda, 2014).

The emergence of Covid 19 opened organizations up to the possibility of employees working at home or working part time and still giving their best skills thereby saving cost. While some organizations benefited from the lock down others struggle to survive and on the other hand, employees lost their jobs and means of survival. Organisations sometimes often ignored the importance of the employees in the organisation and this has led them to so many fallouts affecting productivity level, employee performance, customer's patronage and the organisations gross profit. The inability of the organisation like telecommunication firms in Port Harcourt has treated the employees as machines that can be used without proper care other than assets has led to the employees been stressed and worn out then become more of fatigue which has resulted to low inputs and productivity level. Often times telecommunications have experience backdrops in their services to their customers as a result of poor employees' services and this has a gross

effect on the company. This study seeks to examine how both employees and employers through a flexible working environment reach achieve their goals.

### **Research hypothesis**

For the purpose of this research, the following null hypotheses were posed:

- Ho<sub>1</sub>**: there is no significant relationship between part-time working and organisational goal accomplishment in telecommunication companies in Port Harcourt.
- Ho<sub>2</sub>**: there is no significant relationship between part-time working and organisational resource acquisition in telecommunication companies in Port Harcourt.
- Ho<sub>3</sub>**: there is no significant relationship between part-time working and organisational internal processes in telecommunication companies in Port Harcourt.

### **Part-time working**

There has been rapid growth in part-time work in the past few decades in developed economies. This trend is related to the increase in female labor force participation but also results from policies attempting to raise labor market flexibility in reaction to changing work organization within industries and to the growth of the services sector. The indicator on part-time workers focuses on individuals whose working hours total less than “full time”, as a proportion of total employment. Because there is no internationally accepted definition as to the minimum number of hours in a week that constitute full-time work, the dividing line is determined either on a country-by-country basis or through the use of special estimations.

According to Clark (2000), part-time workers are the workers that work less than 35 hours a week and this set of employees are reported to have the lowest levels of psychological and physical health problems. Workers who wish to balance their work and family participate in part-time work while workers that prefer working for longer hours are not satisfied with part-time work. Why should an employer introduce part-time jobs? Tijdens, (2007) categorised the motives of part-time jobs into three. The first is the secondary employee’s strategy, which is based on the requirement for low-cost and – in some cases – flexible labor. The second motivation is to have the best possible staffing. Optimised staffing factors can be essential in organizations where services are cantered in a few hours per day, where the task varies in other forms, or where the operating parameters are stretched. The underlying premise of the optimal staffing motive is to avoid paying full-time employees for unproductive hours. The third reason for introducing part-time jobs is to accommodate workers' preferences, often known as the accommodation method. A part-time job is one that usually requires a person to work fewer hours per workweek than their employer deems full-time employment.

However, there aren’t a set number of hours per week that's legally considered full-time or part-time employment, so it's up to the employer to decide which positions are classified either way. Reducing employees' hours is effective in managing operating costs during an economic downturn. It also allows the manager to manage their performance by allocating more hours to higher-performing workers and fewer hours to your less efficient ones, Effective Employees.

### **Organisational Effectiveness**

The effectiveness of an organization is a key concern to management and for employees. It is more or less depends on the management, the way they organize staff and manage their human capital. Organizational effectiveness is described as a “necessary form of disciplined self-flagellation than a pursuit of happiness” (March & Sutton, cited in Itishree & Rabindra, 2014). In the same vein, Rogers and Wright, (cited in Itishree & Rabindra 2014) has stated that modern organizations are dependent on complex systems and the knowledge of their employees where organizational effectiveness refers to the degree to which the actual outcomes of the organization match those outcomes necessary for the organization to attain its goals and objectives.

Organizational effectiveness is the ability of an organization to mobilize its centre of power, for action, production and adaptation Mott (2018). He has developed a model for measuring organizational effectiveness which includes:

- (a) Goal attainment which is productivity
- (b) Internal health which is adaptability; and
- (c) Resource acquisition which is efficiency.

Employee performance is one of the dimensions of organizational effectiveness. If employees will perform better it will contribute to overall effectiveness of the organization. Employee performance is measured in terms of their commitment towards organization, willingness to change and to learn new skills. Some of the important factors which are related to individual performance are creativity, leadership, integrity, attendance and cooperation. Another sub-dimension of employee performance is how effectively and quickly the employees solve the problems they face, which refers to their problem-solving skill. Some other factors which will be taken for measuring employees' performance is their ability to handle multiple types of tasks, and how much they are team oriented. The second dimension of organizational effectiveness is productivity of the organization. And the final one is financial performance of the organization. Likewise, the effects of productivity, profitability, and cost-efficiency upon the organization will be taken for measuring organization's financial performance.

### **Part Time Working and Organisational Effectiveness**

Firms with a large share of part-time employees are more productive, effective and efficient than firms with a low share of part-time employees due to allocation efficiency offered by part-time employment. Part-time employees are used to bridge the gap between opening hours and contractual work hours. Due to these fluctuations in customer's demands, part-time employment enables firms to cushion peak hours by deploying more workers during that time than during opening hours with lower customer demand. Whether part-time or full-time workers are deployed during peak hours can depend on their relative productivity. A third way in which part-time employees can provide allocation efficiencies is by bridging the lunch breaks of their full-time colleagues. Deploying a large fraction of part-time employees therefore seems to increase allocation efficiency over the work day, which contributes to greater firm productivity.

Working-time reductions have been historically used as a means of distributing the fruits of increased productiveness. (Bosch & Lehnndorff, 2001) the data suggest that as labor productivity rises, hours worked fall, and productivity rises again. Despite this empirical pattern however, there exists a strong theoretical argument from neo-classical economics which argues that cutting working hours will lead to a fall in productivity, by reducing labor quality or deployment efficiency (i.e., the third factor of productiveness, that of —matching). Whereas this is a possible outcome, it becomes problematic when presented as inevitable since it relies on restrictive theoretical assumptions of labor input and production technology, and has little support from historical evidence. Instead, in addition to the general historical trend (large changes in labor supply over the past four decades reveal no systematic negative effect on output per hour worked); there are many demonstrations of increasing labor productivity following a reduction in working hours.

### **Heider Attribution Theory (1958)**

Attribution theory is concern with how individuals interpret events and how this relates to their thinking and behaviour. Attribution theory assumes that people try to determine why people do what they do, were by attributing causes to behaviour. This theory is relevant to this study in the sense that when employees are not comfortable with the flexibility time schedule they began to exhibit different behaviour, feelings, change of moods towards their job, actions which will in turn affect the productivity of the organization and the employees will not be satisfied while carrying out their duties. It is the responsibility of the organization to identify these changes and act immediately by putting the right flexibility timing that will enable the employees to work effective and efficiently, by so doing increasing employee performance, employee retention and employee commitment to the organization. (Ukessey 2018).

## **Methodology**

### **Research design**

The research design used for this study is the descriptive research design which is based on a theoretical basis where data will be collected, analyzed, prepared, and presented understandably.

### **Population for the Study**

The study population includes managers, CEOs, and heads of departments of thirty telecommunication companies in Port Harcourt. However, a sample was selected based on the size of the company. The study will use a total number of 117 respondents in the telecommunication companies in Port Harcourt with a maximum of six branches. See Appendix for the telecommunication tables and respondent table.



### Sample Size and Sampling Techniques

The Krejcie and Morgan sample size determination was used to determine the sample size for this study. Therefore, the total number sample size was 86 using Krejcie and Morgan's (1970) table.

### Instrument for Data Collection

To gather data for this study, questionnaires constructed by the researcher were distributed and retrieved; and other research work were obtained to gain secondary data.

### Methods of data analysis

The spearman rank order correlation coefficient at a 0.05 level of significance based was adopted. The null hypothesis will be rejected whereas the alternative hypothesis will be accepted. The coefficient was computed with the formula:

$$R = \frac{6 \sum d^2}{N(n^2-1)}$$

Where;

N = number of pairs of data

D = different between ranking in each set of data

Σ = summation

### Bivariate Analysis of the Variables

#### Part Time Working and Organisational Effectiveness

**H<sub>01</sub>:** there is no significant relationship between part-time working and organisational goal accomplishment of telecommunication companies in Rivers state.

**H<sub>02</sub>:** there is no significant relationship between part-time working and organisational resource acquisition of telecommunication companies in Rivers state.

**H<sub>03</sub>:** there is no significant relationship part-time working and organisational internal processes of telecommunication companies in Rivers state.

#### Correlation between Part Time Working and Organisational Effectiveness

			Part time working	Goal accomplishment	Resource acquisition	Internal process
Spearman's rho	Part-time working	Correlation	1.000	.580**	.661**	.479**
		Coefficient	.000	.000	.000	.000
		Sig. (2-tailed)				
		N	80	80	80	80
	Goal accomplishment	Correlation	.580**	1.000	.710**	.535**
		Coefficient				
		Sig. (2-tailed)	.000	.	.000	.000
		N	80	80	80	80
	Resource acquisition	Correlation	.661**	.710**	1.000	.641**
		Coefficient				
		Sig. (2-tailed)	.000	.000	.000	.000
		N	80	80	80	80
	Internal process	Correlation	.479**	.535**	.641**	1.000
		Coefficient				
		Sig. (2-tailed)	.000	.000	.000	.000
		N	80	80	80	80

**\*\*.** Correlation is Significant at the 0.01 level (2-tailed).

*Source: SPSS Output*

Column two of table above shows r value of 0.580 at a significant level of 0.00 which is less than the chosen alpha level of 0.05 for the hypothesis relating part time working and goal accomplishment. Since the significant level is less

than the alpha level of 0.05, the null hypothesis ( $H_{01}$ ) which states that there is no significant influence of part time working on goal accomplishment of telecommunication companies in Port Harcourt was rejected and the alternate hypothesis ( $H_{a1}$ ) was accepted. This implies that there is a moderate significant influence of part time working on goal accomplishment of telecommunication companies in Port Harcourt.

Column three of table above shows r value of 0.661 at a significant level of 0.00 which is less than the chosen alpha level of 0.05 for the hypothesis relating to part time working on resource acquisition. Since the significant level is less than the alpha level of 0.05, the null hypothesis ( $H_{02}$ ) which states that there is no significant influence of part time working on resource acquisition of telecommunication companies in Port Harcourt was rejected and the alternate hypothesis ( $H_{a2}$ ) was accepted. This implies that there is a high significant influence of part time working on resource acquisition of telecommunication companies in Port Harcourt.

Column four of table above shows r value of 0.479 at a significant level of 0.00 which is less than the chosen alpha level of 0.05 for the hypothesis relating to part time working on internal process. Since the significant level is less than the alpha level of 0.05, the null hypothesis ( $H_{03}$ ) which states that there is no significant influence of part time working on internal process of telecommunication companies in Port Harcourt was rejected and the alternate hypothesis ( $H_{a3}$ ) was accepted. This implies that there is a moderate significant influence of part time working on internal process of telecommunication companies in Port Harcourt.

Thus, the results above showed that part-time working has a significant positive influence on organisational effectiveness of organisational effectiveness in Port Harcourt in terms of goal accomplishment, resource acquisition and internal process.

### Discussion of Findings

The findings of this study are as follows:

- H<sub>01</sub>:** there is no significant relationship between part-time working and organisational goal accomplishment of telecommunication companies in Rivers state.
- H<sub>02</sub>:** there is no significant relationship between part-time working and organisational resource acquisition of telecommunication companies in Rivers state.
- H<sub>03</sub>:** there is no significant relationship between part-time working and organisational internal processes of telecommunication companies in Rivers state.

The test of hypotheses one, two and three revealed that there is a significant positive influence of part time working and organisational effectiveness of telecommunication companies in Port Harcourt. On the analysis on the relationship between part-time working and organisational efficiency (goal accomplishment, resource acquisition and internal processes). The study revealed that expenses on recruitment is reduce due to part-time working. It was also notice that organisation that practice part-time working are productive and enable organisation to retain their employees. The study is supported by Bosch &Lehndorff, (2001), they stated in their study on the relationship between part-time working and organisational efficiency that firms with a large share of part-time employees are more productive, effective and efficient than firms with a low share of part-time employees due to allocation efficiency offered by part-time employment. Part-time employees are used to bridge the gap between opening hours and contractual work hours due to these fluctuations in customer's demands.

### Conclusion

The study has examined part-time working and organizational efficiency. The study emerges with the conclusion that part-time working has a very strong positive relationship with organizational efficiency. The adoption of part-time working as a flexible practice will drastically reduce burden on employees and also aid organizations in the attainment of their goal accomplishment, resource acquisition and maintain a good internal processes.

Similarly, based on the specific objective, the following conclusions have been made:

- I. There is significant relationship between part-time working and goal achievement in telecommunication companies in Port Harcourt.
- II. There is significant relationship between part-time working and resource acquisition in telecommunication companies in Port Harcourt.

- III. There is significant relationship between part-time working and internal processes in telecommunication companies in Port Harcourt

### Recommendations

Based on the findings, and conclusions of the study, the following recommendations have been made:

- I. Flexibility is directly related to perception of job insecurity and a breach of employees' psychological contract; as a result, flexibility is portrayed as an unconstructive theory. However, it should not be used as a global conclusion.
- II. Workplace Flexibility should be created and put into place in a way that both the company and the employees may get the most from them.
- III. Organisation whose workforce are over burden often experience absenteeism, therefore, organisations should adopt a flexible workplace to enable goal achievement.

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## INVESTIGATION OF HSE STANDARDS ADOPTED BY VARIOUS OIL AND GAS COMPANIES IN RIVERS STATE

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### Abstract

*Health Safety and Environment (HSE) is key to protecting the wellbeing of workers. The study looked at the investigation of HSE standards adopted by various oil and gas companies in Rivers State. The study adopted the descriptive survey research design. The population of the comprises of 150 HSE instructors from various oil and gas firms in Rivers State. The study developed a questionnaire instrument titled "Investigation of HSE Standards by Oil and Gas Firms in Rivers State" (IHSESOGS). The data obtained from the study was analyzed using simple mean. The response options are presented as 5, 4, 3, 2 and 1 respectively. The value measurement is illustrated as the following Strongly agreed (SA), Agreed (A), Disagree (D), Strongly Disagree (SD), No response (N). During the research, the instrument was validated by two experts from the department of industrial safety and environmental engineering in federal polytechnic, bonny, Rivers State. Finding obtained from table 1 research question revealed that items 1, 2, 3 and 4 are strongly agreed to the various questions on the impact of keeping to HSE standards in oil and gas companies, this makes the effect of HSE standards effective. Also, Findings obtained from table two research question 2 revealed that items 5, 6 and 7 were strongly disagree to the various questions on the Outcome of oil and gas companies violate HSE standards. Further, figure 1 deployed the model development of HSE standards in oil and gas Companies. The model illustrate pattern for coordinating effective safety practice in oil and gas firms. Finally, it was recommended that oil and gas companies should fund and establish strong HSE departments in various branches of their industries to equip them in order to carry our HSE exercises before and after any working task.*

**Keywords:** Investigation, HSE Standards, Oil and Gas Companies

### Introduction

The Africa Oil Corporation HSE Management System defines the principles by which we conduct of our operations with regards to health, safety, and the environment. All management communicates the HSE philosophy to all employees, customers, contractors, and third parties associated with our business, and each Africa Oil Corporation organization must provide positive evidence of conformance to the system in its day-to-day business (Safety Science, 2009). The HSE Management System Oil and Gas Industry Standard model comprises eight interrelated components which are management leadership and commitment; Policy and Strategic Objectives; Organisations, Responsibilities, Resources, Standards and Documentation; Hazards and Effects Management; Planning and Procedures; Implementation and Performance Monitoring; Audit and Review. These are continuously improved by conformance checks on day-to-day standards in organization. As seen in related literatures (Ezekiel, Nandi, Thuo & Wanyonyi, 2012, Agbola, 2012), wherever there are people or group of people working or staying together, the health and safety of people will naturally be of a concern, although the degree may vary due to the level of risk exposure that are peculiar to some organizations.

The Worldwide oil and gas company Accident Database is one of the most comprehensive accident databases available. It contains 6,183 offshore accident reports from between 1975 and 2012, including accidents, incidents and near misses. Over 60 per cent of the data relates to incidents occurring in the northern hemisphere. The records are classified in four categories: insignificant events; near misses; incidents/hazardous situations; and accidents into accidents; this classification is used for all situations and events causing fatalities and developed into accidents; a low degree of damage has been recorded, and repairs or replacements are usually required (Wilson and Koehn, 2000). This category also includes events causing minor health into accidents, but where no damage has occurred and no repairs were required most of these cases no damages were registered and repairs were not required. Small spills of crude oil

and chemicals are also included in this category, as are also very minor personnel injuries such as incidents leading to lost time the more severe events are shown to be 83 per cent of the total collected data (Wilson and Koehn 2000). With respect to type of unit, fixed facilities are more likely to experience accidents than mobile units: 50 and 38 per cent, respectively. Most events were attributed to unsafe procedures (37 per cent) or an absence of procedures that resulted in unsafe acts (44 per cent). The figures indicate that in order to improve safety and health, the safety of equipment and facilities, and the elimination of human and organizational factors need to be addressed. The reason is that the workers just like any other resources require maintenance and care in order to maximize their productivity (Casio, 1996).

### **Statement of problem**

The challenge faced by workers in most oil and gas firm is failure to adhere to common safety practice. Observation show that most oil and gas workers experience huge fatality usually leading to death (Wilson and Koehn, 2000). There is a need to investigate causes of this unsafe practices. Furthermore, changes of installation ownership make it difficult to provide proper cutting had never been done to the detriment of safety. Soon after the sale, Apache shut down one rig for 28 days of repairs, 30 per cent longer than originally scheduled. Canadian Natural Resources had a similar experience in a North Sea field with a fixed platform which was originally built for Chevron. The field had changed hands several times before Canadian Natural Resources took it over in 2002, and all the platforms and the pipelines that serve them needed repair work.

### **Objectives of the study**

The study is aimed at observing the variation in HSE practice and developing a model for harmony in standard working procedures. Specifically, the study sought to:

1. Find out the impact of application of HSE standards in oil and gas companies?
2. Find out the outcomes of workers' violation of HSE standard in oil and gas companies?

### **Research Questions**

The following research questions were used as a guide for the study:

1. What is the impact of application of HSE standards in oil and gas companies?
2. What are the outcomes of workers' violation of HSE standard in oil and gas companies?
3. What is the model adopted in maintain healthy safety practice in an Oil and Gas Firm?

### **Significance of the Study**

Firstly, health and safety standards are of utmost importance in the oil and gas industry to protect workers and nearby communities. These standards include measures to prevent accidents, such as rigorous training programs, hazard assessments, and the use of personal protective equipment. Additionally, oil and gas companies have implemented emergency response plans to address potential incidents and minimize their impacts. Regular inspections and audits ensure that equipment and facilities are well-maintained and meet safety standards.

### **Literature Review**

#### **HSE Standards and Documents**

The HSE Management standards are aligned with the requirements of company HSE Policy and recognised international and national standards including ISO 14001, OHSAS 18001, ISO 31000 and AS 4801 and support the company in its efforts to comply with legal obligations regarding HSE (Sawacha, Naoum and Fong, 1999).

The objectives of the standards are to:

- Set and formalize expectations for the progressive development and implementation of more specific requirements within Africa Oil Corporation
- Provide auditable criteria against which the HSE Management System can be measured
- Provide a basis from which to drive continual improvement

### **International labour standards on OSH**

The ILO s international labour standards provide the minimum legal framework for promoting OSH. The ILO Constitution sets forth the principle that workers should be protected from sickness, disease and injury arising from their employment. The ILO instruments on OSH promote tripartite collective efforts by governments, employers and

workers to build, implement and continuously strengthen a preventative safety and health culture. Tripartism is a key component for effective OSH regimes in the oil and gas industry. A hydrocarbon development project – the trends in risk level in the petroleum activity (RNNP) process – serves to illustrate how tripartism works in the Norwegian oil and gas industry.

This process has developed considerably since its inception in 1999–2000 as a result of tripartite cooperation. The national policy approach to OSH promoted by the ILO emphasizes the role of national governments in OSH management. From a governmental perspective, OSH management is a combination of related parts organized into a related whole or system.

The oil and gas industry plays a crucial role in the global economy, providing the energy needed to power industries, transportation, and homes. However, the extraction and production processes involved in this industry can have significant impacts on health, safety, and the environment. To mitigate these risks, oil and gas industries have adopted various health safety and environmental standards (Needleman, 2000).

Firstly, health and safety standards are of utmost importance in the oil and gas industry to protect workers and nearby communities. These standards include measures to prevent accidents, such as rigorous training programs, hazard assessments, and the use of personal protective equipment. Additionally, oil and gas companies have implemented emergency response plans to address potential incidents and minimize their impacts. Regular inspections and audits ensure that equipment and facilities are well-maintained and meet safety standards.

Furthermore, environmental standards are crucial to minimize the industry's impact on ecosystems and climate change. Oil and gas companies have adopted measures to reduce greenhouse gas emissions, such as the use of cleaner technologies and energy-efficient practices. They also implement strategies to minimize water usage, prevent oil spills, and manage waste responsibly. Environmental impact assessments are conducted before exploration or drilling activities to identify potential risks and develop mitigation measures (Needleman, 2000).

To ensure compliance with these standards, regulatory bodies play a vital role in monitoring and enforcing industry practices. These bodies set regulations and standards that oil and gas companies must adhere to and conduct regular inspections to ensure compliance. In some cases, industry-specific certifications are also required to demonstrate a commitment to health, safety, and environmental standards.

Moreover, industry associations and international organizations provide guidelines and best practices to further improve health, safety, and environmental performance. Collaboration between companies and these entities facilitates the sharing of knowledge and fosters innovation in sustainable practices (Needleman, 2000).

The oil and gas industries play a crucial role in the global economy by providing the much-needed energy resources for various sectors. There are some international and industry standards that may be applicable generally to operations in the Arctic, there are few standards that apply specifically to Arctic operations. Systematic reviews of globally applicable standards for suitability in the Arctic have only been done for a few of the available standards, such as ISO 19906:2010 Petroleum and natural gas industries – Arctic offshore structures. International organizations in the Arctic focus on cooperative activities for the protection of the general population, environmental protection and bio-system protections. There is no single authority or organization to comprehensively address specific OSH standards in the Arctic. International Organization for Standardization (ISO) standards The International Organization for Standardization (ISO) provides universal voluntary management systems. The ILO has been participating in the process of formalizing ISO 45001 on the basis of a Memorandum of Understanding signed by the two organizations in August 2013. ISO 45001 is expected to be adopted in late 2016; it is now at the stage of the preparatory technical work. The standard will set requirements for OSH management systems and is designed to help companies and organizations around the world ensure the health and safety of workers (Labour Convention, 2006).

Furthermore, the oil and gas industries also focus on community safety and engagement. Companies strive to maintain open and transparent communication with local communities, informing them about their operations and potential risks. They establish emergency response plans and conduct drills to ensure preparedness in the event of accidents or unforeseen incidents. Moreover, companies actively engage with local stakeholders to address any concerns or

grievances related to their operations (Kumar and Bansal, 2013). These efforts foster mutual trust and collaboration, creating a safer and more sustainable environment for all.

### Methodology

The study looked at the investigation of HSE standards adopted by various oil and gas companies in Rivers State. The study adopted the descriptive survey research design. The population of the comprises of 150 HSE instructors from various oil and gas firms in Rivers State. The study developed a questionnaire instrument titled "Investigation of HSE Standards by Oil and Gas Firms in Rivers State" (IHSESOGRS). The data obtained from the study was analyzed using simple mean. The response options are presented as 5, 4, 3, 2 and 1 respectively. The value measurement is illustrated as the following Strongly agreed (SA), Agreed (A), Disagree (D), Strongly Disagree (SD), No response (N). During the research, the instrument was validated by two experts from the department of industrial safety and environmental engineering in federal polytechnic, bonny, Rivers State. The mathematical analysis was resolved as follows; adding the value of the number of series in a given data, divided by the total number of figures in a data.

$$\begin{aligned} \sum x/n \\ 5+4+3+2+1/5 \\ = 15/5 \\ = 3 \end{aligned}$$

Therefore, the value that carries the highest number of frequencies based on response is notified as 3.0 and above is accepted as strongly agreed, while the number of frequencies based on response that is below 3.0 is accepted as disagreed or strongly disagreed.

### Data analysis

#### Research question 1

What is the impact of application of HSE standards in oil and gas companies?

**Table 1: Impact of application of HSE standards in oil and gas companies.**

S/N	ITEMS	MEAN	DECISION
1	HSE practices prevents oil and gas companies from breaking safety policies?	3.10	Strongly agreed
2	HSE standards looks out for the interest of oil and gas company workers	3.14	Strongly agreed
3	HSE standards has prevented oil and gas companies from accidents	3.25	Strongly agreed
4	Oil and gas industries and their employees are conditioned in a proper way of work due to safety HSE standards.	3.22	Strongly agreed
	<b>Grand mean</b>	<b>3.15</b>	

Finding obtained from table 1 research question revealed that items 1, 2, 3 and 4 are strongly agreed to the various questions on the impact of keeping to HSE standards in oil and gas companies, this makes the effect of HSE standards effective.

#### Research question 2

What are the outcomes of workers violation of HSE standard in oil and gas companies?

**Table 2: Outcomes of workers violation of HSE standard in oil and gas companies**

S/N	ITEMS	MEAN	DECISION
5	Oil and gas companies experience full assurance of safety management without adopting HSE standards	2.90	Strongly Disagree
6	Oil and gas workers can carry out certain task without the application of safety measures	2.80	Strongly Disagree

7	The rejection of HSE standards have helped oil and gas companies raise more income	2.92	Strongly Disagree
<b>Grand mean</b>		<b>2.86</b>	

Findings obtained from table two research question 2 revealed that items 5, 6 and 7 were strongly disagree to the various questions on the Outcome of oil and gas companies violate HSE standards.

### Research Question 3

What is the model adopted in maintain healthy safety practice in an Oil and Gas Firm?

**Figure 1: Model Development of HSE standards in oil and gas Companies.**

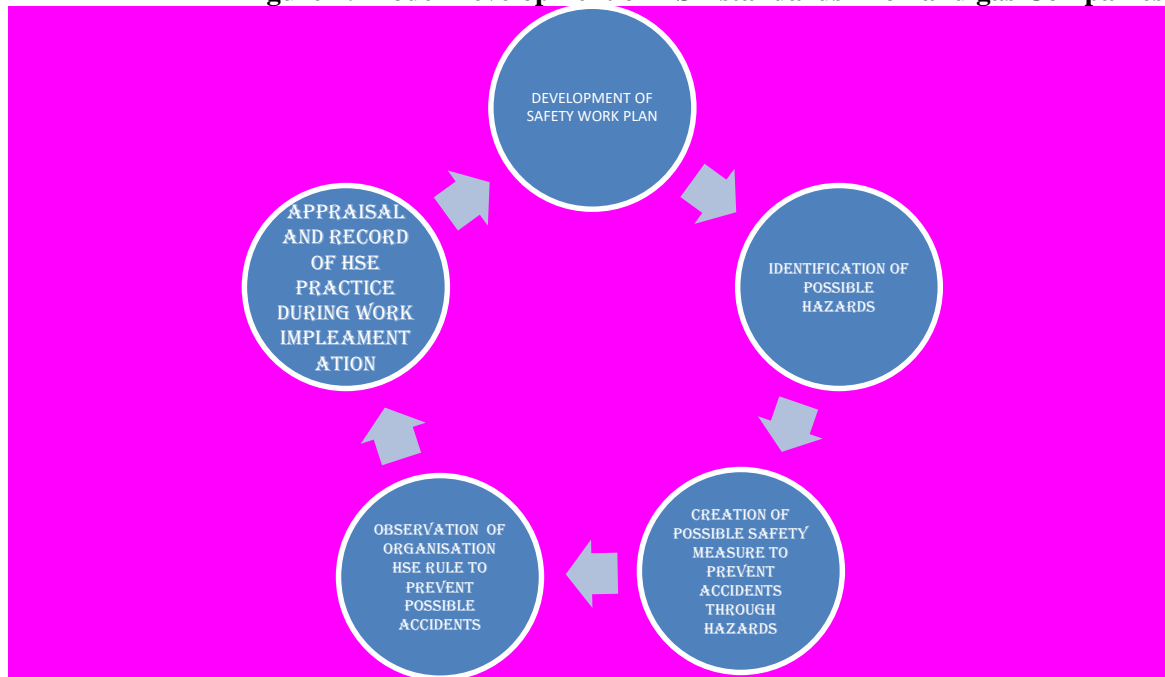


Figure 1 deployed the model development of HSE standards in oil and gas Companies. The model illustrate pattern for coordinating effective safety practice in oil and gas firms. The procedures entail:

- Development of safety work plan
- Identification of possible hazards
- Creation of possible safety measure to prevent accidents through hazards
- Observation of organization HSE rule to prevent possible accidents and
- Appraisal and record of HSE practice during work implementation

### Discussion of Findings

HSE standards is a provision made to guard oil and gas industries and also maintain safety. Based on the findings pertaining to this HSE standard adoption in oil and gas industries, the evaluation done examined that the Worldwide oil and gas company Accident Database is one of the most comprehensive accident databases available (Arthur, 2014). It contains 6,183 offshore accident reports from between 1975 and 2012, including accidents, incidents and near misses. This means that it is essential for oil and gas industries to consciously adapt to HSE standards in order to prevent accidents and dangers in their work environment. This is evident to the research question on the impact of keeping to HSE standards in oil and gas industries and also the risk involved if oil and gas industries fail to adopt HSE standards for safety (Arthur, 2014).

Figure 1 deployed the model development of HSE standards in oil and gas Companies. The model illustrate pattern for coordinating effective safety practice in oil and gas firms. The procedures entails development of safety work plan, identification of possible hazards, creation of possible safety measure to prevent accidents through hazards,



observation of organization HSE rule to prevent possible accidents and appraisal and record of HSE practice during work implementation.

### Conclusion

Finally, HSE standards are crucial to minimize the industry's impact on ecosystems and climate change. Oil and gas companies should adopt measures to reduce greenhouse gas emissions, such as the use of cleaner technologies and energy-efficient practices. They also should implement strategies to minimize water usage, prevent oil spills, and manage waste responsibly. Environmental impact assessments are conducted before exploration or drilling activities to identify potential risks and develop mitigation measures.

### Recommendations

Finally, it was recommended that oil and gas companies should fund and establish strong HSE departments in various branches of their industries to equip them in order to carry out HSE exercises before and after any working task and There should be a continuous review of occupational health and safety policies, to ensure that firms have up to date safety measures in place.

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## ACCURACY AND MORALITY OF FACIAL RECOGNITION TECHNOLOGY IN IDENTIFYING TERRORISTS: A SYSTEMATIC LITERATURE REVIEW

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### Abstract

*Facial recognition technology has made significant strides in recent years, becoming an increasingly important tool in various fields such as security, law enforcement, and retail. This technology utilizes biometric data, specifically facial features, to identify individuals. The article provides an overview of the diverse applications of facial recognition technology, delving into state-of-the-art methods including deep learning-based approaches. Various face databases utilized to evaluate these algorithms are discussed, highlighting their strengths and weaknesses. A significant study, the Face Recognition Vendor Test (FRVT) 2002, is reviewed, illustrating improvements in the technology and the need for further research to address issues such as bias and variability. The potential benefits of facial recognition technology in counterterrorism are discussed, emphasizing the importance of proper regulation to balance security and civil liberties. The article concludes that while facial recognition technology can significantly enhance state authority, it must be used responsibly to ensure it does not infringe upon civil rights.*

**Keywords:** Facial recognition, biometric data, deep learning, face databases, Face Recognition Vendor Test (FRVT), security, civil liberties

### Introduction

Facial recognition technology has evolved remarkably over recent years, emerging as a crucial tool across various sectors including security, law enforcement, and retail. This technology leverages biometric data, specifically the unique features of an individual's face, to verify identity with high precision (Smith & Miller, 2022). The growing reliance on facial recognition underscores the need to understand its applications, advancements, and ethical implications comprehensively.

### Problem Statement

Facial recognition technology has emerged as a powerful tool for identifying individuals and has the potential to be used in the fight against terrorism. However, the use of facial recognition technology for this purpose raises several important ethical and efficacy questions. Research into the efficacy and ethics of facial recognition technology for identifying terrorists is critical for ensuring that this technology is used in an appropriate and effective manner. One of the main concerns with using facial recognition technology for identifying terrorists is the potential for inaccurate identifications. Facial recognition systems are not perfect, and there is a risk that innocent individuals may be wrongly identified as terrorists (Xiao & Watson, 2019).

### Materials and Methods

The state-of-the-art methods in facial recognition primarily utilize deep learning techniques, particularly convolutional neural networks (CNNs), which have shown superior performance in image recognition tasks (Li, 2022). Various face databases, such as those used in the Face Recognition Vendor Test (FRVT), play a critical role in evaluating these algorithms, each offering distinct advantages and limitations (Kortli et al., 2020).

### Search Strategy:

The articles that will be considered for this SLR must meet certain criteria. Firstly, they must have been published between 2018 and 2021. Secondly, they must be part of a reputable scientific article database. Thirdly, they must present the results from experiments testing the efficacy of a particular facial recognition system. Here are some steps to follow for maintain the strategy:

1. Define the research question: The first step in developing a search strategy is to clearly define the research question. This will help to determine the scope of the literature review and guide the selection of relevant articles.
2. Identify relevant databases: The next step is to identify the databases that are most likely to contain relevant articles. These can include academic databases such as PubMed, JSTOR, and Web of Science, as well as industry-

specific databases.

3. Develop search terms: Once the databases have been identified, the next step is to develop a list of search terms that will be used to retrieve relevant articles. These terms should be specific to the research question and should include both keywords and phrases that are relevant to the topic.
4. Conduct the literature search: Using the search terms and databases identified in the previous steps, conduct a literature search to retrieve relevant articles. Be sure to review the search results and include articles that are relevant to the research question even if they do not contain all the search terms used.
5. Assess the quality of the articles: After retrieving the articles, assess the quality of the articles by evaluating their methodology, sample size, and results. This will help to ensure that only high-quality articles are included in the literature review.
6. Refine the search: If the initial search does not retrieve enough relevant articles, refine the search by using different search terms or by searching additional databases. Repeat this step as necessary until enough relevant articles have been retrieved.
7. Organize and analyse the articles: Once the relevant articles have been retrieved, organize, and analyse them to identify trends, patterns, and gaps in the literature. This will help to identify areas where further research is needed and to develop a comprehensive understanding of the topic.
8. Define inclusion and exclusion criteria: As part of the search strategy, it is important to establish inclusion and exclusion criteria. These criteria will help to ensure that only the most relevant and recent articles are included in the literature review and that the results are based on sound and reliable data.
9. Evaluate articles for the relevance to research question: Before including the articles in the literature review, evaluate them for the relevance to the research question. Only the articles that directly address the research question and provide evidence to support the research should be included.
10. Keep a record: Keep a record of the search strategy and the articles that have been retrieved

Table 1. Summary of the search results

String used for search	Data source	Quantity of articles
"face	• IEEE Xplore Dig. Library	26
recognition	• Springer Link	12
in real time"	• World Scientific	1
AND	• Elsevier	2
"accuracy"	• Other academic source	52

The final result is given after applying the inclusion criteria that allowed identifying a subset of thirteen articles, highlighted as results of this SLR.

The table 1 above is a summary that provided pertains to a systematic literature review (SLR) focusing on the topic of face recognition technology, particularly its real-time application and accuracy. Here's an explanation and insight into the analysis based on the provided details:

#### **Search String:**

The search string used for identifying relevant literature included the keywords:

- "face"
- "recognition"

- "in real time"
- "AND"
- "accuracy"

These keywords were chosen to narrow down the articles specifically addressing the accuracy of real-time face recognition systems.

#### **Data Sources:**

The search was conducted across multiple academic databases:

1. IEEE Xplore Digital Library: A prominent source for technology and engineering research.
2. Springer Link: Provides access to a wide range of scientific documents across various disciplines.
3. World Scientific: Publishes significant research in science and technology.
4. Elsevier: A leading provider of scientific, technical, and medical information.
5. Other academic sources: Includes miscellaneous academic databases and repositories.

#### **Quantity of Articles Found**

The initial search yielded the following number of articles from each source:

- IEEE Xplore Digital Library: 26 articles
- Springer Link: 12 articles
- World Scientific: 1 article
- Elsevier: 2 articles
- Other academic sources: 52 articles

This initial collection shows that a significant portion of relevant literature comes from other academic sources, followed by IEEE Xplore and Springer Link.

#### **Application of Inclusion Criteria**

To refine the search and ensure the relevance and quality of the articles, inclusion criteria were applied. These criteria typically involve factors such as:

- Relevance to the specific research questions.
- Quality of the study (e.g., peer-reviewed, methodological rigor).
- Publication date range (to ensure the information is current).
- Specific focus on real-time applications and accuracy metrics of face recognition technology.

After applying these inclusion criteria, the number of articles was reduced to a more manageable subset of *thirteen* articles. This final set of articles represents the most relevant and high-quality research findings on the topic.

#### **Insight and Analysis**

1. Search Strategy: The keywords used are specific and likely to yield highly relevant results. Combining "face," "recognition," "in real time," and "accuracy" ensures that only studies addressing both the implementation and performance aspects of face recognition systems are considered.
2. Source Distribution: The wide distribution across various databases indicates a comprehensive search strategy, ensuring that relevant literature from multiple disciplines and publishing platforms is included.
3. Article Screening: The significant reduction from 93 initial articles to 13 after applying the inclusion criteria underscores the importance of stringent screening to ensure the relevance and quality of the final selection. This process helps in focusing on the most impactful and informative studies.
4. Diverse Sources: The diversity of sources (IEEE, Springer, World Scientific, Elsevier, and others) suggests that the review encompasses a broad spectrum of perspectives and methodologies, contributing to a well-rounded understanding of the topic.
5. Final Subset: The final subset of thirteen articles is critical for in-depth analysis. These articles likely provide a comprehensive overview of current advancements, challenges, and solutions in the field of real-time face recognition accuracy.

In summary, the table highlights a meticulous and structured approach to conducting an SLR, ensuring that the selected articles are both relevant and of high quality. This process aids in deriving meaningful insights and advancing the understanding of real-time face recognition technologies.

Table 2. Articles analysed after the inclusion and exclusion criteria

Item	AUTHOR(S) (REFERENCE #)	Title	Data Source	Year
1	[10]	Automatic attendance monitoring system using facial recognition through feature-based methods (PCA, LDA)	ELSEVIER	2021
2	[11]	Automated attendance system using image processing	IEEE	2018
3	[12]	Computer vision on identifying persons under real time surveillance using IOT	IEEE	2020
4	[13]	Face detection and recognition-based e-learning for students' authentication: study literature review	IEEE	2018
5	[14]	Face recognition-based attendance system using machine learning algorithms	IEEE	2018
6	[15]	Human identification recognition in surveillance videos	IEEE	2019
7	[16]	Improving the capability of real-time face masked recognition using cosine distance	IEEE	2020
8	[17]	LBPH based improved face recognition at low resolution	IEEE	2018
9	[18]	Real-time face recognition: A survey	IEEE	2021
10	[19]	Recognizing Very Small Face Images Using Convolution Neural Networks	IEEE	2020
11	[20]	The Real Time Face Recognition	IEEE	2019
12	[21]	Fractional Krill-Lion algorithm-based actor critic neural network for face recognition in real time surveillance videos	WORLD SCIENTIFIC	2019
13	[22]	Technology: Person Identification	SPRINGER	2020

Table 2 above serves several important functions. It systematically organizes the final set of 13 articles, ensuring transparency and reproducibility in the SLR process. It also provides a quick reference for researchers to assess the distribution of sources and publication years, helping identify trends and gaps in the literature. By listing essential bibliographic information, the table aids in the synthesis of research findings and supports the overall analysis of real-time face recognition accuracy.

## Results

The Face Recognition Vendor Test (FRVT) 2002 provided a pivotal evaluation of facial recognition systems, demonstrating substantial improvements in accuracy and performance over previous years (Prasanna & Reddy, 2017). Despite these advancements, the study highlighted ongoing challenges, including algorithmic bias and variability in system performance, necessitating continued research and development (Patil & Kulkarni, 2021).

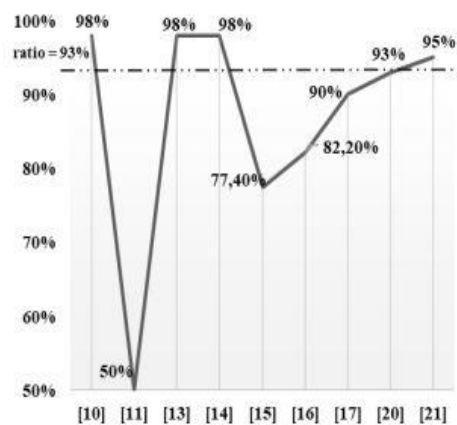


Figure. 1: Accuracy ratio according to selected articles.

From Figure. 1 above, a photograph against a database of individuals who are considered a potential threat, such as known criminals or terrorists. This application raises significant ethical concerns, as it can lead to potential false identification and bias in the criminal justice system.

Overall, the fundamentals of face analysis involve using facial recognition technology for various purposes, including verification, identity, characterization, and watchlist keeping. While this technology has the potential to be beneficial in certain situations, it is important to consider the ethical implications and potential biases that may arise from its use. It is important to note that facial recognition technology is still a relatively new and developing field, and as such, it is important for researchers and developers to continue to study its effectiveness and potential biases to ensure its proper use and to address any potential ethical concerns. Additionally, it is important for policymakers to consider the

potential implications of facial recognition technology and to develop regulations and guidelines to ensure its responsible use.

Furthermore, it is important to consider the potential impact of facial recognition technology on marginalized communities, as studies have shown that these technologies can perpetuate existing biases and discrimination. For example, it has been shown that facial recognition algorithms are less accurate in identifying individuals with darker skin tones. Therefore, it is important to ensure that facial recognition technology is tested and developed in a diverse range of individuals to reduce the potential for bias.

In conclusion, the fundamentals of face analysis involve using facial recognition technology to confirm an individual's identification, provide a description of them, or cross-reference them against a database of possible dangers. While this technology has the potential to be beneficial in certain situations, it is important to consider the ethical implications and potential biases that may arise from its use. Additionally, it is important for researchers, developers, policymakers, and society to continue to study, regulate and monitor the use of facial recognition technology to ensure its responsible use and to address any potential ethical concerns.

### Discussion

Facial recognition technology offers significant potential benefits, particularly in enhancing security and counter-terrorism efforts. The ability to automatically identify known terrorists and prevent attacks can greatly enhance public safety (Karthick et al., 2021). However, the deployment of this technology raises critical ethical and privacy concerns. There is a pressing need for regulatory frameworks to ensure that the use of facial recognition does not infringe on civil liberties and is applied transparently and ethically (Henschke, n.d.).

### Conditions for the use of facial recognition

It is imperative that clear guidelines and conditions are established for the use of facial recognition technology to ensure that it is used ethically and in line with civil rights. The use of this technology must be justified by the state, as it grants them new authority to recognize individuals without human intervention. For its use to be considered ethical in a liberal democracy, there must be a balance between protecting the public's expectation of privacy and the goal of preventing serious crimes such as terrorism. Additionally, only those who are suspected of committing a crime should have their biometric facial data collected and stored in a database.

With the confidentiality and freedom of expression guaranteed by liberal democratic constitutional provisions and civil rights treaties, it is evident that the state must provide a justification for the application of Facial Recognition Technologies prior they may be utilized to apprehend terrorists. This technology does not merely enhance a state's existing authority; rather, it gives the state a brand-new authority. That's the ability to recognize everyone within range of an FRT-enabled camera without requiring human intervention.

### Conclusion

Facial recognition technology holds great promise in various applications, particularly in security and law enforcement. However, its implementation must be carefully regulated to balance the benefits of enhanced security with the protection of individual rights and privacy. Future research should focus on addressing the challenges of bias and variability in system performance to ensure equitable and reliable application across diverse populations.

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## ENHANCING THE LIFETIME AND EFFICIENCY OF WIRELESS SENSOR NETWORKS USING AI-INTEGRATED CRT-LEACH PROTOCOLS

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### Abstract

*This study introduces the AI-Powered CRT-LEACH protocol, an innovative routing method for Wireless Sensor Networks (WSNs) that integrates the Chinese Remainder Theorem (CRT) with the Low-Energy Adaptive Clustering Hierarchy (LEACH) algorithm, further enhanced by artificial intelligence (AI). WSNs, typically deployed in extensive and often hostile environments, face several challenges, including energy limitations, hardware constraints, communication errors, and vulnerability to attacks. These challenges necessitate sophisticated routing protocols that not only minimize energy consumption but also ensure reliability and speed in data transmission. The AI-Powered CRT-LEACH protocol is designed to tackle these challenges. It incorporates CRT for packet splitting, enhancing message reliability while using AI to dynamically optimize both routing paths and the selection of cluster heads. This approach significantly reduces energy usage, extends the operational life of the network, and improves overall performance. Simulations demonstrate that the AI-Powered CRT-LEACH protocol surpasses existing protocols in terms of energy efficiency, transmission speed, and adaptability to network changes, ensuring robust hardware optimization. By effectively addressing the inherent vulnerabilities of sensor nodes and optimizing network resources, this protocol offers a powerful solution to the operational challenges of WSNs, enabling more reliable and efficient environmental monitoring and physical situation observation across diverse applications.*

**Keywords:** Wireless Sensor Networks, Chinese Remainder Theorem, Low-Energy Adaptive Clustering Hierarchy (LEACH), Routing Protocol, Artificial Intelligence (AI) and Energy Efficiency

### Introduction

Wireless Sensor Networks (WSNs) consist of a vast array of sensor nodes deployed across various environments, tasked with the collection of critical environmental and physical data. These nodes, equipped with computational, storage, and transmission capabilities, operate under challenging conditions to monitor a range of physical and environmental parameters, such as temperature, sound, and pressure (Jindal, 2018; Khodabande et al., 2014; Sharma & Sharma, 2016). One of the paramount challenges in WSNs is the efficient management of the nodes' limited energy resources, as these devices typically operate on finite battery power, which is difficult to replace or recharge once deployed (Demigha et al., 2011; Barati et al., 2014; Lee et al., 2016).

Routing protocols play a pivotal role in energy conservation within Wireless Sensor Networks (WSNs), aiming to minimize energy consumption while ensuring reliable and efficient data delivery throughout the network. Among these protocols, the Low Energy Adaptive Clustering Hierarchy (LEACH) algorithm stands out as a pioneering approach for energy-efficient hierarchical clustering in WSNs. However, despite its advancements, LEACH encounters challenges, particularly concerning packet transmission delays from cluster heads (CHs) to the base station, underscoring the necessity for further optimization (Hamamreh et al., 2018). This research introduces an innovative routing protocol for Wireless Sensor Networks (WSNs) that integrates Artificial Intelligence (AI) with the Chinese Remainder Theorem (CRT) and the LEACH protocol, significantly enhancing energy efficiency, data transmission speed, and network reliability. AI's capability to dynamically adapt to environmental data allows for real-time adjustments in routing decisions, optimizing the selection of cluster heads and data paths (Alsheikh et al., 2014). This integration not only minimizes energy consumption but also improves the overall performance of the network.



Further, machine learning (ML) and deep learning (DL), including reinforcement learning (RL), are employed to refine routing decisions based on the network's current state, thereby prolonging network lifetimes and enhancing efficiency (Mnih et al., 2015; Luong et al., 2019). The AI-enhanced CRT-LEACH protocol also incorporates the Local Closest First (LCF) strategy, which helps reduce communication congestion and eliminate data aggregation delays, ensuring more efficient energy use. Simulations show that this AI-powered CRT-LEACH protocol outperforms existing routing protocols in terms of energy efficiency, transmission speed, and reliability. These advancements effectively address the significant challenges faced by WSNs in real-world applications, demonstrating the transformative potential of integrating AI into WSN routing protocols.

### Literature Review

The integration of Artificial Intelligence (AI) in Wireless Sensor Networks (WSNs) allows for dynamic adaptation of routing protocols to respond effectively to changes such as node failures and energy depletion. AI algorithms help predict such events and reroute data packets through healthier network paths, enhancing network reliability and extending its lifespan (Li et al., 2019; Sultana et al., 2019). Additionally, the application of the Chinese Remainder Theorem (CRT) alongside AI algorithms has been shown to optimize data transmission by reducing data volume and energy consumption, thus improving network efficiency while ensuring data integrity and security (Jiang et al., 2018).

The adoption of federated learning represents a significant advancement in optimizing WSNs through decentralized AI processing. This technique allows sensor nodes to train models locally on their data and share only model updates rather than raw data, thus preserving privacy and significantly cutting energy and bandwidth needs—a crucial benefit for energy-limited WSNs. Studies have shown that federated learning can dynamically adjust routing protocols and cluster formations based on real-time environmental data, markedly boosting energy efficiency and extending network durability (Huang et al., 2020).

Further developments include the enhancement of WSN efficiency by 48.85% using the LEACH protocol combined with a modified k-means algorithm, which has improved network lifetime and data transfer efficiency. Despite the increased overhead and processing time, this approach has managed to deliver nearly 77% of sensed data to the sink node, signifying effective energy use and optimal cluster head selection (Ramesh, 2022).

Moreover, recent research has explored the use of deep learning models to automate the selection of routing paths and cluster heads, significantly decreasing energy consumption and more effectively balancing network load compared to traditional methods (Tang et al., 2020; Wang et al., 2021). The exploration of energy harvesting technologies has also been instrumental in extending the operational lifespan of WSNs, with AI-powered routing protocols optimizing the distribution of harvested energy to ensure that critical nodes remain functional for longer periods (Khan et al., 2018).

This study aims to develop and evaluate an innovative routing protocol for WSNs, termed AI-CRT-LEACH, which integrates AI techniques with CRT and LEACH principles to enhance network lifetime, efficiency, and performance. The proposed AI-powered CRT-LEACH framework focuses on dynamic cluster head selection and routing, utilizing reinforcement learning for decision-making and CRT for efficient data aggregation and transmission.

### Research Methodology

This study aims to develop and evaluate an innovative routing protocol for Wireless Sensor Networks (WSNs) that integrates Artificial Intelligence (AI) techniques with the Chinese Remainder Theorem (CRT) and Low-Energy Adaptive Clustering Hierarchy (LEACH) principles, herein referred to as AI-CRT-LEACH. The objective is to enhance network lifetime, efficiency, and performance by dynamically adapting routing paths and reducing energy consumption. For an AI-powered CRT-LEACH framework, an algorithm focused on dynamic cluster head (CH) selection and routing, integrating reinforcement learning (RL) for decision-making and the Chinese Remainder Theorem (CRT) for efficient data aggregation and transmission is proposed.

### Algorithm for AI-Powered CRT-LEACH Protocol

The algorithm emphasizes the dynamic optimization of WSN operations through AI, particularly focusing on efficient energy usage and intelligent data handling to prolong network lifespan and reliability.

**Input:** Set of sensor nodes ( $S = \{s_1, s_2, \dots, s_n\}$ ), Base Station (BS)

**Output:** Optimized routing and clustering plan.

1. Initialize the RL model with state space representing the network's energy levels, node distribution, and historical data transmission patterns.
2. Define action space as the set of possible CH selections and routing paths.
3. Initialize CRT parameters for data aggregation and transmission.
4. For each decision epoch, use the RL model to select CHs based on current network state, aiming to minimize energy consumption and balance load.
5. Assign non-CH nodes to the nearest CH based on a combination of distance and residual energy.
6. Each sensor node ( $s_i$ ) splits its data ( $D_i$ ) into residues using the selected moduli set ( $M = \{m_1, m_2, \dots, m_k\}$ ).
7. Transmit residues to the CH using energy-efficient paths.
8. CHs aggregate received residues and apply the CRT to reconstruct the original data or a compressed version thereof.
9. Aggregate data is sent to the BS through an optimized routing path chosen by the RL model.
10. After each transmission round, update the RL model with new state information and reward based on energy savings and successful data transmission.
11. Retrain the model if necessary to adapt to changing network conditions.
12. Continue from step 4 for subsequent rounds until the network operation concludes or predefined conditions are met.

### Mathematical Formulation

Let the state space ( $X$ ) represent the network state, including energy levels and node distribution, and the action space ( $A$ ) consist of possible CH selections and routing paths. The RL model aims to learn a policy ( $\pi: X \rightarrow A$ ) that maximizes the cumulative reward (e.g., minimized energy consumption and maximized data transmission success). The value function  $V^\pi(x)$  under policy  $\pi$  for state  $x$  is defined as:

$$V^\pi(x) = E[\sum_{t=0}^{\infty} \gamma^t R(x_t, a_t, x_{t+1}) | x_0 = x, \pi] \quad (1)$$

where  $R$  is the reward function,  $\gamma$  is the discount factor, and  $t$  denotes the time step.

Introduce a Reinforcement Learning (RL) model to optimize the selection of cluster heads and routing paths. The goal is to maximize the cumulative reward, which can be related to the network's lifetime and energy efficiency. The Q-learning update rule, for instance, can be represented as:

$$Q(s, a) \leftarrow Q(s, a) + \alpha [R + \gamma \max_{a'} Q(s', a') - Q(s, a)] \quad (2)$$

where  $s$  is the current state,  $a$  is the current action,  $s'$  is the new state,  $a'$  is the next action,  $\alpha$  is the learning rate,  $R$  is the reward, and  $\gamma$  is the discount factor.

**Energy Consumption Model:** Define the energy consumption for transmitting and receiving data. For a sensor node, the energy consumed to transmit  $b$  bits over a distance  $d$  is modeled as:

$$E_{tx}(b, d) = b \times E_{elec} + b \times \epsilon_{amp} \times d_n \quad (3)$$

Similarly, given a set of moduli  $M = \{m_1, m_2, \dots, m_k\}$  that are pairwise co-prime, the sensor data  $D_i$  from node  $s_i$  can be represented by its residues  $r_{ij}$  for moduli  $m_j$ , where  $j = 1, 2, \dots, k$ .

The aggregated data  $D_a$  can be reconstructed from residues  $r_{ij}$  using the CRT as:

$$D_a \equiv r_{ij} \pmod{m_j}, \forall j=1, 2, \dots, k \quad (4)$$

In LEACH, cluster heads are rotated to evenly distribute energy load among the sensors in the network. The probability  $P$  of a node becoming a cluster head in any given round is modeled as:

$$P = \frac{1}{n}$$

$N \times popt$ 

(5)

### Simulation and Performance Evaluation

The research utilizes the Prowler simulation platform within MATLAB to accurately model the Wireless Sensor Network (WSN) environment. Chosen for its extensive library, support for WSN protocols, and flexibility in incorporating custom algorithms, Prowler enables detailed simulation of complex WSN scenarios. Within this environment, a reinforcement learning (RL) model is integrated to improve decision-making, focusing on optimizing routing protocols and reducing energy usage. MATLAB's computational strengths facilitate the efficient training and evaluation of the RL model across various simulated WSN configurations. The performance of the AI-CRT-LEACH protocol is assessed using metrics such as network lifetime, energy consumption, data delivery ratio, and end-to-end latency, and results are compared against existing protocols like CRT-LEACH and MRHC-LEACH.

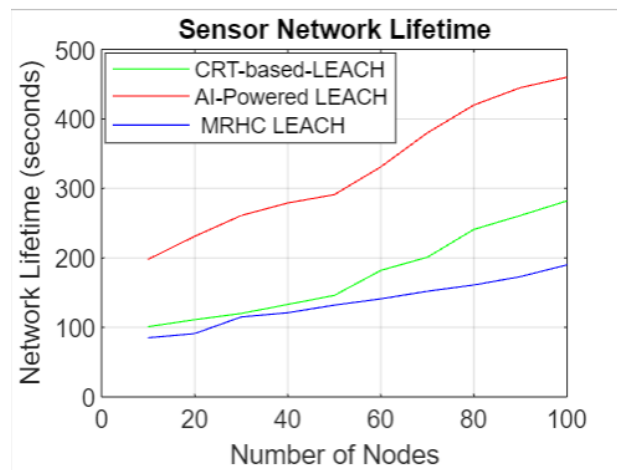


Figure 1: Sensor Network Lifetime

Figure 1 demonstrates that the AI-Powered LEACH protocol significantly outperforms both CRT-LEACH and MRCH-LEACH in terms of network lifetime, showcasing the effectiveness of AI in enhancing WSN operations, particularly through improved adaptive cluster head selection and routing which leads to reduced energy consumption. While CRT-LEACH does offer improvements in data aggregation efficiency that positively affect network lifetime, it does not achieve the enhancements seen with AI integration. MRCH-LEACH, on the other hand, shows less substantial improvements in extending network operation time compared to the others. This analysis highlights the substantial potential of AI-driven methods in boosting the longevity and efficiency of WSNs.

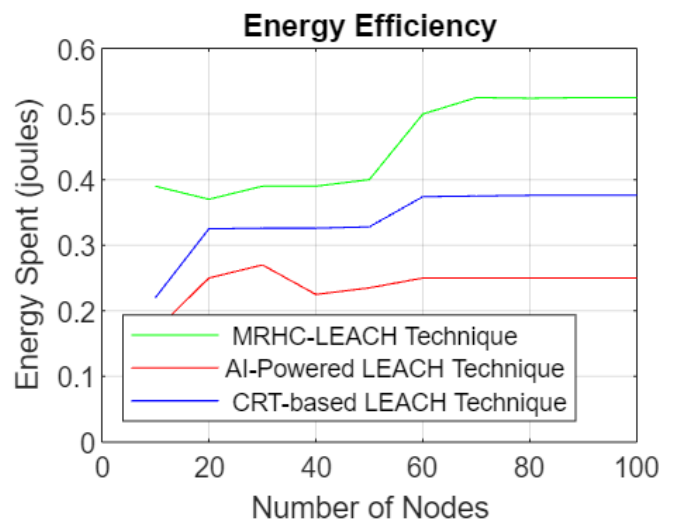


Figure 2: Energy Consumption by Each Node

Figure 2 shows that AI-Powered LEACH is the most energy-efficient protocol compared to CRT-LEACH and MRCH-LEACH. It achieves this by optimizing cluster head selection and routing through AI, which significantly reduces unnecessary transmissions and balances energy use across the network. CRT-LEACH offers improvements through better data aggregation but doesn't reach the efficiency of AI-Powered LEACH. MRCH-LEACH lacks the enhancements of CRT and AI, resulting in poorer energy management. The findings highlight AI's crucial role in enhancing energy efficiency in WSNs.

Figure 3 reveals that AI-Powered LEACH significantly enhances the data delivery ratio in WSNs by effectively adapting to dynamic network conditions. It outperforms CRT-LEACH, which, despite efficient data aggregation, lacks the adaptability offered by AI technologies. MRCH-LEACH trails behind, indicating it requires further improvements to reach the effectiveness of the other protocols. This underscores the vital role of advanced technologies in ensuring reliable data transmission in WSNs, crucial for their broad application.

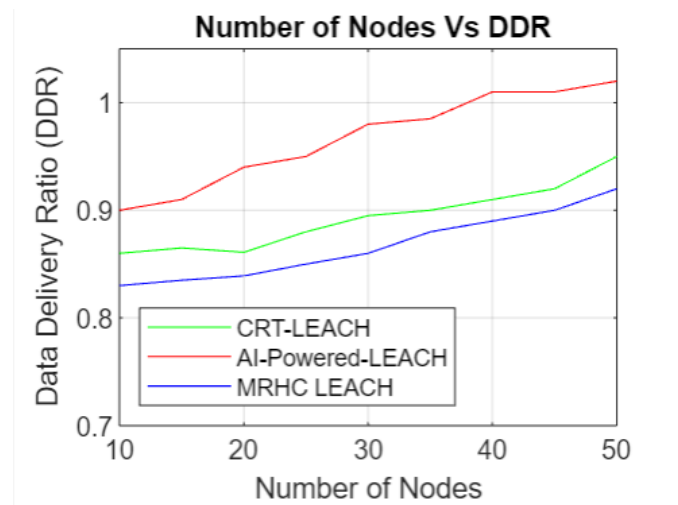


Figure 3: Data Delivery Ratio

Figure 4 shows that AI-Powered LEACH achieves the lowest end-to-end latency in WSNs, highlighting its efficiency in real-time adaptive decision-making and optimized data routing. While CRT-LEACH also lowers latency through efficient data aggregation, it does not achieve the same levels as AI-enhanced protocols. MRCH-LEACH, despite improvements to the LEACH framework, still has higher latency, indicating potential areas for better routing efficiency. This emphasizes the importance of integrating AI and CRT in WSNs to reduce latency, enhancing network responsiveness and reliability for time-sensitive applications.

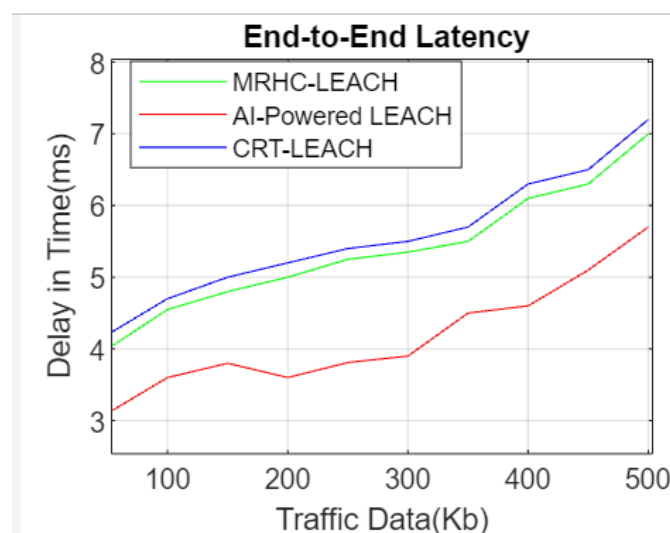


Figure 4: End-to-End Latency

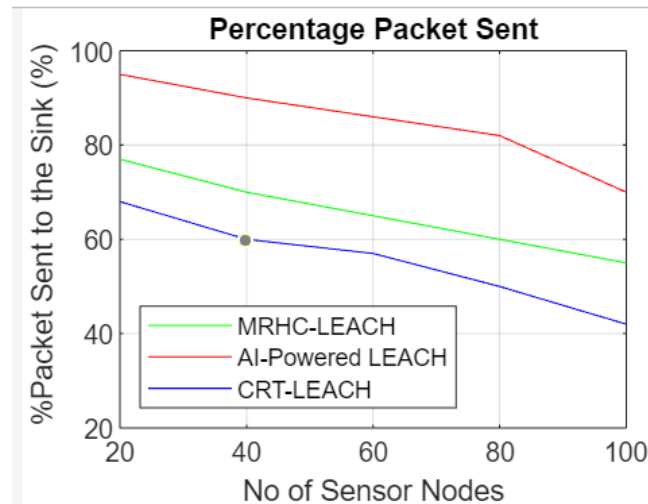


Figure 5: Percentage Packet Sent to the Sink

Figure 5 reveals that AI-Powered LEACH outperforms both CRT-LEACH and MRCH-LEACH in terms of packet delivery to the sink, underscoring the effectiveness of AI in optimizing cluster head selection and routing for improved data transmission in WSNs. While CRT-LEACH also performs well due to its data aggregation capabilities, it does not match the efficiency of the AI-driven protocol. MRCH-LEACH, despite some enhancements, remains less effective, highlighting the crucial role of advanced AI and CRT technologies in boosting packet delivery rates and enhancing the overall reliability of WSNs.

### Result Discussion and Optimization

In this research, we developed and tested an AI-powered CRT-LEACH protocol within a simulated Wireless Sensor Network (WSN) environment using MATLAB. The goal was to evaluate how effectively this protocol could enhance network performance, focusing on factors such as energy efficiency, network longevity, and the reliability of data transmission. The simulation environment was carefully configured to mimic a realistic WSN with varying node densities and a stationary base station, with sensor nodes set up with specific energy levels, sensing ranges, and transmission capabilities. At the heart of the research was the integration of a reinforcement learning (RL) model that dynamically determined optimal cluster head (CH) selection and routing paths. This was combined with the Chinese Remainder Theorem (CRT) for efficient data aggregation and transmission.

Our study introduced the AI-CRT-LEACH protocol—a novel integration of Artificial Intelligence (AI), the Chinese Remainder Theorem (CRT), and the LEACH protocol—which markedly improved WSN performance. This protocol excelled in enhancing network lifetime, boosting energy efficiency, improving the data delivery ratio, reducing end-to-end latency, and maximizing the rate of successful packet delivery to the sink. While the AI-CRT-LEACH protocol demonstrated significant enhancements over traditional protocols, there remains potential for further optimization in computational efficiency and fine-tuning the balance between performance enhancement and processing demands.

The effectiveness of the AI-powered CRT-LEACH protocol was rigorously tested across various simulated scenarios. Statistical analysis validated the notable improvements in performance, with the protocol consistently outperforming under diverse environmental conditions and operational stress tests. The results were meticulously documented, detailing the methodology, simulation configurations, data analysis techniques, and the significant findings. This research underscores the potential of combining AI and mathematical theories to advance WSN technologies and provides a solid foundation for future studies to build upon, indicating a significant step forward in the evolution of WSN routing protocols.

### Conclusion

This research presents AI-CRT-LEACH, an innovative routing protocol for Wireless Sensor Networks (WSNs) that blends Artificial Intelligence (AI), the Chinese Remainder Theorem (CRT), and Low-Energy Adaptive Clustering Hierarchy (LEACH) principles. Designed to outperform traditional routing protocols, AI-CRT-LEACH dynamically adjusts to network fluctuations to optimize routing decisions, thereby enhancing network lifetime and efficiency via

smart cluster head selection and efficient data transmission strategies. Comparative analysis reveals its enhanced performance in terms of energy efficiency, network longevity, data delivery ratios, and latency when compared with existing protocols like CRT-LEACH, MRHC-LEACH, and PEGASIS. This advancement marks a significant stride in harnessing the full capabilities of WSNs for a range of applications, emphasizing the critical role of integrating AI and mathematical principles in the evolution of wireless technologies. The meticulous methodological approach and simulation-based validation provided in this study establish a solid framework for ongoing research in WSN protocol innovation.

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## THE ROLE OF DIGITAL TECHNOLOGY IN SUPPORTING SUSTAINABLE DEVELOPMENT OF NIGERIA

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### Abstract

*Digital Technology is not a one-time event, as it proceeds in waves driven by technological progress and dissemination of innovations. There has been an active expansion of online companies in recent times generating competition with offline giants, which disrupts the traditional manufacturing, delivery and sales processes of goods and services. This lacuna therefore brought about the use of computer technologies such as additive manufacturing, artificial intelligence, remote monitoring, 3D printing and cloud analytic is the way to ensure that the Nigeria's industries are digitalized to enhance a massive growth. The Theoretical Framework Review methodology was used to analyse the findings of existing studies on digital transformation and economic development. The study unveils the relationship between digital transformation and economic growth of substantial importance; digital convergence positively affects growth and development. The findings of this study show that greater access to information and opportunities for technological cooperation can create job opportunities, transfer of skills, and greater efficiency and transparency in politics and business, which also analyses the impact of economic innovation on social systems.*

**Keywords:** Digital Technology, Sustainability, Transformation, Automation, Innovation and Development

### Introduction

Digital technology represents a powerful force, enabling us to tackle developmental needs as well as resolving low levels of trust in government. The proper Digital Technology of data enhances peace and development and respect for human right (Amina, 2022). Digital Technology gives people access to a vast network of untapped data, which has the potential to help society and the environment. Smart systems connected to the internet can systematically provide a unique opportunity to solve difficulties related to long-term sustainability and development. Sustainability deals with the Economy, Society and the Environment of a locality or settlement. The economical aspect of Digital Technology talks about the profitability of the sector and it should be noted that businesses need to be lucrative to be sustained. The Society aspect of it deals with people, a sustainable business must have the endorsement of its stake holders and the community it operates. The environment aspect of it receives the most emphasis as business are focusing on their decreasing carbon footprints, packaging waste, water consumption, etc. Sustainable development happens if all these three principles are achieved (Abri, 2015).

### Methodology

Digital technology has led to an increased customer base, market share, profit level and dominance over competitors, thus leading to growth in economy and sustainable development, as well as a threat to larger sectors as we systematically review the methodology used to analyse the findings of existing studies on digital transformation and economic development. This paper employed the Theoretical Framework Review literature review method to analyse the findings of existing studies on digital technology and its effect on sustainable development. The study unveils the relationship between digital technology and economic growth of substantial importance; digital convergence positively affects growth and development.

### Literature Review

#### Conceptual framework of Digital Technology in supporting innovative Development

According to Ceipek (2021), Social growth has resulted from increased socialization, reducing the social gaps. According to certain estimates, 75% of the global population has embraced digital technology, thus has been online

since April 2022. This has increased by 100% in the last 7 years and is likely to continue to rise. With mobile services becoming increasingly popular, we will soon reach the 100% mark. All areas, such as social, economic, and administrative, are now covered by this, providing great potential for progress in developing countries. According to statistics, mobile phones now account for up to 80% of all market usage, and around 72% of the population in some developing countries, such as India and Nigerian, which uses mobile phones to access online services. As a result of this expanding trend, the market has become more sensitive and digitally dynamic. A year-over-year user increase demonstrates our growing social media and digital transformation footprints. It has always been known that the danger each manufacturing sector face, is the decline of its workforce (Bildstein and Seidelmann, 2016). Today, we are at the cusp of the Fourth Industrial Revolution in which production and network connectivity are integrated through Internet of Things and ICT. The development of digital technologies such as the internet of things (IoT) allows manufacturing sectors to continuously share a network of people, and machines through value creation processes. Nagy (2018) argued that the manufacturing processes through digital technology have allowed sectors to produce products that can compete globally.

According Wekele (2022) Digital technology plays a crucial role in driving sustainable development in Nigeria by enhancing efficiency, increasing productivity, improving access to services, and fostering innovation. Some impact of digital technology on Nigeria's sustainable development are:

- i. **Economic Growth:** According to a report by the World Bank, digital technology has the potential to add \$88 billion to Nigeria's GDP by 2020. This growth is driven by increased digital adoption in key sectors such as agriculture, healthcare, and financial services.
- ii. **Job Creation:** The digital economy has the potential to create over 25 million new jobs in Nigeria by 2030, according to a report by the Nigerian Communications Commission. This includes direct employment in the technology sector as well as indirect jobs in related industries.
- iii. **Financial Inclusion:** Digital technology has enabled greater access to financial services for underserved populations in Nigeria. According to a report by the Global System for Mobile Communications Association (GSMA), mobile money transactions in Nigeria amounted to over \$80 billion in 2020, providing much-needed financial services to millions of people.
- iv. **Education:** The use of digital technology in education has shown promising results in Nigeria. For example, the Federal Ministry of Education reported that over 200,000 students in Nigeria have benefited from e-learning platforms during the COVID-19 pandemic, ensuring continuity in education despite disruptions.
- v. **Healthcare:** Digital technology has also improved healthcare services in Nigeria. A report by the World Health Organization found that the use of telemedicine in Nigeria has increased access to healthcare services in rural areas, resulting in improved health outcomes for many underserved communities.

Overall, digital technology is a key enabler of sustainable development in Nigeria, driving economic growth, job creation, financial inclusion, education, and healthcare improvements. As the country continues to embrace digital innovation, the potential for further progress towards a more sustainable future remains promising (Wekele, 2022).

### Digital Transformation and Economic Growth

Digital technology which gives rise to automation in manufacturing viewed as putting new products into high volume production while ensuring that parts are designed for the available manufacturing process. Automation connotes visions of software performing human tasks; the term means automation of service tasks that were previously performed by humans for business processes (Madakam et al., 2019). Automation has created many opportunities for the globalization of the manufacturing sector and continues to change how our day-to-day operations are being conducted. Through automation, manufacturing sectors can produce large amounts of quality products and little defect or error. This has assisted manufacturing sectors to always meet demand when the markets change. Some research suggests that the productivity of most micro-scale businesses is enhanced by digital transformation processes, which in turn drive the economic growth. Innovative applications such as SMAC (Social, Mobile, Analytics and Cloud) have increased the efficiency of production, sales and communication processes. Access to the Internet and the development of mobile applications allow companies to adapt more quickly to turbulent economic conditions, including new consumer expectations (Olszewska, 2020).



### **Theoretical framework of Digital Technology in Agricultural Sector**

According to Binda (2022), digital technology opens a huge untapped potential for farmers, investors, and entrepreneurs to improve the efficiency of food production and consumption in Nigeria. From precision farming is an efficient food supply chain, which could bring major economic, social, and environmental benefits with the use of technology. In fact, the absolute optimism across the start-up ecosystem is that extreme hunger can be sharply reduced, by significantly transforming the industry that employs most of its citizens (Olszewska, 2020). Digital technology has the potential to connect Africa's hundreds of millions of rural inhabitants, where many of them are farmers, with the emerging lucrative food market. Digital technologies can connect upstream input suppliers – whether suppliers of seed, machinery, fertilizer, finance, or advisory services – with farms and farm enterprises. And digital technologies can link food buyers and sellers more efficiently, both within countries and across borders. The other inefficiencies in resource use and marketing, represent an opportunity for digital technologies to transform the farming sector in Nigeria. Food production is risky due to limited information about weather patterns, soil characteristics, future market demand, and other variables (Botha, 2018). Lastly, the Nigeria's food system is characterized by difficulties to access to technologies, information, and markets that digital innovations can help to overcome. Even in poorly-connected rural contexts, sophisticated off-line digital agricultural technologies can provide opportunities to help illiterate farmers. Digital agricultural information platforms can level the playing field for marginalized groups, such as women, who traditionally have lower access to information and markets. Farmer identification programs can help to better target vulnerable farmers with support services (Fareri, 2020). Nigeria is predominantly agricultural society even though it depends heavily on oil industry for its budgetary revenue. Surprisingly, approximately 70% of the population engages in agricultural production but could not feed the entire nation. Therefore, there is a fundamental problem that requires attention. One of the major challenges of farming in Nigeria is inadequate mechanized farm implements. If Nigeria must feed itself, export its agricultural produce and compete with other countries in the global market, then there is need for automation in agricultural processes and practice and Pdraig Belton, a Technology of Business reporter, stated that: "in not-too-distant future, our fields could be tilted, sown, tended and harvested entirely by fleets of co-operating autonomous machines by land and air" (Salisu et al, 2019).

### **Digital Technology and automation in sustainable development of a society**

Automation and Digital Technology is an effective and efficient aspect in the development of a society. Some of the areas in which automation and Digital Technology contributes in the development of sustainable society are

- i. The society
- ii. Economy and
- iii. Environment (social development).

### **Digital Technology and Automation in Social (society) Development**

Regarding social development, the recent study by Lavicza et al. (2022) reveals that Digital Technology helps improve pedagogical and educational activities and makes these activities more effective. Wekerle (2022) argued that when the technologies are implemented in the classrooms of the students, relatively their constructive, passive, and active learning abilities improve from those with no technological implementation in the class. Besides, Digital Technology not only enhances students' learning capabilities but also increases coordination and communication that influence technology-driven knowledge sharing and decision making. As a result, digitization leads to better job performance, creative thinking, and student innovation Wekerle (2022).

### **Digitalising Nigeria's Oil Operations for Sustainable Development**

According to Onyeche (2017) CEO Siemens Nigeria, embracing a digital revolution in its oil and gas facilities, Nigeria could propel itself from the shadows of persistent under performance to become a global energy powerhouse. Digitalisation in the energy sector involves the use of data to manage and control multiple operations. It drives efficiencies in energy management and automation systems. Importantly, workers in a digital industrial environment enjoy a massive increase in skills and productivity. Nigeria's best approach will be a combination of local skills and knowledge, and the expertise and experience of a proven international partner able to deliver digital technologies and automation, together with traditional instrumentation and controls, across the entire energy value chain. This further supports the backward integration of skills and technical competence in Nigeria's limited skilled workforce. Despite dwindling crude oil sales to the West, West African demand for Nigeria's crude oil is set to rise dramatically. The region annually consumes 22 billion litres of petrol, and Nigeria's domestic market accounts for 17 billion of those litres, yet the country still imports around 80 per cent of this energy. Port Harcourt refinery, for example, has a

capacity for 150,000 bpd of oil production but has been running at just 10 per cent capacity for the past three years. This is mainly due to its reliance on 1980s technology now regarded as obsolete in the global oil and gas sector.

### Conclusion

Digital Technology and Automation has major influence on the economy and will continue to be over the next decade in bringing sustainable development. Employing more automated and digitalized processes and procedures in our day-to-day activities will place Nigeria higher in area of business and other sectors in the nation and global market. And also, deployment of such systems in industries and various homes could lead to significant benefits for the whole economy, for instance, greater GDP, higher productivity, increase in customizing the consumer experience, new opportunities with increased technology and potential for a revitalization of the local industries with self-employed workers having the ability to use their creativity to join a fast-changing economy.

### Recommendations

The incorporation of automation and Digital Technology in the society is becoming a major concern as the world is greatly getting glued to information technology and its advancement. The followings are recommended from the study for effective deployment.

- i. Create conducive environment to foster the development of digital agriculture
- ii. Improve rural digital infrastructure: foster competition in telecoms to boost rural coverage and reduce costs
- iii. Support agricultural digital platforms such as digital farm registries, digital marketing platforms and agricultural observatories
- iv. Enhance agricultural digital skills and literacy by providing targeted training for farmers.
- v. Governments should make the appropriate efforts to enhance public understanding of the connections between Digital Technology and long-term economic growth, and Digital Technology companies should learn more about their customers' sustainability choices.
- vi. Governments and industry stakeholders should explore developing lasting ties between digital and environmental variables to influence tourist growth substantially.
- vii. Digital technology must be familiarized with current findings to discover appropriate digital and environmental aspects that substantially influence economic growth.

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## APPRAISAL OF MEDIA USED AT THE NATIONAL TEACHERS INSTITUTE DISTANCE LEARNING PROGRAMMES IN NIGER STATE, NIGERIA

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### Abstract

*This study focuses on appraising the use of media in the NTI Distance Learning Programmes in Niger State. The objective was to find out media use at the NTI learning programmes in Niger State. Survey Research Design method was adopted and Multi-Stage Sampling Technique was used to select five hundred and five (505) respondents. A structured questionnaire was used to collect data. Frequency distribution tables were used to record data collected from the questionnaire and analyzed using frequency distribution and simple percentages. One of the findings is that there is no availability of modern media for delivering instructions at the centres among others. The study concludes that with the non-availability of media, students prefer print media to electronic media due to lack of these modern media. Government should provide modern instructional delivery tools at the National Teachers Institute Distance Learning Centres and make them functional to substitute for print media to make learning more convenient and improve their performance.*

**Keywords: Media use, Knowledge level, Distance learning, Distance learning Programme, Preference and Media**

### Introduction

One of the objectives of the Nigeria National Policy on Education (2013, as cited by UNESCO, 2020) is the provision of equal educational opportunities to all citizens at different levels of education with regards to high education. An aspect of the policy encourages distance learning (education)-education that may be received outside the school environment to be organized and delivered by tertiary institutions in the country. National Teachers Institute as a distance education institution started in (1976) with the support from UNESCO. It began by training Grade Two Teachers (TC II). In 1990, the Nigeria Certificate in Education (NCE) was also introduced. The expectation was that the minimum teaching qualification/certificate to be NCE. Just recently, the institution introduced Postgraduate Diploma in Education (PGDE) programme in 2005. The institute is made one of the Open Distance Learning (ODL) center in Nigeria which employ the ODL method of learning. The ODL system of learning has adopted a learning method where the learners and the teachers are spacially separated in time and space. The learning method involves the use of study materials which are made available to the students. The study materials incorporate the instructor, instructional strategy and methods which serve as a self-help study guide. Instructional technologies/media are means for transmitting or developing messages and in teaching-learning perspective delivery content to the learners to achieve effective instruction. They provide the learning-teaching process with the tools to engage learners powerfully in the learning process. It greatly enhances the effectiveness of communication if it is properly designed.

However, a lot of challenges are posed by distance education and many teachers feel that the opportunities offered by distance education outweigh the obstacles. The challenges posed are countered by opportunities to:

- i. Reach a wider student audience
- ii. Meet the needs of students who are unable to attend on-campus classes.
- iii. Involve outside speakers who would otherwise be unavailable.
- iv. Link students from different socio-cultural economic and experiential background.

The basis for grouping courses in distance education programme is the next thing because based on the technology in use and the location of the programme, a distance education programme may fall under the following categories.

- i. Print based courses
- ii. Television broadcast courses
- iii. Radio broadcast courses
- iv. Conferencing courses (Video conferencing)

- v. Computer based training (CBT)
- vi. Pre-recorded audio courses (Tapes, Podcast)

National Teachers Institute Programmes in Nigeria started with the use of some of these media like the radio and television station where it was expected that during the school hours, the station would be tuned on at a specific time of the day for the broadcasting of courses/programmes. But presently, National Teachers Institute distance learning centers deliver their instructions through traditional face-to-face method and fully the use of pencil and paper correspondence instead of adopting and improving on the new technologies that will serve and encourage a wider number of enrolments in the programme. Therefore, the contribution of media in the distance learning programme in the country is an area of concern and as such the study seeks to appraise the use of media in the National Teachers Institute Distance Learning Programmes in Niger State

### **Statement of the Research Problem**

Distance learning is always media driven. The National Teachers Institute as a distance learning institution was established in 1976 to train National Certificate in Education graduates using the distance learning model. The Federal Ministry of Education Act No. 7 of 10<sup>th</sup> April 1978 established the Institute and approved the use of radio and television station as the media of instruction. However, many of the NTI learning centres have resulted to the use of face to face teaching and learning while some centres go further by producing some text materials to augment the face-to-face meeting. This scenario has now brought varied instructional methods in the Niger State NTI programme. The gap of the non-usage of the appropriate media may have also resulted to learners' failure in various examinations. It is against this backdrop that this work set out to appraise the media use in the Niger State NTI and see how the situation can be improved upon.

### **Aim**

The main objective of this study is to appraise the use of media in the National Teachers Institute Distance Learning Program in Niger State. The specific objectives will be to:

### **Research Questions**

1. What are the media in use at the National Teachers Institute Distance Learning Programmes in Niger State?
2. What are the differences in the utilization of various media available to distance learners in National Teachers Institute Distance Learning Programmes in Niger State?

### **Methodology**

The research adopted the quantitative approach using Survey Research Method. This method involves the collection of information from a sample through responses to questions. Survey method is a method available to educational researchers interested in collecting original data for the purpose of describing a population too large to observe direct. It is also seen as excellent vehicle for measuring attitudes and orientation prevalent within a large population.

### **Population**

The target populations for this research work were the entire students of the National Teachers Institute Distance Learning Programmes in Niger State. The population for the study is 5,051 (NTI State zonal office 2019). The population spread of the centers is as follow:

### Sample

A sample of five hundred and five 505 was selected participated in the study which constitute ten percent 10% of the entire population. (Crejcie and Morgan 1970) as cited by Lilian C. *et.al* 2016).

**Table 3:2 Sample Distributions of Respondents**

ZONE A	NTI CENTERS	TOTAL POPULATION	NO SELECTED		TOTAL
			MALE	FEMALE	
1	Government College Bida	951	43	30	120
2	Day Secondary School Kutigi	403	40	32	60
3	Mohammed Kobo Secondary School Lapai	391	42	30	65
<b>ZONE B</b>					
1	Ahmadu Bahago Secondary School Minna	434	37	35	63
2	Government Secondary School Kuta	732	32	40	93
3	Government Secondary School Suleja	314	42	30	56
<b>ZONE C</b>					
1	Government Secondary School Kontagora	178	45	27	48
<b>TOTAL</b>		<b>3,403</b>	<b>281</b>	<b>224</b>	<b>505</b>

The sampled National Teachers Institute Centers were picked from the three senatorial zones. Zone ‘A’ had three (3) centers, Zone ‘B’ also had three (3) centers because they all had six (6) centers located in their zones and Zone ‘C’ had one (1) center which is the only center that is in existence in the zone. A total of 281 male and 224 female learners were selected to participate in the study. The selection covers cycle 1 to cycle 4. The reason for this was to get full information on the use of media at the centres. Multi-stage Sampling Technique was used to select seven NTI centers from the three (3) senatorial zones in the state. Stratified Random Sampling was used for selections of the zones while Simple Random Techniques were used to select learners from each stratified centre and students from each center. Thus according to which “Yes” and “No” was written on piece of papers, folded and thoroughly mixed in a container to choose the participants and the centres. Equal chance of being selected was actually covered. Those that picked “Yes” constitute the sample for the study.

### Data Analysis

The data collected were analysed using Statistical Package for the Social Science (SPSS) version 25 with descriptive statistics of frequency count and simple percentages or frequency distribution tables.

### Result

#### Research Question 1

What are the media in use at the National Teachers Institute Distance Learning Programmes in Niger State?

**Table 5. Presentation of media in use at the National Teachers Institute Distance Learning Centres in Niger State**

Media in use	SA		A		D		SD	
	F	%	F	%	F	%	F	%
1. Telephone/Smartphone	175	35	30	6	105	21	190	38
2. Print Media	305	61	106	21.1	48	9.6	41	8.2
3. Internet resources	70	14	105	21	95	19	230	46
4. Classroom Projector	0	0	30	6	150	30	320	64

The table above presents the media in use at the National Teachers’ Institute Distance Learning programme in Niger State. On item (1) among the respondents, 30(6%) agree that they use telephone/Smart phone during their study, 175 (35%) strongly agree that they use telephone/Smartphone during their study, 105 (21%) disagree that they do not use telephone/Smartphone during their study while 190 (38%) strongly disagree that they do not use

telephone/smartphones during their study in the centres. In item 2, 41 (8.2%) of the respondents strongly disagree with the use of print Media, 48 (9.6%) also disagree with the use of print media at the centre, 106 (21.1%) agree with the use of print media at the centre, and 305 (61%) strongly agree to the use of print media in their study at the centre. In item 3, 70 (14%) strongly agree to the use of internet during their study, 105 (21%) agree to the use of internet, 95 (19%) disagree to the use of internet, while 230 (46%) strongly disagree to the use of internet during their study. Item 4 indicates that 30 (6%) agree to the use of projector during their classes, 150 (30%) agree to the use of projector, and 320 (64%) disagree to the use of projector during their classes in the programme. The first objective of this study was to find out the media in use to deliver instruction at the National Teachers Institute Distance Learning Programmes in Niger State. The analysis from the table above answers the objective because the analysis shows that the media in use to deliver instruction at the Niger State NTI centre is mainly print media. The use of modern media to deliver instruction at the centre has not been met and learners still receive lectures using face-to-face contact.

### Research Question 1

What are the media in use at the National Teachers Institute Distance Learning Programmes in Niger State?

The analysis shows that the Niger State NTI centres deliver their instruction using the classroom lecture and mainly print media. The findings are in line with Mudasiru et al (2023) during their study that revealed the use of face-face contact, and print related media as the major media of instruction. The findings are also in line with the study as revealed by Ndimele et al., (2019) during the conclusion in their findings that the two effectively utilized Distance Education instructional delivery strategies by the NTI/ NCE by DLS in Rivers State are print materials and face-to-face contact which is not enough to access quality education at a distance and this answers the research question one of the study.

### Research Question 2

What are the differences in the utilization of various media available by distance learners in National Teachers Institute Distance Learning Programmes in Niger State?

Table 7: difference in the utilization of various media available by distance learners in the centre

Utilization of Media by Distance Learners in the Centres		SA		A		D		SD	
		F	%	F	%	F	%	F	%
1.	I download study materials using my phone	85	17	45	9	205	41	201	40.2
2.	I use computer to do my assignment and save my study materials	55	11	65	13	199	39.8	180	36
3.	I use internet to find sources and other useful materials for my study	99	19.8	104	20.8	108	21.6	189	37.8
4.	Facilitators use projectors to deliver lectures.	39	7.8	46	9.2	201	40.2	214	42.8

The above table shows the utilization of media by distance learners at the NTI Distance Learning centre in Niger State. In item 1, among the respondents, 45 (9%) agree that they can download study materials using their phone, and 85 (19%) strongly agree that they can also download study materials using my phone, while 205 (41%) disagree, and 201 (40.2%) also strongly disagree that they can download study materials using their phone. In item 2, 55 (11%) strongly agree that they can use computer to do their assignment and save study materials, and 65 (13%) also agree that they use computer to do their assignment and save their study materials, while 199 (39.8%) disagree, and 180 (36%) disagree that they can use computer to do their assignment and save their study materials. In item 3, 99 (19.8%) strongly agree they use internet to find source and other useful materials for their studies, and 104 (20.8%) of the respondents agree that they can use internet to find source and other useful materials for their studies, while 108 (21.6%) of the respondents disagree, and 189 (37.8%) strongly disagree that they do use internet to find sources and other useful materials for their studies. In item 4, 39 (7.8%) strongly agree that facilitators use projectors to deliver lectures, 46 (9.2%) also agree that the facilitators use projectors to deliver lectures while 201 (40.2%) disagree with use of projector by the facilitator to deliver lecture, and 214 (42.8%) also strongly disagree with the use of projectors by the facilitators to deliver lectures at the Niger State NTI Centres. The analysis above shows that learners have more

emphasis in utilizing print media of instruction than digital media. This also shows a high level of inability of the learners to utilize media during learning which may be due to non-availability of such media like Smartphone and computer in the centre and this analysis meets the third objective of the study.

**Research Question 2:** What are the differences in the utilization of various media available by distance learners in National Teachers Institute Distance Learning Programmes in Niger State?

In the analysis above, non-availability of instructional tools has made the Niger State NTI learning centres to operate mainly on print media which may be due to lack of effective modern delivery tools. The findings above are linked with one of the challenges highlighted by Maxwell et al., (2015) during their study which answers research question three. The challenge was lack of an effective instructional network of technical assistance and the challenge is related to individual learners that need assistance in terms of easy access to study in distance model by making available the media tools that will enable him to learn which will reduce his cost and allow the learners to manage their time. The finding shows clearly that there are other reasons which may limit their ability to use modern tools and methods of performing learning task. These reasons include lack of access to get smartphone, personal computers and others by the learners.

### Findings of the Study

The study revealed that majority of the respondents prefers print media to electronic media to receive instructions. The study also revealed non-availability of instructional media like computer, smart-phone, and projector etc. The study also revealed that quality of assignment would have been improved with the use of media and its availability would have also motivated their appearance to attend classes when necessary. Performance in term of examination and overall performance of the students would also have been improved with the use of media. It is also revealed in the findings that there is non-availability of instructional media like computes, projectors, and unequal financial capabilities to afford computers. The findings also revealed that majority of the facilitators in the centres do not have working knowledge on ICT. This is also accompanied with unreliable supply of power.

### Recommendations

Base on the findings and in order to facilitate rapid improvement on distance education, the researcher recommends that:

- (1) Government should provide modern instructional delivery tools at the National Teachers Institute Distance Learning Centres and make them functional to substitute the print media.
- (2) Intervention programmes on ICTs capacity building as done by Education Trust Fund and should be established to increase the knowledge level of the learners at the centres.
- (3) The institute should regularly organize seminars and workshops for staffs to increase manpower in the area of Information and Communication Technology.
- (4) Finally, awareness should be given more priority on the importance of modern tools of delivering instruction than the print media.

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## ANTIBACTERIAL PROPERTIES AND PHYTOCHEMICAL SCREENING OF AQUEOUS EXTRACT OF FRESH AND DRIED *CARICA PAPAYA* (PAW-PAW) LEAVES

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### Abstract

*Paw-paw otherwise as Carica papaya leaves are used traditionally for treating various ailments in African countries and as well in Nigeria, this is attributed to the presence of naturally occurring compounds in plants known as phytochemicals, and this study evaluated antibacterial properties and phytochemical composition of aqueous extract from its fresh and dried leaves. Bioactive compounds were extracted from both fresh and dried leaves via solvent extraction using distilled water as the solvent, the presence of phytochemicals was determined qualitatively based on color change appearance and intensity. The antibacterial analysis was carried out on Escherichia coli and Pseudomonas species grown on potato dextrose agar with sensitivity disc prepared from the leaves extract using penicillin antibiotic disc as control. The results showed inhibitory activity with both aqueous leave extract for both species, with increased inhibition zone from 5mm (at 10mg/ml) to 13mm (at 50mg/ml) for pseudomonas Specie, however, the inhibition activity was shown to decrease when the concentration was increased to 100mg/ml. Alternatively, with E. coli the inhibition zone increases with increased concentration from 11mm at 50mg/ml to 18mm at 100mg/ml of the fresh extract while, no inhibition was observed at less concentration; 10mg/ml. No inhibition zone was observed with a minimum concentration (5mg/ml) of dried extract for both bacteria, while the highest inhibition zone observed was (E coli; 11mm and Pseudomonas species 5mm) with 100 mg/ml of the extract. C. papaya is a good inhibitory agent of Pseudomonas Spp and E coli, and the result showed processing considerable effect on the phytochemical composition of the leaves.*

**Keywords:** Paw-paw, Phytochemicals, Antibacterial, *Escherichia coli* and *Pseudomonas Specie*

## INTRODUCTION

Plant materials such as leaves, stem, root, and bark have been reported to be used for medicinal purposes due to certain properties such as antioxidant, antibacterial, or antimicrobial activities that have been credited to the presence of secondary metabolites such as alkaloids, flavonols, flavones, tannins, saponins, steroids, alkaloids, and other phytochemicals. Many studies have also reported that medicinal plants contain a wide variety of free radical scavenging molecules, which act against bacterial diseases. (Dwivedi *et al.*, 2020). Immense benefits have been derived by mankind from the use of medicinal plants in disease management due to their low cost, and safety, and sometimes offer more therapeutic value than synthetic drugs (Elinge *et al.*, 2020). These reasons and their versatile application (Kayalvizi *et al.*, 2015) and increased discovery have demanded increased scrutiny of their bioactivity so as to provide data that will help physicians and patients make wise decision before use. Natural products, principally medicinal plants have long been prescribed in traditional medicine for centuries for therapeutic value has continued to represent a source of new effective medicine (Elinge *et al.*, 2020). Over the past two decades, there has been a lot of interest in the investigation of natural materials as a source of new antibacterial agents. Plant and extract have formed important positions in modern medicine due to their chemical content found in natural form. Their secondary metabolites represent a large reservoir of structural moieties which work together exhibiting a wide range of biological activities. Microorganism has the genetic ability to transmit and acquire resistance to antibiotics and has become a global health problem. The vast majority of antibiotics used today are produced by microorganisms, yeast, or fungi that belong to the vegetable kingdom (Elinge *et al.*, 2020). Therefore, the study of medicinal plant extracts and plant products constitute the phytochemicals, antimicrobial and antioxidant properties which indicate that many such plants are elementary sources of antibiotics (Alexandra *et al.*, 2019).

*Carica papaya* belonging to the family *Caricaceae*, is believed to probably originate from Southern Mexico and Costa Rica and then plantation crop was started in almost all regions of tropical and subtropical. It is widely grown now and used in different parts of the world not only for food but also for ornamental purposes. It has also been utilized in traditional medicine to provide relief for various ailments. The plant roots can be shed as medicine for renal urinary bladder problems and its seeds have anti-helminthic activity (Kayalvizi *et al.*, 2015). The flower possesses antioxidant activity and consumption has been shown to help the body neutralize free radicals and modulate the immune system thus, decreasing disease susceptibility (Dwivedi *et al.*, 2020). The plant extract of the leaf has also shown the presence of antibacterial, antiviral, antitumor, hypoglycemic, anti-inflammatory (Singh *et al.*, 2020), anti-malarial, and anti-plasmodial properties. The leaf of the *C. papaya* plants contains karpain, this is an important part of the leaf that kills microorganisms which causes disturbance of the digestive functions (Alexandra *et al.*, 2019), and it is also shown to possess phenolic compounds, such as protocatechuic acid, p-coumaric acid and caffeic acid (Kayalvizi, *et al.*, 2015).

In the Northern region of Nigeria, medicinal plant parts are not often administered fresh rather they undergo processing including drying or boiling before administration. Hence this study attempts to investigate the effect of drying on the phytochemical content and antibacterial properties of *C. papaya* leaves on some bacteria.



**Figure 1:** *Carica papaya* Leaf  
Source: (Nduchee *et al.*, 2019)

## MATERIALS AND METHODS

### Sample Collection and Preparation

Fresh leaves of *C. papaya* were collected from Azare, Katagum Local Government of Bauchi State, the leaves were sorted cleaned, and divided into two (2) portions each of 200g. The fresh portion was analyzed on the same day while the other portion was air-dried for five (5) days and ground to powder before analysis. The Identification and authentication of the plant leaves was carried out in the Department of Botany, Bauchi State University, Gadau, Nigeria.

### Aqueous Extract Preparation

The fresh leaves were pounded using a mortar and pestle and 150g from the sample was dissolved in 450ml distilled water and allowed to stand for 24 hrs, the mixture was percolated into 500ml flask and allowed to dry at 45 °C in a water bath to recover concentrated leave extract. The powdered leaves (150 g) were also extracted similar to the procedure for the fresh leaves (Harborne, 1998).

### Phytochemical Analysis

Phytochemical analysis of the extract was tested for the presence of secondary metabolites. Basic phytochemical analysis consists of performing chemical tests to detect the presence of alkaloids, flavonoids, saponins, tannins, and steroids (Harborne and Jefferey, 1998).

### Qualitative Test for Alkaloids

The leave extract (2 ml) was added to 2 ml of 10% Hydrochloric acid and a few drops of Wagners' reagent were added. A reddish-brown precipitate was immediately formed which indicates the presence of alkaloids, (Harborne, 1998).

### Qualitative Test for Flavonoids

Three (3) drops of NH<sub>3</sub> solution were added to 1 ml of leaf extract, followed by 0.5 ml of concentrated hydrochloric acid was added. A brown colour was observed indicating the presence of flavonoids, (Harborne, 1998).

### Qualitative Test for Saponins

Saponins were qualitatively screened by the method of Harborne, (1998), 2 ml of the extract and 2 ml of distilled water added in a test tube and shaken thoroughly. The whole tube was filled with froth that lasted for several minutes indicating the presence of saponins.

### Qualitative Test for Tannins

Tannins were qualitatively screened by the method of Harborne, (1998), in 2-3ml of extract, 5% ferric chloride was added drop by drop, and a dark-green-coloured complex was formed indicating the presence of condensed tannins.

### Qualitative Test for Steroids

To 2ml of extract, 2ml of chloroform was added followed by the careful addition of 2ml concentrated sulphuric acid to form a lower layer. A reddish-brown colour formed at the interface indicates the presence of a steroidal ring.

### Culture Media and Disc Preparation

Muller Hilton (38g) was diluted in 100ml distilled water and sterilized for 15 minutes at 121°C. Discs of about 6mm in diameter were made from Whatman's No1 filter paper and dully sterilized at 121°C for 15 minutes.

### Microorganism

Pure strains of *E. coli* and *Pseudomonas Spp* were obtained from the microbiology laboratory, at the Bauchi State University of Gadau. The isolates were checked for viability and purity before being transferred to the agar slant and stored. The inoculated plants were allowed to stand for 15mins before inoculating for 24 hrs at 37°C

### Bioassay Procedure

Standard inoculation of the isolate was streaked on the plate of solidified agar in separate Petri dishes. The disc of extracts (100 mg/mL, 50mg/mL, and 10mg/mL) and blank without extract and reference antibiotic disc (penicillin) were placed on the inoculated media. The plates were incubated at 37°C for 24 hours before observation and the inhibition zone was measured in millimetres (Bauer *et al.*, 2020).

## RESULTS AND DISCUSSION

The results of the qualitative analysis of fresh and dried *C. papaya* leaves are presented in Table 1 below. Saponins were shown to be higher in fresh leaf extract which reduces significantly when processed (dried), flavonoids and tannins increase in the dried leaves while alkaloids were not affected completely.

Table 1. Result of phytochemical screening of fresh and dried *C. papaya* leaves

Phytochemicals	Fresh extract	Dried extract
Saponins	+++	+
Alkaloids	++	++
Flavonoids	+	++
Tannins	+	++
Steroids	+	+

Note: +++ (Much abundant), ++ (less abundant), + (minute)

The result showed the effect of processing on the quality of the phytochemical in the leave extract, it was known that processing affects the bioavailability of nutrient in leaves which was seen in our previous study on the effect of processing on the vitamin content of leafy vegetables. Unlike vitamins that are affected negatively, phytochemicals can be increased when processed, as shown by Fahad *et al.*, (2018) in their study stated that phytochemicals can be deteriorated upon processing while in some cases can improve their bio-activity and bio-availability. This is seen with flavonoids and tannins in the present study, with a decrease in saponins while alkaloid was not affected at all.

#### Antibacterial Activity

The inhibitory effect of the fresh and dried *C. papaya* leaf extracts was evaluated against two different bacterial strains. The antimicrobial activity was determined using the disc diffusion method summarized in Table 2 below. The activity was quantitatively assessed on the basis of inhibition zone (IZ), and results were compared with the activity of standard drug penicillin (20 mm) against *E. coli* and (18mm) against *Pseudomonas Spp* (13mm).

Table 2. Results of antibacterial activity of fresh and dried *Carica papaya* leaves

Treatment	Concentration (mg/mL)	ZONE OF INHIBITION (mm)	
		<i>E. coli</i>	<i>Pseudomonas Spp</i>
Fresh	10	NZ	5
	50	11	13
	100	18	10
Dried	10	NZ	NZ
	50	7	3
	100	11	5

NZ: No zone of inhibition

The fresh extract was shown to have high antibacterial activity over the dried extract. The fresh extract was shown to inhibit the growth of *Pseudomonas Spp* even at lower concentrations (10mg) with a maximum inhibition zone (13mm) at moderate concentrations on *Pseudomonas Spp* while with *E. coli* turns out not to be affected at low concentrations but alternatively more effective than on *pseudomonas Spp* with highest IZ of up to 18mm at 100mg. This showed different concentration works for different bacterial strain even though they belong to the same class (gram-negative), this was similar to a study carried out by Alexander *et al.* (2019) where some bacteria are more susceptible to the *C. papaya* extract than others tested. Also processing decreased the antibacterial activity shown by the diminished activity on both strains at low concentrations and showed moderate inhibition even at 100mg/l concentration of the dried extract when compared with the fresh extract.

The decrease in antibacterial activity of the *C. papaya* leaves might be due to the high content of saponins which was shown to decrease (the antibacterial activity) upon drying coincident with the decrease in saponins. Flavonoids and tannins might contribute to the activity due to their increase in the dried extract which might be to compensate for the decreased saponins. This is evident that saponins, flavonoids, and tannins have antibacterial properties as stated by Dwivedi *et al.*, (2020) while Alkaloids contribute to stimulation, flavouring communication, and pigmentation since it was not affected in both cases. Therefore, the results showed that *C. papaya* leaves used for medicinal purposes are better ingested fresh than dried.

## CONCLUSION

*Carica papaya* leaf extract has antimicrobial properties against strains of human pathogenic bacteria. This activity can be attributed to the presence of certain phytochemical constituents present in the extract which tend to decrease upon processing. The leaves were found to be more potent in activity at different concentrations for different bacterial strains. This therefore shows that the leaves of *C. papaya* can be used as an effective herbal medicine in a fresh state because of its high inhibitory activity than after drying.

## Abbreviations

*Carica papaya*: *C. papaya*

*Escherichia coli*: *E. coli*

Inhibition Zone: IZ

No zone of inhibition: NZ

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## WORKFORCE TURNOVER AND ORGANIZATIONAL GROWTH OF SELECTED MONEY DEPOSIT BANKS IN BONNY ISLAND, RIVERS STATE

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### Abstract

*This study examined workforce turnover and organizational growth of selected money deposit banks in Bonny Island, Rivers State. Using organizational performance and customer retention to measure organizational growth; this study made use of one hundred and one (101) participants, comprising of staffs of the four selected banks in Bonny Island. The participants consist of 38 males and 63 females, age ranged between 24 to 61 years with mean age of 35.16 and standard deviation of 5.3, the participants were selected through a purposive sampling technique. However, survey design was adopted for the study while Pearson product moment correlational statistical analysis was employed to analyze the data in order to test the two formulated hypotheses. The result of the Pearson Moment Correlation Analysis revealed that workforce turnover has a significant negative relationship with customer retention ( $r = -.329$ ;  $p < .05$ ) and organizational performance ( $r = -.217$ ;  $p < .05$ ) of money deposit banks in Bonny Island. In line with the finding, the researcher recommends that; (i) That money deposit banks in Bonny Island should create a conducive working condition which is free from work overload, stress and burnout as this will help increase employee satisfaction and as well reduce turnover intention and also (ii) improve their working conditions, free from work overload, stress and burnout as this will help increase employee satisfaction and as well reduce turnover intention. However, all analyses in this study were done using Statistical Package for Social Sciences (SPSS).*

**Keywords: Workforce Turnover, Customer Retention, Organizational Performance, Growth**

### Introduction

The problem of Workforce turnover among Money Debit Banks has been an enigma for decades. Almost universally, many executives have been complacent regarding the issue of Workforce turnover on Organizational growth but little has been known if it has any impact on Organizational Growth especially among Money Debit Banks. However, money deposit banks have been experiencing employee turnover for a period of time, some employees no longer feel attached to the organization and when these employees quits, the organization has to suffer a great amount of direct and indirect cost. The expenses of workforce turnover can be shocking ranging from advertising expenses, resource management expenses, loss of time and efficiency, work imbalance, and training and development expenses for freshly employees (Harrie, 2020). This can be very disturbing to any organization, if experienced workers who have the knowledge and have learnt the culture of the organization regularly quit the organization and look for other jobs in different companies, this therefore means that the organization would definitely lose its market share to their competitors.

According to Phillip (2015), workforce turnover affects distribution of the roles and duties in different department to new employees who have no capability on effective operations of organization services, this greatly worsens the superiority of organization services and as result, low level of clients or customer satisfaction is recognized. The organization sales income falloff and this drops the level of organization competence. New employees who are not experienced and do not have the capacity to function well on the roles and duties they have been assigned for, they take time and money thus exposing the organization to huge expenses on recruitment and orientation to replace the work force gap generated by the exiting employees. The main issue to workforce turnover is that the organization loses the best qualified and capable employees that the organization had capitalized seriously in training and coaching on different job tasks. In the same vein, employee performance, employee commitment and customer retention are core measures of organizational growth especially to organization within the service sector who do not engage in manufacturing of products like money deposit banks and its growth is tied to the general performance in terms of service quality assurance, ability to retain its customers while maintaining employee commitment, and growth is hampered when these elements are affected.



However, having looked at the negative impact of workforce turnover, this study tends to extend the scope of knowledge to investigate if there is a correlation between workforce turnover and organizational growth, with much emphasis on money deposit banks within Bonny Island.

### **Problem of the Study**

In the contemporary world of business, most organization desire growth in order to prosper and not just to survive. Organizational growth, however, means different things to different organizations. Indeed, there are many parameters organization select to measure its growth but the most core aspect is the one that shows progress with respect to an organization's stated goals. The ultimate goal of most organization is to maximize profit, other business owners, may use sales turnover, employee performance, quality service, physical expansion, or other criteria to judge organizational growth. Many firms desire growth because it is seen generally as a sign of success, progress and expansion. Organizational growth is, in fact, used as one indicator of effectiveness for both small and large businesses and is a fundamental concern of many practicing managers. (Cole, 2002).

Over the last two decades, many researchers are kin to identify factors that may hinder organizational growth both in private and public sector and to provide solutions to arrest such factors but over the years the issue of Workforce turnover still exists in most of the organization throughout the world and its impact on the organization cannot be undermined. Even highly paid sectors still suffer from workforce turnover. But the question remains, does workforce turnover has any negative effect on organization growth especially in the banking sector? Extensive studies have been done concerning workforce turnover. Many studies have looked at workplace factors that may cause employee turnover intention while some studies have tried to identify methods and strategies to minimize or eliminate it from work environment but little or no studies has attempted to evaluate its impact on organizational growth especially on money deposit banks. Therefore, in other to cover this gap, this study tends to answer the following questions;

- i. Is there any relationship between workforce turnover and customer retention of Money Deposit Banks in Bonny Island?
- ii. Is there any relationship between workforce turnover and organizational performance of Money Deposit Banks in Bonny Island?

### **Aim and Objectives**

The main purpose of this study is to determine the impact of workforce turnover on organizational growth of selected money deposit banks in Bonny Island, Rivers State but specifically, this study tends to look at these following objectives;

- i. To ascertain the relationship between workforce turnover and customer retention of Money Deposit Banks in Bonny Island?
- ii. To determine the relationship between workforce turnover and organizational performance of Money Deposit Banks in Bonny Island?

### **Hypotheses**

- i. There will be a significant negative relationship between workforce turnover and customer retention of Money Deposit Banks in Bonny Island?
- ii. There will be a significant negative relationship between workforce turnover and organizational performance of Money Deposit Banks in Bonny Island?

### **Literature Review**

#### **Theoretical Review**

#### **Human Capital Theory of Employee Turnover (Durkheim, Simmel & Weber, 1978)**

Human capital theory (Durkheim, Simmel, Marx & Weber, 1978) proposed that turnover stress organizational performance and growth. The theory recommends that experienced employees perform well since they are more skilled and knows the nature of the work better. However, when qualified employees quit, an organization is stressed since it loses more skilled and experienced employees in which it has invested on human capital. Furthermore, turnover creates extra human resource management expenses such as recruitment, selection, and training costs. Human capital theory suggests that turnover lessens social capital asset by reproducing the personality of social affairs within the organization. Growth in turnover rates interrupts an organization collective function. In addition, turnover causes

extra beginner's socialization expenses for an organization. Human and social capital theories concentrates on growth in turnover rates and advise that turnover rates are linearly and destructively connected to organizational performance and growth (Hausknecht & Trevor, 2014).

## **Empirical Review**

### **The Effect of Workforce Turnover on the Growth of an Organization**

Mwansa and Chrine (2023) state that there are many hidden of direct costs like the expenses incurred in training and supervising new entrants as well as those they are replacing and supervising new entrants as well as those they are replacing and overtime that they have to be paid during staff shortages. Robbins (2013) states that cost of staff turnover and the impact therefore on productivity alone is enough to depress any human resource manager and the organization. There might be a delay of service delivery while waiting for the replacement staff to arrive. Mathis and Jackson (2007) states that employees have to work extra hours to compensate for the work of those that have resigned. Mullins (2005) maintains that the cost of recruiting and engaging new members of staff and considerable the adds that the affect the direct costs like advertising, agency fees, paper work and interview time. According to Nel, et al (2004), the following are some of the factors that impact on staff turnover and organizational effectiveness: increased customer complaint about the services, the quality of service is decreasing because of staff shortage, the replacement staff may be unfamiliar with the unit and task or duties to be performed, therefore inefficiency and errors may result, sometimes a personnel member in the unit is in the lower categories of staff. Therefore, they are restricted by their scope of duty. They can perform certain duties under the direct supervision of a trained member or sometimes they are completely forbidden to do certain duties. Steers (2002) states that staff turnover is costly and disruptive. Costly as it reduces the output and disruptive, as it requires that schedules and programmes to be modified.

### **The Relationship between Workforce Turnover and Organizational Growth**

Mwansa and Chrine (2023), analyzed the effect of High employee turnover in the banking industry using 115 employees of Ecobank Plc Zambia, using regression analysis the result indicated that employee turnover affects the general performance of the organization, he continues to state that there is a relationship between employee turnover and recruitment cost proved to be negative on organization performance and finally there was a relationship between employee turnover and employee morale. Taye and Getnet (2020) studied the impact of staff turnover on organizational effectiveness and performance in Mada Walabu University using 425 employees. The study concluded that staff turnover causes reduction in work productivity and quality of services rendered as well as it causes too much wastage of resources when new staff settles and lose public confidence in the operation of the organization. Adrian (2017), studied employee turnover on organizational performance using 605 Lecturers in Kenyatta University. The study analyzed that the degree of commitment and loyalty can be achieved if the organization enrich on the jobs, empowers and compensate employees properly. Another study on the "Influence of employee turnover on their performance and organizational effectiveness" by Sudhakar, Alemayehu and Agarwal (2017) concluded that high rate of employee turnover leads to poor employee performance which in turn impacts on organizational effectiveness. Ruth (2015), in her study on employee turnover on organizational performance using employees of Kenyatta University, Kenya. Analyzed that employee turnover had a negative effect on organizational productivity.

## **Methodology**

In other to analyze and test the formulated hypotheses, correlational research design was adopted and using Taro Yamani formula this study made use of one hundred and one (107) employees from the four (4) randomly selected money deposit banks (Access, First, GTBank and UBA) in Bonny Island. A total of 107 set of questionnaires were distributed to the participants, 105 were returned while 101 questionnaires were valid for the final analysis. However, the participants consist of 63 males and 38 females. Their ages ranged between 24 and 61 years, with mean age of 35.16 and standard deviation of 5.3. Although, to maintain reliability and validity, two pre-tested scales from previous researchers were used to collected data from the participants. The questionnaires include: Bothma and Roodt's (2013) 6- item Turnover Intension Scale (TIS) which is rated on a 5 point likert scale format (1 = strongly disagree to 5 = strongly agree) was used to measure workforce turnover; and Md Murad Miah (2020) 2-dimensional Organizational Performance Scale (OPS) rated on a 5 point likert scale format (1 = strongly disagree to 5= strongly agree) was also be used to measure Organizational performance and Customer Retention (Organizational Growth). Meanwhile, demographic variables like age, gender, marital status, educational level and religion were also included in the overall instrument. While, the hypothesis will be tested using Pearson Product Moment analysis.

## Analysis and Result

**Table 1: showing the relationship between workforce turnover and customer retention.**

		Workforce Turnover	Customer Retention
Workforce Turnover	Pearson Correlation	1	-.329
	Sig. (2-tailed)		.000
	N	101	101
Customer Retention	Pearson Correlation	-.329	1
	Sig. (2-tailed)	.000	
	N	101	101

The result of the table 1 above shows that there is a negative significant relationship between workforce turnover and customer retention ( $r = -.329$ ,  $p < .002$ ).

**Table 2: showing the relationship between workforce turnover and organizational performance**

		Workforce Turnover	Organizational performance
Workforce Turnover	Pearson Correlation	1	-.217
	Sig. (2-tailed)		.002
	N	101	101
Organizational Performance	Pearson Correlation	-.217	1
	Sig. (2-tailed)	.002	
	N	101	101

The result of the table 2 above shows that there is a negative significant relationship between workforce turnover and organizational performance ( $r = -.217$ ,  $p < .002$ ).

## Summary of Findings

Having examined the relationship between workforce turnover and organizational growth (customer retention and organizational performance) of Money deposit banks in Bonny Island, the result of the Pearson Product Moment Correlation in table 1 which tested for the relationship between workforce turnover and customer retention showed that workforce turnover has a negative relationship with customer retention at  $r = -.329$ ,  $p < 0.05$ . Therefore, the hypothesis two which stated that “there will be a negative relationship between workforce turnover and customer retention” was also accepted. This implies that workforce turnover negatively affects the consistency and the quality of service delivery to customers, this reduces ability to retain customers and affects general growth of the organization. Although, the result is supported by the findings of and Taye and Getnet (2020), Robbins (2013); and Mwansa and Chrine (2023); whom in their various studies concluded that workforce turnover causes loss of experienced employees, reduction in productivity, quality of services rendered and also causes wastage of resources in recruiting new employee and lose public confidence in the operation of the organization and this affect the organizational performance and growth as well.

Similarly, the result of table 2 which test for a significant relationship between workforce turnover and organizational performance revealed that workforce turnover has a significant negative relationship on organizational performance at  $r = -.217$ ,  $p < 0.05$ . Therefore, the hypothesis one which stated that “there will be a significant negative relationship between workforce turnover and organizational performance” was accepted. This result indicated workforce turnover has a negative impact on organizational performance and it equally implies that when an organization loses their critical employees it jeopardizes the general performance of the organization and their effort to attain organizational objective and growth. However, the result is in agreement with the findings of Mwansa and Chrine (2023); Sudhakar,

Alemayehu and Agarwal (2017); Adrian (2017); Ruth (2015); and Nel et al (2004) whom in their various studies concluded that employee turnover affects the general performance of the organization as well as employee morale and quality delivery and assurance.

### Conclusion

This research examined the impact of workforce turnover on organizational growth of selected money deposit bank in Bonny Island” using organizational performance and customer retention as measures of organizational growth; it is therefore concluded that workforce turnover has a negative effect on organizational growth (organizational performance and customer retention) of money deposit banks in Bonny Island. Thus, it implies that frequent resignation of employees of money deposit bank in Bonny Island negatively affects the overall performance and growth of bank including their ability to retain customers as it also jeopardizes the quality of service delivery of the organization.

### Recommendations

Based on the findings and conclusion, this study recommends the following to help organizations benefit intensively from this study;

1. That money deposit banks in Bonny Island should offer opportunities for employee career growth and advancement, this may increase employee engagement and perceived organizational support and as well reduced workforce turnover.
2. That money deposit banks in Bonny Island should create a conducive working condition which is free from work overload, stress and burnout as this will help increase employee satisfaction and as well reduce employee turnover intention.
3. That money deposit banks in bonny Island should ensure that employees are given chance for job promotions and other monetary incentives, and finally improve employee job security. As job security gives employees a sense of belonging and encourages citizenship behavior.

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## NAVIGATING GEOPOLITICAL RISKS: ENHANCING FOREIGN DIRECT INVESTMENT RESILIENCE IN NIGERIA'S OIL AND GAS SECTOR

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### Abstract

*This study investigated the effect of regional instability and insurgencies on foreign direct investment (FDI) in the Nigerian oil and gas sector. Given the country's heavy reliance on hydrocarbon exports and the complex geopolitical environment it operates in, understanding the impact of these risk factors is crucial for financial risk management. The objectives were to determine the effect of regional instability on FDI and investigate the impact of insurgencies on FDI in Nigerian oil and gas companies. A quantitative approach was employed, with data collected through an online survey of oil and gas companies in Lagos, Nigeria. The survey utilized a structured questionnaire with Likert scale questions. Statistical analysis, including regression analysis was performed using SPSS software. The regression model's R-squared value of 0.432 indicated that it explained approximately 43.2% of the variance in FDI, representing a moderate fit. The adjusted R-squared value of 0.270 provided a more accurate measure of the model's fit, considering the number of independent variables. The coefficient for regional instability (-0.811) and insurgencies (-0.189) were both negative, suggesting that higher levels of these geopolitical risk factors might be associated with lower levels of FDI. The study contributes to the ongoing discourse on managing geopolitical risks in the oil and gas industry, underscoring the need for robust risk management strategies and fostering a stable environment for foreign investment.*

**Keywords:** Geopolitical Risk, Foreign Direct Investment, Oil and Gas.

### Introduction

Nigeria's economy is heavily reliant on its oil and gas reserves. Hydrocarbon exports account for a substantial portion of the country's government revenue (Nigerian National Petroleum Corporation, 2023) and remain a critical driver of foreign direct investment (FDI) (Fitch Solutions, 2023). This dependence creates a vulnerability to fluctuations in global oil prices, as witnessed during the 2014-2016 oil price downturn which significantly impacted Nigeria's economic growth (World Bank, 2017). Nigeria operates within a complex geopolitical environment. Regional instability, characterized by issues like piracy in the Gulf of Guinea and insurgencies in the Niger Delta, pose a direct threat to oil and gas operations (International Crisis Group, 2022). Disruptions to production and infrastructure due to these factors can lead to revenue losses and project delays, impacting the financial health of the sector. Government policies and regulations surrounding the oil and gas sector can significantly influence financial risk. Frequent changes in fiscal regimes, profit-sharing agreements, and licensing terms can create uncertainty for investors, making it difficult to accurately assess long-term project viability (EY, 2023). This uncertainty can deter investment and hinder the sector's ability to attract the capital needed for growth and development. The oil and gas industry in Nigeria has a long history of strained relations with local communities. Environmental degradation caused by oil spills and inadequate profit-sharing mechanisms can lead to social unrest and protests (Friends of the Earth, 2023). Disruptions caused by such unrest can further exacerbate financial risk by hindering production and increasing security costs.

While the qualitative impact of geopolitical events is understood, there is a lack of quantified data on the precise financial losses incurred by the Nigerian oil and gas sector due to specific events. This study will explore ways to bridge this data gap.

### The following objectives were formulated for this study:

- i. Determine the effect of Regional instability on foreign direct investment of Nigerian oil and gas companies
- ii. Investigate the impact of Insurgencies and foreign direct investment of Nigerian oil and gas companies

**The following hypotheses were formulated for this study:**

Ho1: Regional instability has no effect on foreign direct investment of Nigerian oil and gas companies

Ho2: Insurgencies has no impact on foreign direct investment of Nigerian oil and gas companies

**Literature Review**

Nigeria's relationship with oil and gas is a complex and crucial one. As the largest oil producer in Africa, the sector underpins a significant portion of the country's economy (International Trade Administration, 2022). Nigeria boasts substantial oil and gas reserves. Estimates suggest around 37 billion barrels of crude oil and over 200 trillion cubic feet of natural gas (Bank of Industry, 2023). This abundance initially fueled rapid economic growth (Statista, 2023). Exploration began in the early 20th century, with significant discoveries in the 1950s (Wikipedia, 2023). By the 1970s, Nigeria had joined the Organization of the Petroleum Exporting Countries (OPEC) as a leading exporter (Statista, 2023). Oil and gas revenue contributes significantly to Nigeria's GDP, though estimates vary. The International Trade Administration (2022) suggests a contribution of around 6.63% in 2022, while Statista (2023) cites a historical average of 9%. This revenue stream also accounts for a substantial portion of Nigerian exports, with the United States being a major buyer (Wikipedia, 2023).

Despite the economic benefits, the oil and gas industry presents several challenges in Nigeria. The Niger Delta, the heart of Nigeria's oil production, has faced regional instability and resource nationalism (KPMG Nigeria, 2021). This can disrupt production and create security concerns for companies operating there. Oil spills and gas flaring have significant environmental consequences in the Niger Delta (Wikipedia, 2023). This has led to increased scrutiny from international organizations and environmental activists. Nigeria's heavy reliance on oil revenue exposes it to fluctuations in global oil prices (KPMG Nigeria, 2021). This can lead to economic hardship when prices fall. Theft of crude oil is a major problem in Nigeria, impacting production and revenue (International Trade Administration, 2022). Additionally, aging infrastructure can hinder efficient production and distribution. The long-term future of oil and gas in Nigeria is uncertain. The global push for renewable energy sources could lead to decreased demand for fossil fuels. However, Nigeria still holds vast reserves, and the sector is likely to remain significant in the near future (Energy Transition Plan, 2023).

Nigeria, Africa's most populous country and the continent's largest economy, has long been a target for foreign direct investment (FDI) (Lloyds Bank International Trade Portal, 2023). However, the story of FDI in Nigeria is complex, marked by periods of significant inflows followed by fluctuations (Statista, 2024). Understanding the factors that attract and deter FDI is crucial for Nigeria's continued economic development. In the pre-deregulation era, particularly during the oil boom of the 1970s, the Nigerian government's policies towards FDI were ambivalent. While pronouncements encouraged foreign investment, bureaucratic hurdles and inconsistent regulations often discouraged potential investors (CBN Economic & Financial Review, 2012). Additionally, policies like the Indigenization Decree of 1972 reserved certain sectors for domestic ownership, further limiting foreign participation (Library of Congress, 2012). The economic crisis of the 1980s forced a shift in policy. The government embraced deregulation and established the Nigerian Investment Promotion Commission (NIPC) in 1995 to streamline the investment process and attract FDI (Lloyds Bank International Trade Portal, 2023). These efforts led to a surge in FDI inflows in the late 1990s and early 2000s (Statista, 2024). Hydrocarbons, particularly the oil and gas sector, have traditionally been the magnet for FDI in Nigeria (Lloyds Bank International Trade Portal, 2023). However, recent years have seen growing interest in other sectors such as telecommunications, manufacturing, and finance (National Bureau of Statistics, 2023). FDI can play a crucial role in these sectors by providing much-needed capital, technology, and expertise (UNCTAD, 2023).

The international landscape is increasingly characterized by geopolitical volatility, a state of instability marked by shifting alliances, regional conflicts, and competition for resources (Beckfield, 2014). This volatility presents significant challenges for governments, businesses, and individuals alike. Several factors contribute to a geopolitically volatile environment. The rise of nationalism and populism can lead to increased tensions between states (Mearsheimer, 2018). Competition for scarce resources, such as water and energy, can also spark conflict (Homer-Dixon, 1994). Additionally, the proliferation of cyber threats and nuclear weapons creates a constant undercurrent of anxiety and potential escalation (Copeland, 2009). The consequences of geopolitical volatility are multifaceted. Businesses operating in volatile regions face disruptions to supply chains, increased security risks, and potential

expropriation of assets (Doherty, 2020). Investors may become hesitant to engage in volatile markets, hindering economic growth (Copeland, 2009). Geopolitical instability can also lead to humanitarian crises and mass displacement of populations (Castles, 2003).

## Methodology

Researchers employed a quantitative approach to gather data from oil and gas companies in Lagos, Nigeria. An online survey served as the primary data collection method. The survey instrument itself was a structured questionnaire utilizing Likert scale questions for data collection. To ensure clarity, validity, and reliability, the survey underwent pre-testing with a small sample group. The target population for this research consisted of oil and gas companies operating within Lagos, Nigeria. Convenience sampling, chosen for its ease of access to online participants in the Lagos oil and gas sector, was the sampling method employed. The researchers acknowledged the limitations of convenience sampling, particularly the potential for bias. Determining the ideal sample size necessitated a power analysis considering factors like effect size and desired confidence level. A common rule of thumb suggested a minimum sample size of 30 for reliable statistical analysis. However, to enhance the generalizability of the findings, a larger sample size (100) was adopted. Statistical software program SPSS was used to analyze the quantitative data collected through the survey. Correlation analysis was employed to identify any statistically significant relationships between specific geopolitical factors and the financial performance metrics of the participating companies.

## Results

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.658 <sup>a</sup>	.432	.270	1.273

a. Predictors: (Constant), REGINST, INSURG

R-squared: The R-squared value of 0.432 indicates that the model explains approximately 43.2% of the variance in FDI. This is a moderate fit. Adjusted R-squared: The adjusted R-squared value is slightly lower at 0.270, which is a more accurate measure of the model's fit when considering the number of independent variables. Std. Error of the Estimate: This value (1.273) represents the average difference between the predicted FDI values and the actual FDI values.

ANOVA <sup>a</sup>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.649	2	4.324	2.667	.138 <sup>b</sup>
	Residual	11.351	7	1.622		
	Total	20.000	9			

a. Dependent Variable: FDI

b. Predictors: (Constant), REGINST, INSURG

Regression: This section shows the explained variance (8.649) by the model, including its two independent variables. Residual: This section shows the unexplained variance (11.351) that the model could not capture. F-statistic: The F-statistic (0.138) echoes the non-significant result from the model summary. Sig.: This value (0.138) again confirms the lack of statistical significance for the entire model.

Coefficients <sup>a</sup>						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	6.000	3.145		1.908	.098
	INSURG	-.189	.541	-.189	-.350	.737
	REGINST	-.811	.541	-.811	-1.500	.177

a. Dependent Variable: FDI

Constant: The constant term (6.000) represents the predicted FDI value when both regional instability and insurgencies are zero. INSURG: The coefficient for insurgencies (-0.189) is negative and statistically insignificant (Sig. = 0.737). This suggests that a higher number of insurgencies might be associated with a slight decrease in FDI. REGINST: The coefficient for regional instability (-0.811) is negative but also statistically insignificant (Sig. = 0.177). This suggests that higher regional instability might be linked to lower FDI.

## Conclusion

This study aimed to analyze the effect between geopolitical risk factors (regional instability, insurgencies) and foreign direct investment (FDI) in the Nigerian oil and gas sector. The findings from the regression analysis suggest that while regional instability and insurgencies may have a negative impact on FDI, the relationships were not statistically significant. The R-squared value of 0.432 indicates that the model explains approximately 43.2% of the variance in FDI, which is a moderate fit. However, the adjusted R-squared value of 0.270 provides a more accurate measure of the model's fit, considering the number of independent variables. The coefficients for regional instability (-0.811) and insurgencies (-0.189) were both negative, suggesting that higher levels of these geopolitical risk factors might be associated with lower levels of FDI. The negative coefficients align with the theoretical expectation that geopolitical risks can deter foreign investment. Further research with a more comprehensive measurements, and the inclusion of additional relevant variables could provide more definitive insights into the impact of geopolitical risks on FDI in this sector. This study contributes to the ongoing discourse on managing geopolitical risks in the oil and gas industry, particularly in regions characterized by instability and volatility. The findings underscore the need for robust risk management strategies and the importance of fostering a stable and conducive environment for foreign investment to thrive in this crucial sector.

The following are three recommendations based on the study's findings and conclusion:

1. Oil and gas companies operating in Nigeria should enhance their risk monitoring systems to proactively identify and mitigate potential regional instability and insurgency threats.
2. Given the geopolitical risks associated with the Nigerian oil and gas sector, companies and investors should consider diversifying their investment portfolios.
3. To address the underlying drivers of regional instability and insurgencies, oil and gas companies should prioritize stakeholder engagement and community development initiatives.

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## MULTIMEDIA LEARNING FOR YOUTH EMPOWERMENT IN A CROSS CULTURAL AFRICAN SCHOOL

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### Abstract

*Youth empowerment is a process where children and young people are encouraged to take charge of their lives. They do this by addressing their situation and then take action in order to improve their access to resources and transform their consciousness through their beliefs, values, and attitudes. Youth empowerment gives kids and teens the courage to believe in themselves and not be swayed by the opinions of others or negative culture and to go after their dreams. When youths are not given positive development, it can lead to poverty, unemployment, high rate of crime, low standard of living and lastly national insecurity. Youth can be empowered through different means. These means can be deployed using a multimedia learning platform. Multimedia learning involves using the aid of technology to deliver a blend of text, static images, animation, video and audio. Some examples of common types of media used for learning are slide decks, recorded videos, info graphics and podcasts. Each of the various types of media supports learning by enabling learners to use their different senses. Rather than simply reading words, they can also hear and see the content – which enriches the learning experience. In the design of a Multimedia Learning Skill acquisition empowerment program, Structured System Analysis and Design methodology (SSADM) was adopted. Multimedia Learning skill acquisition empowerment program was developed using python programming language. This study also adopts a mixed research method. When youths are empowered with a multimedia learning platform, it can result to improved social skills, improved behavior, increased academic accomplishment, increased self-esteem and increased self-efficacy.*

**Keywords:** Multimedia, Learning, Youth, Empowerment and Culture.

### Introduction

Youth Empowerment can be defined as a process where people gain the ability and authority to make informed decisions and implement change in their own lives and the lives of other people. It is a means of encouraging youths to do great things for themselves and also to make great impact in their society (Olusola, 2019). Youth empowerment also refers to the process of giving young people the tools, resources, and opportunities they need to take control of their lives and shape their futures. This includes providing education, support, and access to resources and decision-making power so that young people can actively participate in creating a better future for themselves and their communities. Youth empowerment program can be deployed through different means. In schools for instance, youth can be empowered academically through teaching and reading of books. It can also be done through hands on practical. Multimedia on the other hand, is a cognitive theory of learning which has been popularized by the work of Richard E. Mayer and others. Multimedia learning happens when we build rational representations from words and pictures. The theory has mostly been defined by Mayer's cognitive theory of multimedia learning. by and large, the theory tries to address the issue of how to arrange multimedia instructional practices and use more effective cognitive strategies to help people learn proficiently.

### Background of the Study

With the growing need for youth of nowadays to be engaged positively and not negatively, there is need to deploy youth empowerment programs that can cut across cultural differences. There are different platforms such as convectional educational classrooms, skill acquisition centers etc to mount this program but some of the platform are not appealing to youths of this 21<sup>st</sup> century. These youths resorts to other negative practices that are appealing to them. Multimedia learning platform can be used to empower youths of this 21<sup>st</sup> century. Recent research on multimedia learning has shown that the emotional design of multimedia learning material can induce positive emotions in learners that in turn facilitate comprehension and transfer. Other research has investigated which design factors (e.g., shape, color) can induce emotions in multimedia learning. Recent advances in affective neuroscience and emotion research

confirmed that the human mind is continuously emotional. That is, cognition and emotion are inherently interconnected. This interconnectedness is an essential aspect of the complexity of human consciousness. An important quality of this interconnectedness is that emotional activity enables and sustains cognitive activity, including mechanisms that are central to learning, such as attention and memory (Plass and Kaplan, 2016). Based on our research, we propose that youth empowerment program be deployed using a multimedia learning platform. This is because multimedia ensures that learning is accessible to a diverse range of learners. For example, videos with closed captions or transcripts can be beneficial for learners who are hearing impaired or for those who prefer to read along. Utilizing multimedia in your learning materials will ensure instructional designers or course designers not need to build as many alternate learning options for the variety of learners you might be teaching. The use of video, audio, graphics, and animations can help to break up text-heavy content and can make learning more motivating and unforgettable. Implementing multimedia learning solutions is also a gainful solution for organizations and stakeholders that want to provide training and development opportunities for youths but cannot afford to run live trainings for each new group of learners. By leveraging existing technology and resources, organizations and stakeholders can create multimedia content that can be used frequently and shared across youths of different cultural background.

### Research Objectives

The objectives of the research include:

- To emphasize the need for youth empowerment, its importance, and then explore what our society will look like when youths are not empowered.
- To take a look on multimedia learning, the different forms and its benefits.
- To design a skill acquisition multimedia system for youth empowerment in TVET that will break the barrier of ethnicity, cut across culture irrespective of the geographic area.
- To design a skill acquisition multimedia system for youth empowerment in TVET that will be appealing to the youth of the 21<sup>st</sup> century.

### Literature Review

Youth empowerment is a process where children and young people are encouraged to take charge of their lives. They do this by addressing their situation and then take action in order to improve their access to resources and transform their consciousness through their beliefs, values, and attitudes (Kar, Pascual & Chickering, 1999). Youth empowerment is often addressed as a gateway to intergenerational equity, civic engagement and democracy building. (Sazama, J. & Young, K., 2006) Some dimensions of youth empowerment include: psychological, community, organizational, economic, social and cultural youth empowerment.

1. Psychological empowerment enhances individual's consciousness, belief in self-efficacy, awareness and knowledge of problems and solutions and of how individuals can address problems that harm their quality of life. This dimension aims to create self-confidence and give youth the skills to acquire knowledge.
2. Community empowerment focuses on enhancing the community through leadership development, improving communication, and creating a network of support to mobilize the community to address concerns.
3. Organizational empowerment aims to create a base of resources for a community, including voluntary organizations, unions and associations that aim to protect, promote and advocate for the powerless.
4. Economic empowerment teaches entrepreneurial skills, how to take ownership of their assets and how to have income security.
5. Social empowerment teaches youth about social inclusion and literacy as well as helping kids find the resources to be proactive in their communities.
6. Cultural empowerment aims to recreate cultural practices and redefine cultural rules and norms for youth.

### Importance of Youth Empowerment

Meanwhile the importance of youth empowerment cannot be over emphasized, they include:

1. Improved Self-Confidence and Self-Esteem: Empowered young people make better decisions and have greater independence because empowerment increases their self-esteem and confidence.

2. **Employment Creation:** When a youth is empowered, the society is also empowered. This is because the society will now have individuals that are engaged positively and there won't be problem of unemployment that many nations are battling with in the current time. An empowered youth can in turn create jobs for others.
3. **Increased Innovation and Creativity:** Empowered youth are often more innovative and creative, which helps to generate fresh ideas and solutions for societal problems.
4. **Better Standard of Education:** Empowering the youths academically advance the spirit of patriotism and loyalty in the education sector. The empowered youths know the value of education. Scholarships are given to the students because some individuals understand the value of education. These individuals are empowered and so in return they want to empower others academically.
5. **Good Political Practice:** When young people are empowered, they become more politically active and engaged, they empower the masses, thereby paving path for a better future. To build a better tomorrow, we need to nurture the youths of today.
6. **Crime reduction and National Security:** Empowerment engages the youths and since they have source of livelihood and are busy, crime is reduced and the security of the nation is guaranteed to an extent.
7. **Poverty Eradication:** Youth empowerment can curtail the poverty rate to a large level. One of the ways to empowering the youth is with skill acquisition. When a youth is having essential skills, he or she can use it to be independent. He can feed and assist others, and even invest thus developing the economy of the nation. (Olusola, 2019)

Lastly Youth empowerment is very important to both nations and the empowered. Therefore, all hands, including the youths should be on deck to empower the youths, otherwise the society will suffer from poverty, unemployment, high rate of crime, low standard of living and national insecurity.

### Multimedia Learning

Multimedia is a form of communication that uses any combination of text, graphic art, sound, animation, and video that is delivered by computer. When you allow the user – the viewer of the project – to control what and when these elements are delivered, it is interactive multimedia. When you provide a structure of linked elements through which the user can navigate, interactive multimedia becomes hypermedia. (Vaughan, 1993). Multimedia learning involves using the aid of technology to deliver a blend of text, static images, animation, video and audio. Some examples of common types of media used for learning are slide decks, recorded videos, infographics and podcasts. Each of the various types of media supports learning by enabling learners to use their different senses. Rather than simply reading words, they can also hear and see the content – which enriches the learning experience. Multimedia Learning can take many forms, such as:

- **Video:** Pre-recorded video or a series of videos can be used to explain complex concepts or demonstrate procedures and techniques.
- **Images and infographics:** Images and infographics can be used to present data and information in a visually appealing and easy-to-understand manner.
- **Interactive media:** Interactive elements, such as quizzes, simulations, and games, can be used to engage learners and provide them with a more immersive learning experience.
- **Audio:** Audio recordings such as podcasts or voice notes can be used to provide learners with spoken instructions, feedback, or commentary on course materials.
- **Animations:** Animations can be used to illustrate complex processes or systems, making them easier to understand and remember.
- **Social media:** Social media can be used to facilitate collaboration and communication among learners and between learners and instructors. Most social platforms allow you to create groups where you can come together to discuss a common thread.

Multimedia Learning is a great tool for enhancing the learning experience and making it more appealing, interactive, and effective. It allows course creators to deliver content in various formats that serve for different learning styles and preferences, eventually resulting in a more personalized and effective learning experience for learners.

The design principles for multimedia learning, can be used to:

**Identify learning objectives:** Multimedia elements can be used to identify the learning objectives of the course by providing visual and interactive representations of the learning outcomes. For example, a course designer can use infographics to present the course goals and objectives in a visually appealing way.

**Develop content:** Multimedia elements can be used to develop content by presenting information in various formats, such as videos, images, and animations. This helps to make the content more engaging and easier to understand.

**Repurpose content:** Multimedia elements can be used to repurpose content into different formats to cater for learners differing needs.

**Improve engagement:** Multimedia elements can be used to enhance learner engagement by providing more stimulating and interactive learning experience. For example, interactive simulations can be used to provide learners with a hands-on learning experience.

**Evaluate learning:** Multimedia elements can be used to assess learning by providing interactive quizzes and assessments that provide instant feedback to learners. This helps to identify areas where learners need to improve and adjust the course content accordingly.

**Ease collaboration:** Multimedia elements can be used to facilitate collaboration by providing opportunities for learners to interact with each other and share their knowledge and experiences. For example, discussion forums and social media can be used to encourage learners to engage with each other and share their thoughts and ideas.

## 1.0 METHODOLOGY

In the design of a Multimedia Learning Skill acquisition empowerment program, Structured System Analysis and Design methodology (SSADM) was adopted. Multimedia Learning skill acquisition empowerment program was developed using python programming language. This study also adopts a mixed research method. The first was based on an experimental research where fifty (50) youths out of three hundred (300) youths from an institution were empowered using two different programs: (1) the skill acquisition empowerment program designed with multimedia learning and (2) A Skill acquisition empowerment program designed with other platforms. The second was based on a questionnaire administered to the 50 participants after the exercise. The questions listed below helped the researchers to formulate the key benefits of multimedia learning for youth empowerment using a 5 Likert scale of Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree

- Why is there dire need for youth empowerment?
- How can youth be empowered?
- What are the benefits of youth empowerment?
- What is multimedia learning?
- Do you know about multimedia learning before now? Have you used any multimedia learning system before now?
- What are your experiences after participating in the two empowerment programs?
- What are the benefits of multimedia learning based empowerment over the other?

The instrument for data collection comprised 50 questionnaires given to these participants, who were able to state their level of agreement or disagreement with the benefits of multimedia learning empowerment after their participations on (1) A Skill acquisition empowerment program designed with multimedia and that of (2) A Skill acquisition empowerment program designed with other platforms. The responses from them were analyzed with a simple percentage formula using a pie chart.

Benefits of multimedia learning empowerment program	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Deeper understanding of the material	22	11	5	5	7
Higher positive emotions	18	15	3	8	6
Easy access to knowledge	12	17	9	5	7
Immersive learning opportunities	27	18	2	2	1
Better problem solving	27	15	1	4	3

## Findings

The Multimedia Learning skill acquisition empowerment software includes interactive videos and e-learning platforms that assist youths from different cultural backgrounds and locations to learn different skills. The software was appealing to the youths of the 21<sup>st</sup> century because of its many benefits as affirmed by the fifty (50) youths. Specifically, the fifty (50) youths reported that using multimedia learning platform for their empowerment program fostered deeper understanding of the material, higher positive emotions, access to knowledge, Immersive learning opportunities and better problem solving. The findings provide support for the benefits of multimedia learning for youth empowerment.

## Conclusion

Youth empowerment is a comprehensive process that seeks to furnish young people with the skills, resources, and opportunities they need to become energetic and responsible citizens, capable of shaping their own lives and contributing to the welfare of their communities. Youth empowerment programs can be in form of learning, skills development, entrepreneurship and employment, civic engagement, health and wellness, technology and innovation, art and culture. These different forms of youth empowerment programs can be deployed using a multimedia learning platform which supports learning by enabling learners to use their different senses. Rather than simply reading words, they can also hear and see the content – which enriches the learning experience, makes room for deeper understanding of the material, create higher positive emotion, easy accessibility to knowledge and then better problem solving attitudes. When youths are empowered with a multimedia learning platform, it will eventually result to improved social skills, improved behavior, increased academic accomplishment, increased self-esteem and increased self-efficacy and thus reduce crime rate, eradicate poverty, create employment, increase political engagement and increase innovation and creativity. The researchers therefore recommend that curriculum developers, educators, and TVET institutions should use interactive video and other multimedia learning platforms to enhance youth empowerment in TVET.

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## DYNAMIC CAPABILITIES AND ORGANISATIONAL AGILITY OF OIL AND GAS COMPANIES IN RIVERS STATE, NIGERIA

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### Abstract

*Dynamic capabilities are the ability of organisations to integrate, build, and reconfigure internal and external resources/competences to address and shape rapidly changing business environments. Dynamic capability is crucial for an organisation to be able to cope with changes in the environment by delivering the right knowledge at the right time to the right person, as well as encourage knowledge sharing in order to achieve organisational goals thereby enhancing organisational performance. This study therefore examines the relationship between dynamic capabilities and organisational agility of oil and gas companies in Rivers State, Nigeria. The dimensions of dynamic capabilities (independent variable) are sensing capabilities and seizing capabilities, while the measures of organisational agility (dependent variable) are responsiveness and flexibility. Four objectives, research questions and hypotheses were formulated for this study. The population of this study constitutes two hundred and ninety-five (295) oil and gas companies registered in Rivers State. The Krejcie and Morgan's formula was used to determine a sample size of 169 oil and gas companies. The study adopted the simple random sampling technique to draw one (1) manager from each of the 169 oil and gas companies studied, to arrive at 169 managers for the complete sample. Data was gathered using self-administered questionnaire, and a 5-point likert-scale designed questionnaire ranging from Strongly Agree (SA) to Strongly Disagree (DA) was distributed to the respondents, of which out of the 169 copies of designed questionnaire distributed, 119 copies accounting for 70% were recovered from the respondents. However, 85 (71%) of the questionnaire were properly filled and subsequently used for analysis. Spearman Rank Correlation Coefficient was used to examine the relationship between the independent and dependent variable. The data was analyzed by the use of statistical package for social sciences (SPSS version 21.0). The findings of the study revealed that there is a relationship between dimensions of dynamic capabilities (sensing capabilities and seizing capabilities) and measures of organisational agility (responsiveness and flexibility). This study therefore concludes that proper application of dynamic capabilities in oil and gas companies can be used to achieve responsiveness and flexibility, thereby making organisations to become agile, and recommended that oil and gas companies should ensure that they frequently scan the environment to enable them become responsive to the environment; oil and gas companies should endeavour to devise means of embracing opportunities easily in order to gain competitive advantage; processes and procedures of oil and gas companies should be one that can be easily adjusted in order to adapt to the business environment; and managers of oil and gas companies should always endeavour to know the choices and preferences of customers in order be ahead of competitors.*

**Keywords:** Dynamic Capability, Organizational Agility, Sensing Capability, Seizing Capability and Responsiveness, Flexibility.

### Introduction

Organizations such as oil and gas companies which operate in a dynamic environment face the inevitability of endless change (Breu, Hemingways & Strathem, 2001). Under this condition, oil and gas companies ought to be agile and be able to sense and respond to market changes quickly and smoothly to maintain their competitiveness (Lee, 2004, Weill et al; 2002). Oil and gas companies that fail to be agile might find themselves losing market share and competitive advantage. Oil and gas companies have accepted the fact that turbulence in the market place is uncontrollable and unpredictable, limiting their ability to respond effectively in a pre-planned manner (Das, 1995). Organisational agility is an important and relevant concept for more organisations especially the oil and gas companies in today's competitive and fast-changing environment.

Organisational agility is the capability of a company to rapidly change or adapt in response to changes in the market. An agile organisation embraces change by moving quickly, decisively and effectively to anticipate, initiate, and take advantage of change and yet remains strong enough to absorb any setbacks. Organisations particularly the oil and gas companies that operate in a dynamic turbulent and even hostile environment require greater agility to thrive than those that operate in less turbulent business environment (Tallon, 2008). Agility is achieved by being alert to both internal and environmental changes – opportunities as well as challenges and the ability to use available resources in a timely, flexible, affordable and relevant manner, in order to respond to those changes effectively. According to Sharifi and Zhang (1999), organisational agility measures include responsiveness, flexibility, competency and speed.

Categorically, in emerging and developing economies like China, Malaysia, Singapore, South Korea, Ghana, South Africa, Nigeria among others, oil and gas companies have recorded unstable performance due to global shock, unpredicted economic policies, oil price volatility, dynamic market forces, technological advancement among others (Arokodare, 2020; International Energy Agency, 2020). Scholars such as Oyerinde, Olatunji, and Adewale (2018) and Arokodare and Asikhia (2020) argued that for oil and gas firms to manage and overcome unavoidable challenges inherent in the oil and gas industry, there is need for dynamic capabilities and organizational agility. This indicates that oil and gas companies within and outside developed, emerging and developing economies cannot survive without adoption of dynamic capabilities as a way of doing business. This entails the engagement of dynamic capabilities initiatives which include the ability of the organisations to sense changes in dynamic and fast-paced environments, and to quickly respond to these changes by seizing market opportunities through reconfiguration of the organisations' capabilities (Arokodare, 2020).

Dynamic capability is crucial for an organisation to be able to cope with changes in the environment by delivering the right knowledge at the right time to the right person, as well as encourage knowledge sharing in order to achieve organisational goals thereby enhancing organisational performance (Quinn, 1999). Organisations especially the oil and gas companies with high dynamic capabilities can quickly cope with dramatic changes in the external environment and can establish competitive advantage and increase market value. Dynamic capability is a core element for an organisation to survive in the ever present dynamic environment (Rehman & Saeed, 2015). According to Teece (2007), dynamic capabilities can be disaggregated into three (3) classes namely the sensing, seizing and configuring capabilities.

Lots of research work have examined dynamic capabilities with various constructs such as dynamic capabilities and organisational performance, dynamic capabilities and competitive advantage, dynamic capability influence on strategic agility, dynamic capabilities for service innovation, the impact of dynamic capabilities on resource access and development, the value of dynamic capabilities for strategic management etc. No intensive work has been carried out on dynamic capabilities and organisational agility with a focus on oil and gas companies in Rivers State, Nigeria using sensing capabilities and seizing capabilities as the dimensions of dynamic capabilities, and responsiveness and flexibility as measures of organisational agility. For this reason, this study seeks to bridge this gap in literature by examining the relationship between dynamic capabilities and organisational agility of oil and gas companies in Rivers State, Nigeria.

### **Aim of the Study**

The aim of this study is to examine the relationship between dynamic capabilities and organisational agility of oil and gas companies in Rivers State, Nigeria.

### **Objectives of the Study**

1. To examine the relationship between sensing capabilities and responsiveness.
2. To ascertain the relation between sensing capabilities and flexibility.
3. To investigate the relationship between seizing capabilities and responsiveness.
4. To determine the relationship between seizing capabilities and flexibility.

### **Research Questions**

1. What is the relationship between sensing capabilities and responsiveness?
2. What is the relationship between sensing capabilities and flexibility?



3. What is the relationship between seizing capabilities and responsiveness?
4. What is the relationship between seizing capabilities and flexibility?

### Research Hypotheses

The following hypotheses have been formulated to serve as a guide to this study;

- H<sub>01</sub>:** There is no significant relationship between sensing capabilities and responsiveness.  
**H<sub>02</sub>:** There is no significant relationship between sensing capabilities and flexibility.  
**H<sub>03</sub>:** There is no significant relationship between seizing capabilities and responsiveness.  
**H<sub>04</sub>:** There is no significant relationship between seizing capabilities and flexibility.

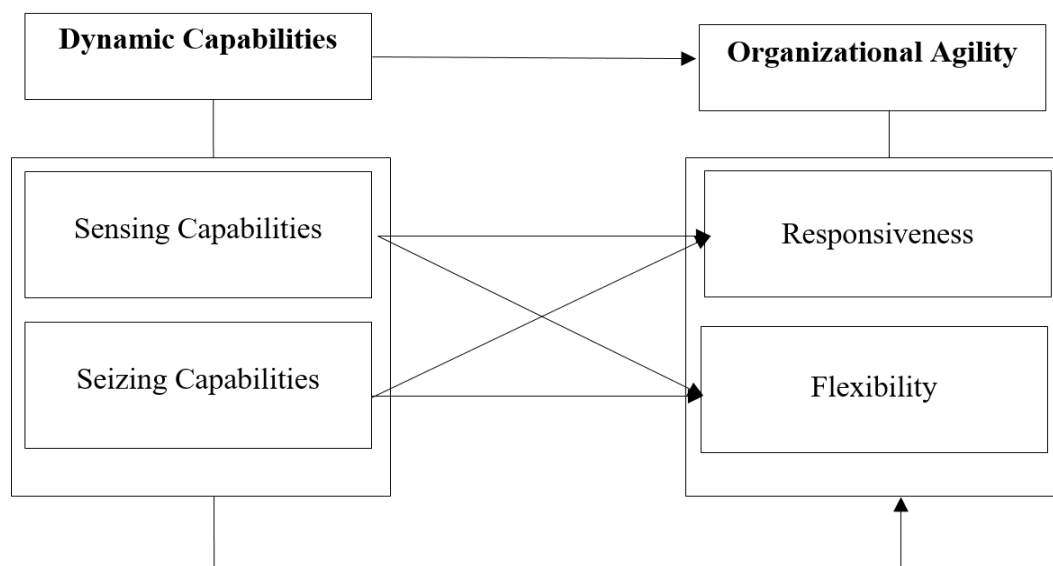
### Literature Review

#### Theoretical Underpinning

This study was theoretically anchored on **Dynamic Capabilities Theory (DCT)** as baseline theory, since the Dynamic Capabilities Theory dynamically explains how firms could react and respond to the uncertain features of the business environment so as to survive economic risk hurdle and gain superior performance. This theory was selected to guide this study because its perspectives are tied to the focus of the study and the variables under investigation. The Dynamic Capabilities Theory is the capability of an organization to purposefully adapt an organization's resource base. Dynamic capabilities theory, which was developed by Teece, Pisano and Shuen (1997) was defined as “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (p. 516) and it examines how firms address or bring about changes in their turbulent business environment through reconfiguration of their firm-specific competencies into new competencies (Teece, 2007).

The Dynamic Capabilities Theory emerged as both an extension to and a reaction against the resource-based view (RBV) and its inability to interpret the development and redevelopment of resources and capabilities to address rapidly changing environment (Bleady, Ali, & Ibrahim, 2018). The concept of Dynamic Capabilities Theory explained the mechanism that links resources and product markets to competitive advantage and firm survival. The Dynamic Capabilities Theory further explains how firms gain sustainable competitive advantage and survive in competitive and turbulent business environments in several ways. The justification for this theory employed in this study is based on the dynamic nature of oil and gas industry which was best explained by the Dynamic Capabilities Theory that strategic agility measures and theoretical explanation determine overall firm performance.

#### Operational Conceptual Framework



**Figure 1:** Operational conceptual framework showing the relationship between dynamic capabilities and organisational agility of oil and gas companies in Rivers State, Nigeria.

### **Concept of Dynamic Capabilities**

A firm's dynamic capabilities govern how it integrates, builds, and reconfigures internal and external competences to address changing business environments. This class of capabilities is underpinned by organisational and managerial competences for "reading" the environment and developing business models that address new threats and opportunities. Dynamic capabilities thus define the firm's capacity to innovate, adapt to change, and create change that is favorable to customers and unfavorable to competitors. Dynamic capabilities can be thought of as falling into three primary clusters: (1) identification, development, co-development, and assessment of technological opportunities (and threats) in relationship to customer needs (the "sensing" of unknown futures); (2) mobilization of resources to address needs and opportunities and capture value from doing so ("seizing"); and (3) continued renewal ("transforming" or "shifting"). Engagement is continuous or semi-continuous (but not necessarily sequential). Sensing, seizing, and transforming are essential if the firm is to sustain itself in the longer term as customers, competitors, and technologies change. Dynamic capabilities can be analytically separated from the formulation of strategy but must be congruent with the strategic direction that emerges from the strategy process. A strategy that is consistent, coherent, and accommodating of innovation is just as vital as dynamic capabilities to achieving competitive advantage. Hence, while strategy and capabilities can be analytically separated, as a practical matter they need to be developed and implemented together. While routines and processes are vital components of dynamic capabilities, in our framework strong capabilities are never based entirely on routines or rules. One reason is that routines tend to be relatively slow to change. Good managers think creatively, act entrepreneurially and, if necessary override routines. Put simply, managers matter in our framework. (Teece, Peteraf, & Leih, 2016).

### **Sensing Capability**

In order to identify opportunities, firms need to continuously scan their environments and search for opportunities that are constantly opening up, inside and outside the firm's boundaries. It is the ability of an organisation to gather usable data, transform this into information, interpret and analyze the urgency, causes and impact, and as such, anticipate or defect opportunities and threats in the business environment (Oosterhout, 2010).

### **Seizing Capability**

It is defined as a firm's ability to set up on identified opportunities and threats for instance launching new services and products timely or building and adjusting processes effectively (Teece, 2007). It can also be referred to as the organisational strategy and infrastructure for making appropriate decisions and absorbing and integrating resources to create and capture value from opportunities (Katkalo et al, 2010).

### **Concept of Organisational Agility**

Agility, as a business concept was coined in a manufacturing context particularly in relation to flexible manufacturing system (Christopher & Towill, 2002). Agility refers to "an effective integration of response ability and knowledge management in order to rapidly, efficiently and accurately adapt to any unexpected change in both proactive and reactive business or customer needs and opportunities without compromising with the cost or the quality of the product / process". Sull (2009), defines organisational agility as "the capacity to identify and capture opportunities more quickly than rivals do". Barney and Arikan (2001) note that organisational agility helps an organisation sustain competitive advantage in turbulent environment. It is a firm's ability to sense opportunities and threats, and respond by assembling the needed organisational resources with rapidly (Overby, Bharadwaj & Sambamurthy, 2006). Organisational agility emphasizes on speed and flexibility as the primary attributes (Sharifi & Zhang, 2001). Responding to change in proper ways and exploiting and taking advantages of changes are the main characteristic of an agile organisation. Yusuf, Sarhadi and Gunsekaran (2003) proposed that organisational agility is the successful application of responses such as speed, flexibility, innovation and quality by the means of the integration of configurable resources and best practices of knowledge – rich environment to provide customer – driven products and services in a fast changing environment.

### **Responsiveness**

It is the ability of an organisation to respond to its external environment in an appropriate manner (Clippinger, 1999). It is considered as the ability of an organisation to detect the extra – organisational changes and to take measures to adapt to the situation. According to Gresov, Hareman and Oliva (1993), responsiveness is the aggressiveness of an organisation's marketplace strategy. Bray et al, (2007) refer to it as the organisation's ability to respond in an

appropriate manner to mitigate negative threats or capitalize on positive opportunities generated by the organisation's environment.

### **Flexibility**

It is the degree to which an organisation has a variety of managerial capabilities and the speed at which they can be activated to increase the control capacity of management and improve the controllability of the organisation (Volberda, 1996). It is the main capability that enables companies to face environmental fluctuations as it makes the organisation more responsive to change. The concept of flexibility refers to the ability to adapt and change in response to what is happening both internally and externally to an organisation. Flexibility can be thought of as an ability of organisation to quickly and efficiently respond to market changes and to bring new products and services quickly to market place using a flexible information system (Bran, 2015). Internal flexibility is the capacity of organisations to adapt to the environment while external flexibility refers to the organisations capacity to influence the environment and thus reduce their vulnerability (Anosff & Brandenburg, 1971).

### **Relationship between Dynamic Capabilities and Organisational Agility**

The agile based competence management research of Van Assen (2002) suggests that organisational agility is a dynamic capability to respond reactively or proactively to various demands from changing environment. A number of previous studies have shown that environmental turbulence, encapsulating the idea of continuous, uncertain and potentially disruptive change, both internal and external, is the key drive for the development of firm dynamic capabilities, for example agility (Vazquiz – Bustelo, Avella & Firnandez, 2007; Gunasekaran & Yusuf, 2002). Dynamic capabilities correspond to definition of organisational agility as both of them are the abilities of business to exploit extrinsic signals in order to perform efficiently in volatile environment. Even though organisational agility does not stress the importance of continuity, it does have it in concept as agility is both short and long term aim of organisations.

### **Empirical Review**

Johnson and Onuoha (2019) carried out a study on dynamic capabilities and organizational agility of manufacturing firms in Port Harcourt, Nigeria. Their study examined the relationship between dynamic capabilities and organizational agility in manufacturing firms in registered and operating in Port Harcourt, Rivers State, Nigeria. The study adopted a cross-sectional survey of the quasi experimental design. The population of study consists of seven (7) manufacturing firms that were systematically selected from the 31 firms registered under the Manufacturers Association of Nigeria Rivers State. Questionnaire were given to managers of these firms and hypotheses analyzed. Findings of the study revealed that there is a significant relationship between dimensions of dynamic capabilities and measures of organizational agility. Their study therefore recommended that organizational managers should endeavour to frequently scan the environment and devise means of embracing opportunities to gain competitive advantage.

Yi, Oh, & Amenuvor (2023) investigated the effect of SMEs' dynamic capability on operational capabilities and organisational agility. Their study empirically investigated the effect of small and medium-sized enterprises' (SMEs) dynamic capability on operational capabilities, organisational agility and performance while assessing the moderating role of environmental uncertainty. Data were gathered from 288 company representatives from the South Korean provinces of Daegu and Gyeongbuk. Companies in Daegu and Gyeongbuk are purposively sampled as research subjects and classified as manufacturing and/or distribution, and other industries, with a questionnaire administered to firm representatives and employees. The proposed hypotheses were tested using structural equations modelling. The study finds that dynamic capability has a significant positive effect on marketing capability, managerial capability, and technical capability, respectively. The study also discovers that marketing capability positively affects organisational agility. Furthermore, the findings show that technical capability influences organisational agility, which in turn affects innovation capability positively. The study furthermore reveals that technological uncertainty moderates the relationship between dynamic capability and technical capability. The outcome of this study implies that rather than reducing the scale or scope of support projects, the technical and management levels should be prepared in the institutional system so that disabled companies can acquire and strengthen more diverse capabilities and resources.

Pereira, Mellahi, Temouri, Patnaik, & Roohanifar (2018) carried out a study on investigating dynamic capabilities, agility and knowledge management within EMNEs- longitudinal evidence from Europe', Their study analysed the

impact of dynamic capability (DC) of emerging market multinationals (EMNEs) on their firm technological performance by teasing out the concepts of agility and knowledge management (KM) through DC. Evidence from their study was contextualised on EMNEs that operate in the UK, Germany and France. The investment in intangible assets through which EMNEs are able to develop their DC over the period 2005-2016, was examined and how this leads to increased firm technological performance, was as well investigated. Results showed that higher investments in DC allows EMNEs to be more agile and gain competencies through KM and thereby sustain competitiveness in the three leading European countries. Their study also identified which EMNE groupings show greater technological performance and how such EMNE groupings are able to translate dynamic capabilities into greater technological performance compared to others over time. The role of DC during of the global financial crisis was furthermore examined, where they are required to be more agile. Their study moreover sheds light on a novel way and motivation of successful EMNEs in using developed host countries as a location for generating DC through agility and KM.

### Methodology

This study adopts a quantitative research design. The population of this study constitutes two hundred and ninety-five (295) oil and gas companies registered in Rivers State, Nigeria. The Krejcie and Morgan's formula was used to determine a sample size of one hundred and sixty-nine (169) oil and gas companies in Rivers State, Nigeria. More precisely, the study adopted the simple random sampling technique to draw one (1) manager from each of the 169 companies studied, to arrive at 169 managers for the complete sample. Data was gathered using self-administered questionnaire, and a 5-point likert-scale designed questionnaire ranging from Strongly Agree (SA) to Strongly Disagree (DA) was distributed to the respondents, of which out of the 169 copies of designed questionnaire distributed, 119 copies accounting for 70% were recovered from the respondents. However, 85 (71%) of the questionnaire were properly filled and subsequently used for analysis. Spearman Rank Correlation Coefficient was used to examine the relationship between the independent and dependent variable. The data was analyzed by the use of statistical package for social sciences (SPSS version 21.0).

**Table 1: Reliability Test**

Variables	Number of cases	Number of items	Alpha
Sensing capability	15	3	.961
Seizing capability	15	3	.956
Responsiveness	15	3	.952
Flexibility	15	3	.956

**Source:** Researcher's Desk, 2024

### Results and Discussions

Responses gotten from the questionnaire were analyzed and results obtained are shown in the tables below:

**Table 2: Statistical Analysis for Hypothesis One.**

**Ho<sub>1</sub>:** There is no significant relationship between sensing capabilities and responsiveness.

			Sensing Capability	Responsiveness
Spearman's rho	Sensing Capability Coefficient	Correlation	1.000	.740***
		Sig. (2-tailed)	.85	.000
	Responsiveness Coefficient	Correlation	.740**	1.000
		Sig. (2-tailed)	.85	.000
		N	N	N

\*\* Correlation is significant at the 0.01 level (2-tailed)

**Source:** SPSS Window Output, Version 21.0 (based on 2024 field survey data).

**Table 3: Statistical Analysis for Hypothesis Two.**

**H<sub>02</sub>:** There is no significant relationship between sensing capabilities and flexibility.

			Sensing Capability	Flexibility
Spearman's rho	Sensing Capability Coefficient	Correlation	1.000	.810**
		Sig. (2-tailed)	.	.000
		N	85	85
	Flexibility Coefficient	Correlation	.810**	1.000
		Sig. (2-tailed)	.000	.
		N	85	85

\*\* Correlation is significant at the 0.01 level (2-tailed)

**Source:** SPSS Window Output, Version 21.0 (based on 2024 field survey data).

**Table 4: Statistical Analysis for Hypothesis Three.**

**H<sub>03</sub>:** There is no significant relationship between seizing capabilities and responsiveness.

			Seizing Capability	Responsiveness
Spearman's rho	Seizing Capability Coefficient	Correlation	1.000	.834**
		Sig. (2-tailed)	.	.000
		N	85	85
	Responsiveness Coefficient	Correlation	.834**	1.000
		Sig. (2-tailed)	.000	.
		N	85	85

\*\* Correlation is significant at the 0.01 level (2-tailed)

**Source:** SPSS Window Output, Version 21.0 (based on 2024 field survey data).

**Table 5: Statistical Analysis for Hypothesis Four.**

**H<sub>04</sub>:** There is no significant relationship between seizing capabilities and flexibility.

			Seizing Capability	Flexibility
Spearman's rho	Seizing Capability Coefficient	Correlation	1.000	.858**
		Sig. (2-tailed)	.	.000
		N	85	85
	Flexibility	Correlation Coefficient	.858**	1.000
		Sig. (2-tailed)	.000	.
		N	85	85

\*\* Correlation is significant at the 0.01 level (2-tailed)

**Source:** SPSS Window Output, Version 21.0 (based on 2024 field survey data).

Table 1 above reveals a correlation coefficient ( $r = 0.740$ ) between sensing capability and responsiveness to be strong and positive. The coefficient of determination ( $r^2 = 0.55$ ) indicated that 55% of responsiveness can be explained by sensing capability. Table 2 displays a correlation coefficient ( $r = 0.810$ ) between sensing capability and flexibility to be strong and positive with a coefficient of determination ( $r^2 = 0.66$ ) indicating that 66% of flexibility can be explained by sensing capability. Table 3 shows that a correlation coefficient ( $r = 0.834$ ) between seizing capability and responsiveness is positive. The coefficient of determination ( $r^2 = 0.70$ ) indicating 70% of responsiveness that can be explained by seizing capability. For table 4, the correlation coefficient ( $r = 0.858$ ) between seizing capability and

flexibility is positive. The coefficient determination ( $r^2 = 0.74$ ) indicating that 74% of flexibility can be explained by seizing capability. Their significant values of ( $P < 0.05$ ) revealed a significant relationship, based on that, all the null hypotheses are rejected. Therefore, a significant relationship exists between the dimensions of dynamic capability and measures of organisational agility in the oil and gas companies in Rivers State, Nigeria.

In line with Eisenhardt and Martin (2000), organisations with strong sensing capability will be quick to respond to opportunities and threats. Having sensed the opportunities in the environment, the 'respond' component of agility offers more specific and actionable guideline for managers to decide and act in turbulence. Overby et al, (2006) affirm that sensing and responding capabilities enable organisations to effectively capture business opportunities by optimizing organisational resources. Sensing capability generates knowledge of the business environment, while responding capability transforms that knowledge into action effectively (Gattiker et al, 2005; Haeckel, 1999). According to Teece (2007), successful organisations that constantly seize opportunities, have a deeper comprehension of user needs and are able to respond to its environment in an appropriate manner. Zollo and Winter (1999) confirm that firms have to orient to customers at any given moment, strive for target that promote values and satisfy customer demands and rely on environment seizing and response capabilities so that they can dynamically adapt to complicated changes of the external environment.

### Summary of Hypotheses

**Table 6: Summary of Hypothesis Testing Result**

S/N	Hypothesis	Result	Decision
Ho <sub>1</sub>	There is no significant relationship between sensing capabilities and responsiveness.	$r = 0.740$ $p\text{-value} = .005$	Reject Ho <sub>1</sub> since $p\text{-value} < 0.01$ significance level.
Ho <sub>2</sub>	There is no significant relationship between sensing capabilities and flexibility.	$r = 0.810$ $p\text{-value} = .005$	Reject Ho <sub>2</sub> since $p\text{-value} < 0.01$ significance level.
Ho <sub>3</sub>	There is no significant relationship between seizing capabilities and responsiveness.	$r = 0.834$ $p\text{-value} = .005$	Reject Ho <sub>3</sub> since $p\text{-value} < 0.01$ significance level.
Ho <sub>4</sub>	There is no significant relationship between seizing capabilities and flexibility.	$r = 0.858$ $p\text{-value} = .005$	Reject Ho <sub>4</sub> since $p\text{-value} < 0.01$ significance level.

**Source:** *Survey Data, 2024*

### Conclusion

Based on the findings, we conclude that proper application of dynamic capability in oil companies can be used to achieve responsiveness and flexibility, thereby making organisations to become agile.

Based on the conclusion of this study, the following are recommended:

- 1) Oil and gas companies should ensure that they frequently scan the environment to enable them become responsive to the environment.
- 2) Oil and gas companies should endeavour to devise means of embracing opportunities easily in order to gain competitive advantage.
- 3) Processes and procedures of oil and gas companies should be one that can be easily adjusted in order to adapt to the business environment.
- 4) Managers of oil and gas companies should always endeavour to know the choices and preferences of customers in order to be ahead of competitors.

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## EFFECT OF MOISTURE CONTENT ON THE PHYSICAL PROPERTIES (GEOMETRIC AND GRAVIMETRIC PROPERTIES) OF COWPEA (*Vigna unguiculata*)

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### Abstract

*The aim of this work was to evaluate the influence of moisture content on the physical properties of cowpea (Vigna unguiculata) for both dry and wet basis. It was observed that poor mechanization of cowpea in Nigeria is due to unavailability of handling machine due to large numbers of variations in physical properties of agricultural products. To design a functioning machine for the mechanization of the crop, physical properties of the crop is needed.*

*Statement of the Problem: The design of equipment for handling, processing and storing of cowpea is difficult, due to lack of essential information on the behaviour of these physical properties.*

*Methodology: The selected properties were measured using standard method. The geometric and gravimetry properties of 100 seeds of the sample were evaluated.*

*Findings: It was observed from the report that the higher the moisture content in the cowpea seed the lower the physical properties of the seed, except the mass of seed which increases with increase in moisture content.*

*Recommendation: Cowpea is highly potential in protein, water, ash, fat and carbohydrates. Therefore, determination of the physical properties are important in the design of appropriate machine for harvesting, processing, transporting, separating, packaging and storage processes.*

*Contribution: The physical properties investigated are length, width, thickness, geometric diameter, arithmetic diameter, bulk and true densities, porosity, and mass of seeds for both wet and dry basis.*

**Keywords: Geometric property, Gravimetric property, Moisture content and Sphericity.**

### Introduction

Cowpea, *Vigna Unguiculata* is an annual herbaceous legume from genus *Vigna*. It is a food and animal feed crop grown in the semi-Arid tropics such as Africa, Asia, Europe, United States and central and south America. It originated and was domesticated in southern African and was later moved to east and west Africa and Asia (IITA Researchers, 2020). Cowpea plant growth habit is climbing depending mostly on genotype, although growing conditions can also affect plant stature (Michael & Jeff, 2014). For storage, the maximum moisture content for safe storage of cowpea is 12% and the highest level of temperature recommended is 38°C. Factors such as high storage, temperature, high moisture content of the seed and long storage period, all increase its cooking time. (Thomas & Olugbemi, 2009).

International institutes of tropical Agriculture, 2020 reported that cowpea's has high protein content, its adaptability to different type of soil and inter-cropping systems, its resistance to drought and its ability to improve soil fertility and prevent erosion makes it an important economic crop in many developing regions. From a research report that cowpea is very rich in protein, water, ash, fats and carbohydrates of about 23.4%, 11%, 3.6%, 1.3% and 5.6% respectively (Davies & Zimbokere, 2011). It enhances the quality by the synergistic effects of high protein and high lysine from cowpea and high methionine and high energy from the starchy food so because of its high protein, vitamins and minerals contents, it impacts positively on the health of women and children (Ajeigbe, Ihedioha & Chikoye, 2008).

Physical properties are needed for effective design equipment to be used in sorting, grading, processing, transportation and storage of agricultural materials and also to increase the sanitation of the processing conditions (Amadi & Okorie, 2022). The changes in the physical properties of the grains during their processing requires adequate determination and knowledge, as these are characteristics of fundamental importance for optimizing industrial processes.

Properties of food item are assessed to compute the gravimetric properties of which can be made use of in the design of appropriate equipment for handling, processing, and storage of these products. Geometric and Arithmetic mean dimension are essential data for the design of separating and cleaning machines (Aderinlewo, Raji & Olayanju, 2011). Amadi & Okorie, (2022) explained further that the size of seed determines occupation of space, which is based on the seed geometric dimension which include length, width and thickness. Geometric Mean Diameter (GMD) is useful in

determining aperture or size of opening in seed processing and handling equipment. The different measure of the diameters is part of the essential information needed for the determination of terminal velocity of the grain (Idowu & Oloyede, 2022). This terminal velocity determines the effectiveness of winnowing in selecting the velocity of the air blast for separation of chaff, dirt and other unwanted materials from clean grain in air screen grain cleaners.

Sphericity is an expression of the shape of the seed relative to that of sphere. Sphericity is relevant in the conceptualization of hoppers which decision is based on rolling and sliding characteristics of agricultural product and handling machines. Sphericity is also considered in calculating various cooling and heating loads of materials (Amadi & Okorie, 2022). Aspect ratio relates the width of the seed to the seed length which indicate the seed tendency towards being oblong in shape (Aderinlewo, Raji & Olayanju, 2011). Surface Area is important physical characteristics in processes such as harvesting, cleaning, separating, handling, aeration, drying and storing of agricultural product. It is also useful in designing the seed cleaners separators and conveyors. Increase in surface area raises heat and mass transfer rate of Seeds (Amadi & Okorie, 2022). Mass of 100 Seed is used to classify legume into size categories. The mass of Seed is an important parameter in the design of machines and size of handling, processing, storage and equipment (Idowu & Oloyede, 2022).

### Bulk and True Densities

Bulk density is an important parameter in aeration, loading and drying system of agricultural seed, it also plays an important role in storage facilities. Bulk density is not an intrinsic property of a material as it can change depending on how the material is handled and the degree of intensity of the compact process. While True density is important in developing a separation system for seeds and it also useful in calculating product yield and throughput in processing machinery (Amadi & Okorie, 2022).

Porosity indicate the volume fraction of void space, which account for interaction of components formation during processes. porosity is useful in air flow, heat flow and drying studies and it is also important in the design of aeration system during storage. when a Seed has high porosity, it does not hydrate easily but when a Seed has low porosity, it has the tendency to hydrate more easily (Amadi & Okorie, 2022). Moisture plays a very significant role as a crop factor in grain processing, it has a lot of influence on the separation of air during cleaning and sorting operation, also on storage and efficiency of processing machines and many other operation (Thomas & Olugbemi, 2009).

### Materials and Methods

#### Sample collection and preparation

The cowpea Seed was purchased at Oja-Odan Ilaro, Ogun state, Nigeria. This sample was taken to the laboratory for the bench work.

Table 1. List of materials and their respective quantities.

Materials	Quantity
• Cowpea Seed	750g
• Crucible	3
• Measuring cylinder	100cm <sup>3</sup> = 1, 50cm <sup>3</sup> = 2
• Desiccator	1
• Digital vernier caliper	2
• Drying Oven	1
• Crucible tong	1
• Electronic weighing balance	1
• Frictional incline plane	1
• Bottomless cylinder	1
• Xylene reagent	50cm <sup>3</sup>

The samples were packed into three labeled crucibles after washing and dried in an oven for 2 hours. After drying, these crucibles were removed from the oven with crucible tongs and quickly transferred into a desiccator for cooling. Then, the mass of the seeds plus crucibles and crucible only were also measured and recorded. All measured samples were again oven dried at 100°C for 2 hours and weighed again after cooling with an electronic weighing balance. This process was repeated for six times and then six different values were taken and recorded. The initial moisture content was determined using standard oven drying method. This was carried out by adding a calculated quantity of distilled water to the sample and the result was obtained using Eqn. 3.1.

The prepared sample was sealed in a polythene bag and was then placed in a refrigerator at 5°C for 48 hrs to enable diffusion to take place in the sample uniformly. The result was taken out of the refrigerator for equilibrium to take place under room temperature.

$$Q = W_o \frac{M_f - M_o}{100 - M_f} \quad (1)$$

Where Q is the quantity of water added (kg)

$W_o$  is the initial mass of the sample (kg)

$M_o$  is the initial moisture content of the sample (%)

$M_f$  is the desired water content of the sample (%)



Figure 1: Image of the sample

### Determination of the Physical Properties

#### Dimension, Geometric and Arithmetic Mean Diameter

The average dimension of cowpea seed was estimated; 100 seeds of cowpea were selected randomly. The length, L (mm), width, W (mm) and thickness, T (mm) of the selected seeds were measured using digital vernier caliper. The arithmetic mean diameter,  $D_a$  (mm) and geometric mean diameter,  $D_g$  (mm) of cowpea seed were calculated from principal dimension using the following equation.

$$D_a = \frac{L + W + T}{3} \quad (2)$$

Geometric diameter

$$D_g = (L W T)^{1/3} \quad (3)$$

#### Sphericity ( $\Phi$ )

$$\Phi = \frac{(L W T)^{1/3}}{L} \quad (4)$$

#### Surface area

Surface area of a cowpea seed was determined by,

$$S = \pi D_g^2 \quad (5)$$

#### Bulk and true density

Bulk density was determined by measuring a handful of cowpea seeds in to measuring cylinder of 100 cm<sup>3</sup>, and the volume of the seeds were recorded.

$$\text{Bulk and Tapped density} = \frac{\text{Weight of cowpea seed}}{\text{Volume of cowpea seed}} \quad (6)$$

True density was determined by displacement method, a reagent called xylene, was used to soak the samples in this process because of it low surface tension.

$$\text{True density} = \frac{\text{Weight of cowpea seed}}{\text{Volume of cowpea seed}} \quad (7)$$

Porosity indicate the porous space in the cowpea Seed. It was determined from bulk and true density using the following equation.

$$\text{Porosity} = \frac{\text{True density} - \text{Bulk density}}{\text{True density}} \times 100\% \quad (8)$$

## Results and Discussion

### Results

Table 2. Moisture contents for both dry and wet sample

Initial moisture content (M <sub>o</sub> )	55.87%
Final moisture content (M <sub>f</sub> )	60%
Mass of seed (W <sub>o</sub> )	500g
Quantity of water (Q)	51.62g

Table 3. Geometric and gravimetric properties of dry and wet cowpea samples

Properties	Cowpea sample	
	Dry	Wet
<b>Geometric</b>		
Length (mm)	7.5445	6.9597
Width (mm)	6.1176	5.5828
Thickness (mm)	4.6438	4.0067
Geometric diameter (mm)	6.0953	5.5163
Arithmetic diameter (mm)	71.25	51.89
Sphericity (mm)	9.4696	7.4557
Aspect ratio	81.30	80.21
Surface area (mm <sup>2</sup> )	116.7	94.6
<b>Gravimetric</b>		
Bulk density (g/cm <sup>3</sup> )	0.6874	0.6779
Tapped density (g/cm <sup>3</sup> )	0.7014	0.6852
True density (g/cm <sup>3</sup> )	1.18	1.14
Porosity (%)	41.15	40.22
Mass of 100 seeds (g)	217.5	256.8

### Discussion

The result on table 2. above shows that the moisture content of the dry seed was 55.87% and the moisture content was raised to 60% for the wet sample. The value obtained for length, width and thickness for the dry basis are 7.5445mm, 6.1176mm and 4.6438mm respectively and for the wet basis are 6.9597mm, 5.5825mm and 4.0067mm respectively. The effect of moisture contents on geometric and arithmetic mean diameter shows that the dry basis are greater than wet basis (Table 3). Both arithmetic and geometric values were calculated and recorded as 71.2543mm and 6.095mm while 51.8901mm and 5.5163mm were obtained for dry and wet basis respectively. The value of the sphericity for both dry and wet basis were found to be 9.4696 and 7.4557 respectively. Another physical properties determined was aspect ratio for dry and wet basis, 81.3024 and 80.2118 respectively. Thus, 116.77 (dry) and 95.64 (wet) were obtained for surface area of the cowpea. Table 3. illustrated the values obtained for bulk density in both cases are lesser than the tapped density. Moreover, the true density for dry basis is higher than the wet basis. Finally, higher value of porosity was recorded for dry basis.

### Conclusion

The length, width, and thickness for the dry cowpea were in this range, 7.5445mm, 6.1176mm, 4.6438mm, while the

wet were also in this ranges, 6.9597mm, 5.5825mm, 4.0067mm. The arithmetic and geometric mean diameter for the dry cowpea ranges as follows, 6.095mm, 71.2543 respectively, while the Wet were in the range 5.5163mm, 51.8901mm. The sphericity, ratio, surface area, bulk density, true density, porosity, and mass of the Seeds for both dry and wet basis were also determined. The test conducted shows that there are significant differences between the dry basis and wet basis of the cowpea seeds. The experiment carried out on the cowpea Seed shows that the physical properties are useful for designing equipment for post-harvest handling and processing operations and it is also useful in the analysis and determination of efficiency of a machine, development of new product and the final quality of the product.

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## RATIO ANALYSIS OF THE FINANCIAL HEALTH STATUS OF PIGGERY ENTERPRISES IN ABIA STATE, NIGERIA

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### Abstract

*This study focused on ratio analysis of the financial health status of piggery enterprises in Abia State, Nigeria. A multi-stage random sampling technique was used in choosing the sample. Primary data collected from 33 piggery enterprises were used for the study. Data collected were analyzed using budget analysis accompanied by liquidity, solvency, and leverage ratios computation. Findings showed that the composite balance sheet of piggery enterprise in Abia state, ending December, 31, 2017 shows that the mean total current assets of piggery enterprise in Abia state was ₦4,180,140.09. The mean total intermediate assets value of the piggery enterprise in Abia state was ₦78,000 while the mean total fixed asset of the piggery enterprise was ₦1,595,050.00. These amounted to mean total assets of ₦5,853,190.09 for the 33-piggery enterprise sampled in the study that operates at small-medium scale level. The assessment of the liabilities of the piggery enterprise in the study area shows that the mean total current liabilities of the piggery enterprise in Abia state was ₦1,522,751.85. The long-term liability of the piggery enterprise was ₦1,204,500.00. These amounted to mean total liabilities of ₦2,727,251.85 for the 33-piggery farms sampled in the study. The mean net worth (equity) of the piggery enterprise in Abia state was ₦3,125,938.24 and the mean total liabilities and net worth of the piggery enterprise amounted to ₦5,853,190.09. The liquidity ratio (measured using the current ratio) of the piggery enterprise in Abia state on the average was 2.745, approximately 3.00. The result shows a solvency value of 2.146 for piggery enterprise in the study area. The computed financial leverage ratio of the 33 piggery enterprises sampled in Abia state was averagely 0.872. The study showed that piggery enterprise in the state are liquid, solvent and not highly leveraged; therefore, the study recommends that there is need for government and other investors in agriculture to invest in large scale piggery enterprise in the state so as to provide employment opportunity to the masses, make pork meat supply more available as well as generate more funds to run the state affairs. Agricultural investors seeking investment options to invest in Abia State should consider investing in piggery enterprise since the business is liquid, solvent and not highly leveraged.*

**Keywords:** Ratio Analysis, Financial Health Status, Piggery and Enterprises

### Introduction

The financial health of any business is very important for sustaining and expanding the business and serves as an important decision factor for business continuity or otherwise. Using financial data like the balance sheet, ratio analysis may be used to quantitatively acquire an understanding of a business's liquidity, solvency, operational efficiency, and profitability. An essential part of any fundamental study of a business's financial health status is the use of ratios. Ratio analysis is used by investors and analysts to assess a business's financial health by looking at its historical and current financial statements. An enterprise's success over time may be shown by comparing its past results with its current results and with those of similar businesses, and this information is used to predict the enterprise's future results. This information may be used to assess the competitiveness of a firm in relation to others operating in the same market, as well as to compare the firm's financial health to that of the industry as a whole and to averages for similar businesses. By using ratio analysis, the profitability, liquidity, operational efficiency, and solvency of a business may be gleaned from a comparison of line-item data in the financial statements. Although ratios are helpful, their use should not be in isolation but rather in conjunction with other measures to provide a more complete view of a business's financial health. With financial ratios, one gets a better picture of the firm and can be on the lookout for warning signs.

Pig production, among other species, has a high potential to contribute to high economic gains. The swine have some unique advantages over all other animals, which makes them a good species of animal to multiply extensively to combat protein shortages. Among these advantages are their fast growth rate, which is only slightly exceeded by that of the best, carefully managed broilers, and their prolificacy, which is unsurpassed by that of any other animal species except the birds. Also, pigs are very efficient in feed utilization, which brings better returns per unit of input than most

other animals, and the quality of their meat is more tender and nutritive in protein and B-vitamins than that of other animals. Pig production in Nigeria has not yet developed like that of ruminants and poultry. Several studies have listed several varying and, most times, similar factors limiting pig and poultry production in Nigeria. A study by Oguniyi and Omoteso (2011) reveals that the neglect or slow growth of the swine industry can be attributed to acceptability and management problems. Management issues include disease outbreaks, feed efficiency, and high feed costs, all of which stem from a lack of swine production knowledge (Uneze and Onugu, 2012), skill, and, frequently, the Nigerian stockman's ignorance of new techniques. The complications from these are low ratios of stock keeping to humans, poor animal productivity, limited supplies, and a low intake of animal protein, resulting in malnutrition. According to Uddin and Osasogie (2016), some of the difficulty in securing institutional loans ranked as the highest, accounting for 61.0%, closely followed by the cost of feed and feed ingredients (46.3%), among others. Inadequate finance can restrict farmers from expanding their scale of production. According to Charles (2009), Oguniyi and Omoteso (2011), and Bamiyi (2013), one of the major constraints of the animal industry, particularly in developing countries like Nigeria, is capital. Financial inadequacies have led to slow-growing or moribund animal industries or even destroyed animal production industries. Low-income earners who dominate the animal industry are not able to cope with the demands of the industry, especially when production is not at its optimum level. Arbitrary costs of feed and feed ingredients can hinder pork production (Adejoba, Adu, Meduna, and Adekunle, 2004). Understanding the financial health status of pig enterprises in Abia State in terms of liquidity, solvency, and leverage will serve as a guide to agricultural investors in their decision to invest. Therefore, this study aimed at ratio analysis of the financial health status of piggery enterprises in Abia State, Nigeria.

### Methodology

Abia State, Nigeria, was chosen as the site for the study. Abia is one of the 36 states that make up the Federal Republic of Nigeria. The state is located in the southeast of Nigeria and has a unique geopolitical position. It is between 50° 47' and 600' north and 70° 23' and 80° 02' east. The state occupies roughly 5.8% of Nigeria's total land area, or around 5,243.7 square kilometres (Nigerian Galleria, 2017 report). An estimated 4,533,911 individuals call the state home (NPC, 2017). In the north and northeast, Abia is bordered by the states of Anambra, Enugu, and Ebonyi. River State is to the south, Cross River State is to the west, and Akwa-Ibom State is to the south-east of Imo State. The southern part of the state shares a river with another country. Due to its low elevation, the state receives its average annual rainfall of around 2,400 millimetres (mm) between April and October. As for the remainder of the state, it's mostly a very high plain. The state's two most significant rivers are the Imo and Aba, both of which empty into the Atlantic Ocean by way of the Niger Delta. The state may expect temperatures anywhere from 20 to 36 degrees Celsius since it is situated in the Nigerian forest area (Onwumere, 2008). Aba, Umuahia, and Ohafia are the state's three (3) agricultural zones. There are seventeen (17) local government areas in all. Abia state's whole population of poultry farms were included in the research. Abia State has 63 registered poultry farms, according to the state's Ministry of Commerce and Industry. The study's poultry enterprise were chosen using a multi-stage sampling technique. To begin, the study was limited to two of the state's three agricultural zones. The agricultural zones that were chosen were Umuahia and Aba, based on the fact that these two agricultural zones had a large number of poultry enterprise. Second, from each of the two agricultural zones, two local government areas were chosen. Finally, because there were too few in the various communities and villages, the selected ones were gathered at the local government area (LGA) level. Thirty-three (33) piggery enterprise were chosen at random from the four (4) LGAs studied. Nine (9) pig enterprise were chosen from each of the four (4) Local Government Areas. Primary data was used in this investigation. The data for this study was acquired through the administration of a questionnaire and an oral interview. The researcher also assisted respondents who were having trouble answering some of the questionnaire's questions, particularly those that they did not understand. A total of thirty-three (33) copies were sent to piggery business owners. A maximum of two days was given to each respondent to review the questionnaire and respond appropriately. The researcher and the two research assistants recruited for the study returned at the conclusion of the period to collect the questionnaire from the respondents. The instrument was validated prior to delivery, and item statements were checked to ensure that they addressed. A budget analysis accompanied by liquidity, solvency, and leverage ratios computations were as used to examine the study's data.



## Results and Discussion

The financial health status of the piggery enterprises in Abia state was assessed by looking at the composite balance sheet of piggery enterprise in Abia State. Table 1 presents the result of the balance sheet analysis of piggery enterprise in the Abia state. The result shows that the mean total current assets of piggery enterprise in Abia state which accrued from cash, saving account, 52 matured pig averagely sold at ₦64800, empty bag/manure, securities marketable, cash value of insurance and accounts receivable of the enterprise was ₦4,180,140.09. The mean total intermediate assets value of the piggery enterprise in Abia state was ₦ 78,000 accumulated from supplies. The mean total fixed asset of the piggery enterprise was ₦1,595,050.00 being valued accumulated from machinery and equipment, vehicles farmland of 0.81hectares estimated at ₦500,000/ha; and buildings and improvements. These amounted to mean total assets of ₦5,853,190.09 for the 33-piggery enterprise sampled in the study that operates at small-medium scale level. The assessment of the liabilities of the piggery enterprise in the study area presented in Table 1 shows that the mean total current liabilities of the piggery enterprise in Abia state was ₦1,522,751.85 accumulated from account payable, bank notes, loans payable in three years, accrued taxes, machinery depreciation, vehicles depreciation and equipment depreciation. The long-term liability of the piggery enterprise was ₦1,204,500.00 accumulated from farm farmstead and building depreciation. These amounted to mean total liabilities of ₦2,727,251.85 for the 33 piggery farms sampled in the study. The mean net-worth (equity) of the piggery enterprise in Abia state was ₦3,125,938.24 and the mean total liabilities and net worth of the piggery enterprise amounted to ₦5,853,190.09. This shows that the total assets of the piggery enterprise were higher than their total liabilities.

**Table 1: Composite Balance Sheet of piggery enterprise in Abia State, ending December 31, 2021**

Date	ASSETS		LIABILITIES	
1/1/2021-31/12/2021	Current	₦	Current	₦
	Cash, saving account	407,000.00	Accounts Payable	638,000.00
	Mature pigs—52 @ ₦64800.00	3,369,600.00	Bank Notes	70,200.00
	Empty bags/ Manure	25,540.09	Loans payable @3 years	354,900.00
	Securities marketable	65,000.00	Accrued Taxes	54,300.00
	Cash value of insurance	105,000.00	*Machinery Depreciation	156,550.00
	Accounts receivables	208,000.00	*Vehicles Depreciation	167,850.00
	<b>Total Current</b>	<b>4,180,140.09</b>	*Equipment Depreciation	80,951.85
			<b>Total Current</b>	<b>1,522,751.85</b>
	<b>Intermediate</b>	<b>₦</b>	<b>Intermediate</b>	<b>₦</b>
	Supplies	78,000.00	-----	-----
	<b>Total Intermediate</b>	<b>78,000.00</b>	<b>Long Term</b>	<b>₦</b>
	<b>Fixed</b>	<b>₦</b>	*Farmstead	531,500.00
	*Machinery& equipment,	519250	*Building Depreciation	673,000.00
	*Vehicles	325,000.00	<b>Total Fixed</b>	<b>1,204,500.00</b>
	Farmland (0.81 ha@500,000/ha)	405,000.00	<b>Total Liabilities</b>	<b>2,727,251.85</b>
	*Buildings & Improvements	345,800.00	<b>Net Worth (Equity)</b>	<b>3,125,938.24</b>
	<b>Total Fixed</b>	<b>1,595,050.00</b>		
	<b>Total Assets</b>	<b>5,853,190.09</b>	<b>Total Liabilities and Net Worth(Equity)</b>	<b>5,853,190.09</b>

Source: Field survey data, 2022.

Figures are mean values of the total sampled piggery enterprises in Abia state.

\*Life span of assets is taken to be 5 years.

The computation of such ratios as liquidity ratio, solvency ratios and leverage ratio for the piggery enterprises in the study area is presented in Table 2 below.

### Ratio analysis interpretation

The computed liquidity ratio, solvency ratio and leverage ratio from the composite balance sheet of piggery enterprise in Abia state is presented in Table 2 below.

**Table 2: Computation of liquidity ratio, solvency ratio and leverage ratio for a piggery enterprise in Abia state.**

Ratio Computed	Class of Ratio	Value	Remark
Current Ratio	Liquidity Ratio	2.745	Good financial position
Net Current ratio	Solvency Ratio	2.146	Solvent
Debts/ Equity	Leverage Ratio	0.872	Not highly leveraged

Source: Computed by the author from the balance sheet in Table 1 above

The liquidity ratio (measured using the current ratio) of the piggery enterprise in Abia state on the average was 2.745, approximately 3.00. This value of liquidity was positive. This shows that current assets of piggery the study area were higher than the current liabilities of the farms indicating a strong liquidity position hence the ability of these piggery farms to meet up with their short-term financial obligations as they enterprise in come due. As earlier noted, this will make loan repayment not to be difficult and hence the ability to obtain credit for production purposes by these enterprises. The result further means that its current assets of the piggery enterprises in the study area could be reduced by 50 percent and still be sufficient to cover its current liabilities. This means that the piggery enterprise in Abia state are more able to use its working capital to generate sales. Therefore, piggery enterprise in Abia state are in good financial position. As such, lenders who run the risk of not recovering their loans after lending to livestock enterprises with weak financial position will be more willing to lend to the piggery enterprise due to their strong financial position. The solvency of the piggery enterprise in Abia state was measured using the net current ratio which is given as the ratio of total assets to total liabilities. The result shows a solvency value of 2.146 for piggery enterprise in the study area. This implies that small and medium scale piggery farms in Abia state have the ability to sustain operations after paying off their debts. The result indicated that the piggery farms have the ability to sustain their business for a long time. The solvency ratio shows that the piggery enterprise in the study area has the ability to make payments and pay off its long-term obligations to creditors and banks. Thus, piggery enterprises in Abia state are solvent and can meet their obligation more than two times. This suggests that they can be guaranteed for short-term loans from lending agencies. The computed financial leverage ratio of the 33 piggery enterprises sampled in Abia state was averagely 0.872. This shows that piggery enterprise like the poultry enterprise in the state are not highly leveraged. This means that piggery enterprise in the study area will be more rational not to borrow more than 1% of their total assets to finance their business over a long period of time. The high total debt to equity ratio generally means that the piggery farms in the study area has not been so aggressive in financing its growth with debts.

### Conclusion and Recommendations

This study focused on ratio analysis of the financial health status of piggery enterprise in Abia State, Nigeria. Findings have shown that piggery enterprise in Abia state are solvent and have the ability to sustain operations after paying off their debts. Piggery enterprise in the state are not highly leveraged. The study showed that piggery enterprise in the state are liquid, solvent and not highly leveraged; therefore, the study recommends that there is need for government and other investors in agriculture to invest in large scale poultry and piggery enterprises in the state so as to provide employment opportunity to the masses, make pork meat supply more available as well as generate more funds to run the state affairs. Agricultural investors seeking investment options to invest in Abia State at any scale of operation should consider investing in piggery enterprise since the business is liquid, solvent and not highly leveraged.

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## PETROGRAPHY AND STRUCTURES OF THE PRECAMBRIAN BASEMENT ROCKS OF THE KAZAURE SCHIST BELT, NORTHWESTERN NIGERIA

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### Abstract

*Geological mapping and systematic sampling of the rocks in Kazaure and environs was carried out on a scale of 1:25,000. The Kazaure schist belt (KZSB) is part of the Northwestern Nigeria basement complex and is dominantly underlain by phyllites, schists, quartzites, gneisses and granites as major lithological units; whereas amphibolites, diorites, banded iron formation (BIF), pegmatites and tourmalinites as minor units. However, the rocks largely vary in mineralogy and texture. Petrography revealed that the schists are composed of muscovite, quartz, biotite and opaque minerals. The quartzites are purely composed of quartz mostly obliterated with minor biotite and muscovite flakes. The amphibolite is composed of hornblende, minor quartz, feldspar, biotite, muscovite and opaque minerals. Conversely, quartz, feldspar, biotite, muscovite, hornblende constitute the essential minerals in the granites and opaque minerals as the dominant accessories. Moreover, structures in the area include joints, faults, folds, foliations and lineations showing various deformational levels (brittle and ductile) and history. Measurements of dip and strike were made, readings were taken and Rose diagram was plotted to determine the general direction of the trends. Two structural trends were inferred in the study area; the dominant NNE-SSW as major and minor NE-SW representing imprints of the Pan-African orogeny. The structures could likely serve as conduits for passage of hydrothermal fluids as envisaged by silicification in the area (quartz-veins network) and are hence believed to be important in compartmentalisation of valuable mineral deposits and revealing diverse geological tapestry.*

**Keywords:** Basement complex, Geology, Kazaure schist belt, Petrography and Structures.

### Introduction

The KZSB was believed to have evolved from an ancient basin comprised of various psammitic and pelitic Precambrian sediments which have been affected by different tectonic episodes which led to their metamorphism and subsequent emplacement of some plutons prior to Pan-African orogeny (Danbatta, 2010). Previous works revealed that the Kazaure schist belt is partly unconformably overlain to the north by Cretaceous sediments of the Iullummeden Basin and to the northeast by Tertiary sediments of the Chad Basin (Danbatta, 1999). It is bounded by the Karaukarau belt to the northeast and dominated by massive quartzites which can be traced for 90 km south from the Niger border (Turner, 1983). The belt is dominantly underlain by phyllites, schists, quartzites, gneisses and granites; while amphibolites, diorites, BIF, pegmatites and tourmalinites formed the minor rock types (Morton, 1967; Turner and Webb, 1974; Aderotoye, 1977; Verheijen and Ajakaye, 1977; Turner, 1983; Saleh, 1998; Danbatta, 1999; 2002; 2010; Ibrahim, 2003; 2006; 2008; Osadebe *et al.*, 2011; Idris, 2016; Ibrahim and Jibril (2018); Kankara and Idris (2020); Suleiman, 2021; Sa'ad *et al.*, 2021; Sa'ad, 2023). The works in the area mainly are on the geology, geochemistry, tectonic evolution, geophysical investigation, engineering geology and hydrogeology. This present work discusses the petrography and structures of the rocks of the Kazaure area.

### Study Area

The study area lies between Latitudes 8°23'00" N and 8°30'00" N and Longitudes 12°35'00" E and 12°45'00" E (Fig. 1) on Kazaure Sheet 35 SE (1:50,000). The area forms part of the 'Northern Nigeria Plains' (Burke and Durotoye, 1970). It comprises of a series of discontinuous quartzite ridges from the east and inselbergs of granites from the west making the area slightly a rugged terrain with the highest peak as Bayan Dutse which rises about 106m above the plain and the lowest at Farar Gada (Danbatta, 1999; Idris, 2016). The geology in the area controls and influences the pattern of the drainage which is generally dendritic with river Kiye being the prominent drained by lakes Kiye and Dakwat.

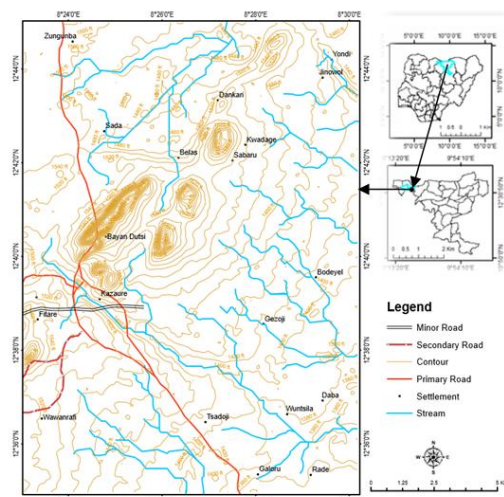


Figure 1: Location and Drainage Map of the Study Area

### Geology and Evolution of the Nigerian Basement Complex

The Nigerian basement complex forms a part of the Pan-African mobile belt and lies between the West African and Congo Cratons (Fig. 2a) and south of the Tuareg Shield (Black, 1980). The belt is interpreted to have evolved by plate tectonic processes which involved continental collision between two blocks (Fig. 2b), the passive continental margin of the West African Craton and the active continental margin (Pharusian belt) of the Tuareg Shield about 600 Ma (Burke and Dewey, 1972; Leblanc, 1981; Black *et al.*, 1979; Caby *et al.*, 1981; Ajibade *et al.*, 1987; Garba, 2002; Dada, 2008). The Nigerian Basement Complex lies in the reactivated part of the belt (Ajibade *et al.*, 1987). It is intruded by the Mesozoic calc-alkaline ring complexes of the Jos Plateau (Younger Granites) and is conformably overlain by Cretaceous and Younger sediments (Fig. 3). The basement rocks occupy about half of the land mass of the country (Black, 1980). Within the basement complex three main lithological units are distinguishable (Fitches *et al.*, 1985; Woakes *et al.*, 1987; Ajibade *et al.*, 1989) as follows:

- i). A polymetamorphic migmatite-gneiss-quartzite complex with ages ranging from Pan-African to Eburnean. These rocks are mainly quartzites, amphibolites, calcareous rocks, biotite hornblende gneisses, quartz schist and biotite-hornblende schist (Wright *et al.*, 1985).
- ii). Low grade, sediment-dominated schist belts (including some metavolcanic units) trending N-S which are best developed in the western part of Nigeria. These belts are considered to be upper Proterozoic supracrustal rocks which have been infolded into the migmatite-gneiss-quartzite complex. Some may include fragments of ocean floor material from small back-arc basins (Woakes, *et al.*, 1987). Turner (1983), Ajibade *et al.* (1987) and Adekoya (1995) classified the main schist belts of Nigeria into twelve: Zungeru-Birnin Gwari, Kushaka, Malumfashi (Karaukarau), Kazaure, Wonaka, Maru, Anka, Zuru, Toto, Iseyin-Oyan River, Ife-Ilesha and Igara-Kabba-Lokoja belts (Fig. 3).
- iii). Pre-syn and post-tectonic rocks of the Older Granite suite which cut both the migmatite-gneiss-quartzite complex and the schist belts. They range widely in age (750-450 Ma) and composition (Woakes *et al.*, 1987). The term "Older Granites" was first used by Falconer (1911) as a descriptive label to encompass a Precambrian suite of plutonic rocks which include granites, coarse porphyritic/porphyritic granites, adamallites, granodiorites, quartz diorites, tonalites, charnokites and gabbros. Granitoid plutons of the Older Granite suite are considered as syntectonic to late tectonic granitoids emplaced during the Pan-African. Earlier granitoids are foliated calc-alkaline granodiorite intrusions, while later undeformed late tectonic intrusions are monzonitic, sub-alkaline to alkaline in character (McCurry and Wright, 1977).

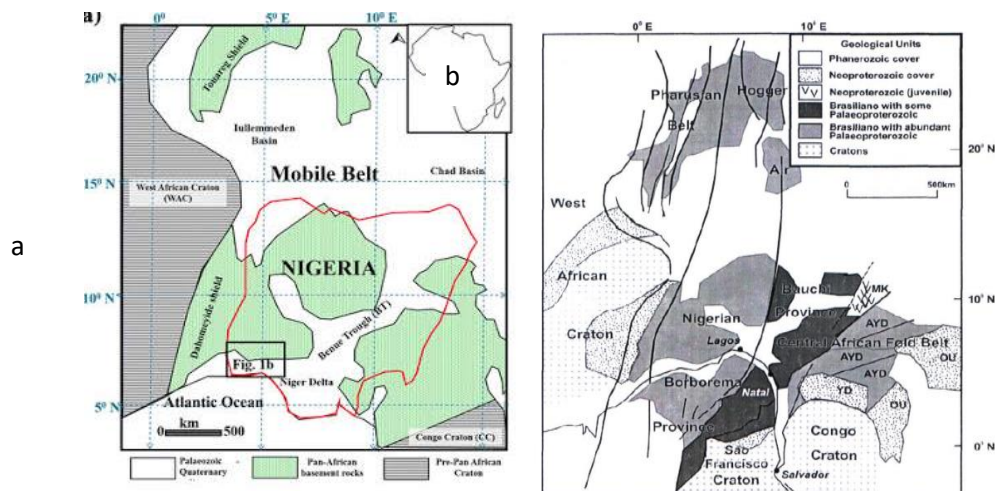


Figure 2: (a) Regional geological setting of Nigeria (Modified after Woakes *et al*, 1987) in Omosanya *et al*, 2015. (b) Location of the Nigerian Basement Complex between the West African and Congo Cratons and in relation to Hoggar and Borborema Provinces (Dada, 2008).

## Materials and Methods

The materials used include compass-clinometre, hammer, GPS, measuring tape, masking tape, field notebook and sample bag. Twelve (12) representative samples were thin-sectioned at the Department of Geology, Ahmadu Bello University Zaria, Nigeria. These include four granitic rocks (S5, S8, S11 and S12), two quartzites (S10 and S17); two ferruginous quartzite (S13 and S16); three schists (S1, S3 and S4) and one amphibolite (S6). Details of the method has been described by Rowland (1953); Sa'ad and Baba (2017).

## Results, Interpretations and Discussions

### Geology of the Area (Field Relation)

The study area is underlain by schists, quartzites and granites as major rock types; with amphibolites, diorites and pegmatites as minor rock types. The map produced (Fig. 4) summarised the geology of the area.

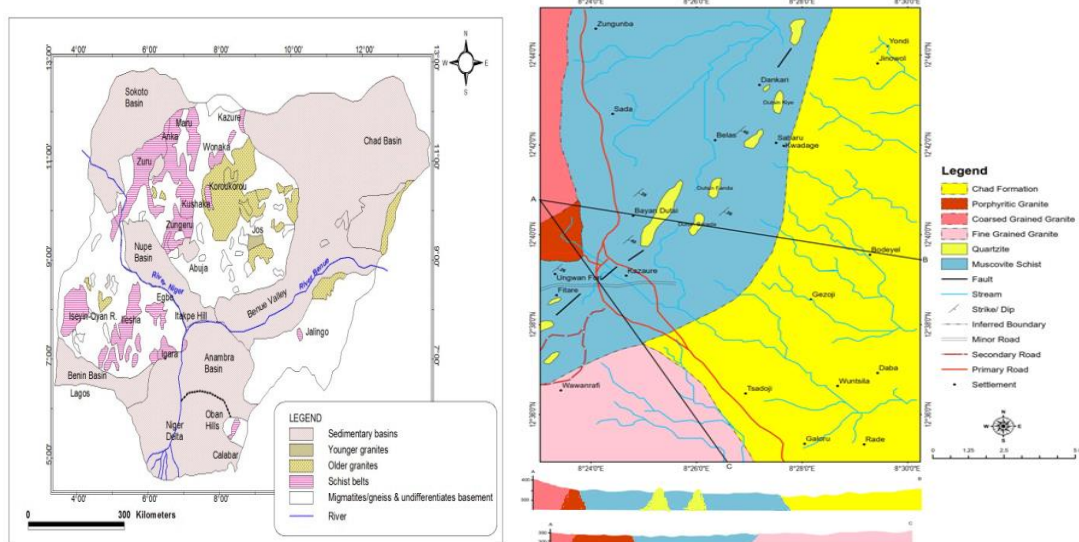


Figure 3: Generalised geological map of Nigeria showing the schist belts (Modified after Woakes *et al*, 1987) in Akinola *et al*, 2014. Figure 4: Geological map of the study area (1:25,000).

## Petrographical Description of the Rock Units

Four lithologies have been mapped in the study area. The schists are highly weathered exposures only occur in deep gullies, whereas the quartzites mostly occur as ridges. The amphibolites are massive occurring as boulders. The granites are low-lying bodies and in some places mostly isolated as inselbergs.



## Megascopic Description

The lithologies mapped in the study area include the schists, the quartzites, the amphibolites and the granites. Below is an *in situ* hand specimen description of the rocks.

### Schists:

Schists are strongly foliated pelitic rocks formed by regional metamorphism as they readily split into flecks. The conspicuous schistosity of all schists is attributed to mineral orientation. They are fine grained micaceous rocks occasionally showing segregation layering. The rocks in the study area are highly weathered and mostly found along stream channels (fig. 5a) overlain by quartzite and appeared dark gray to light obviously showing schistosity. The schists include muscovite schist, quartz-mica schist (silicified schist), carbonaceous phyllitic schist (graphitic schist) and talc schist.

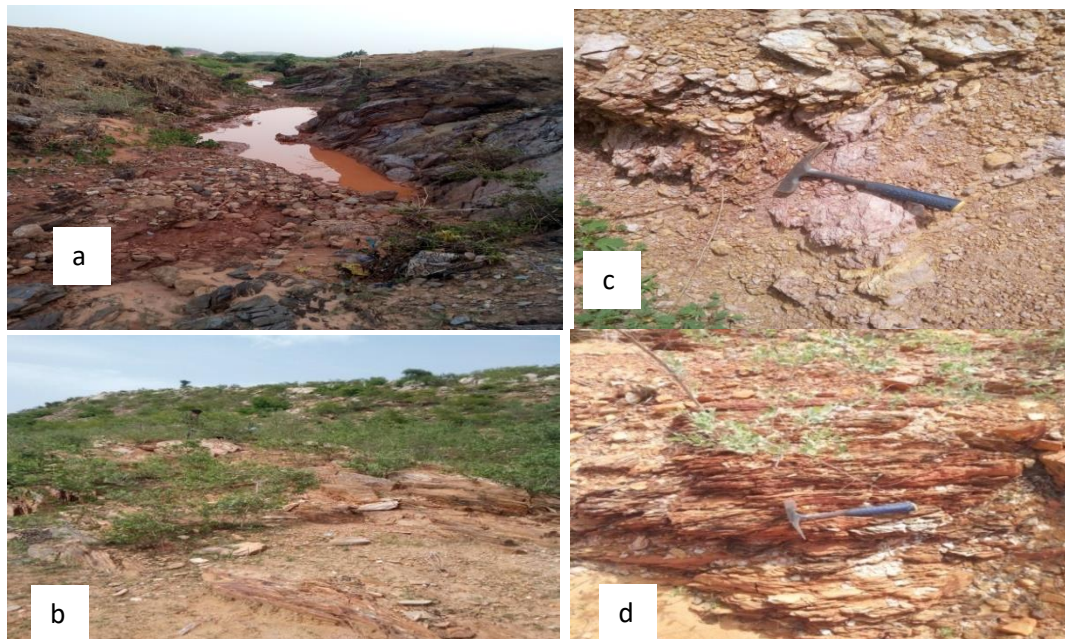


Figure 5: (a) Carbonaceous phyllitic schist along a stream channel (12°39'40"N, 8°24'12"E). (b) Quartz-mica schist (12°42'36"N, 8°27'19"E). (c) Talc schist (12°39'30"N, 8°25'06"E). (d) Muscovite Schist highly weathered (12°40'58"N, 8°26'41"E).

### Quartzites

The rocks are intensely fractured, brecciated and appeared white to gray (schistose) in most of the locations (Fig. 6a) and are composed mainly of quartz and exhibit red colouration (ferruginous quartzite) in others (Fig. 6b) with a fine to medium-grained texture. Two varieties of quartzites abound in the area; a massive quartzite and a foliated (schistose-quartzite), with the massive type occurring on top of the foliated variety.

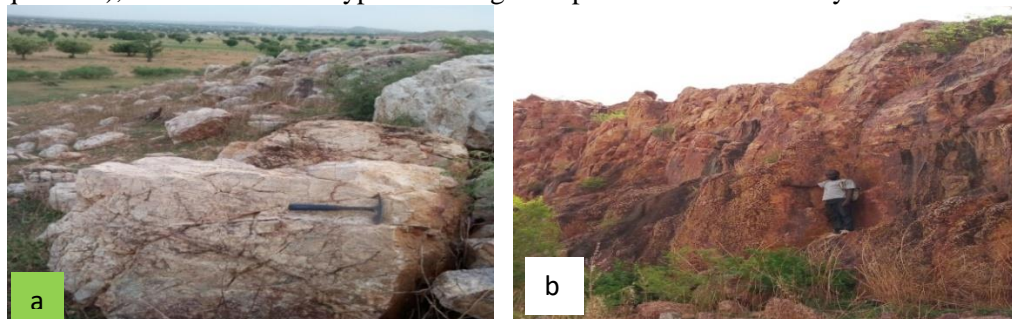


Figure 6: (a) Quartzite at Dutsin Barada (12°40'04"N, 8°26'01"E). (b) Ferruginous quartzite at Babban Dutse (12°40'27.85N, 8°24'21.80E).

### Amphibolites

These are fine to medium-grained metamorphic rocks composed mainly of amphiboles, formed by the regional metamorphism of basic igneous rocks. The rocks in the area (Fig. 7) are massive and appeared melanocratic (dark green) with a medium-grained texture mostly occurring as boulders and essentially composed of hornblende, feldspar, biotite and quartz.

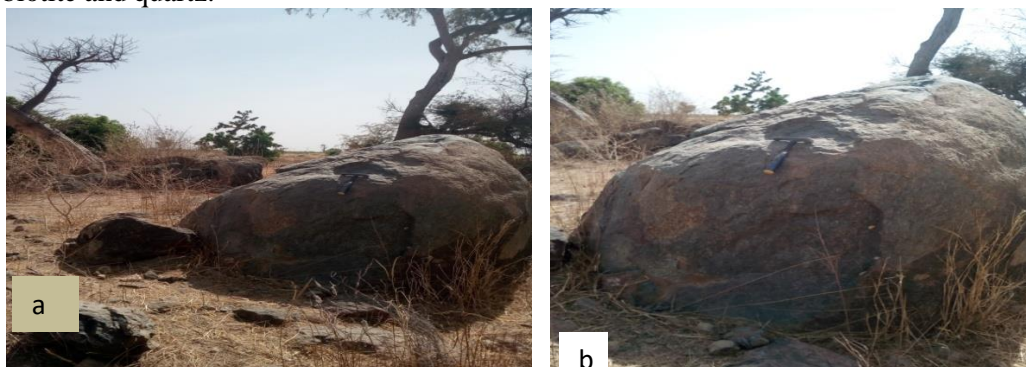


Figure 7 (a-b): Amphibolites occurring as boulders ( $12^{\circ}39'47.78''\text{N}$ ,  $8^{\circ}23'34.16''\text{E}$ ).

#### *Porphyritic Granite*

The rocks are leucocratic (grayish black in colour) with a coarse porphyritic texture occurring as flat bodies to whaleback in shape and composed of major minerals in order of abundance of feldspar, quartz, biotite and hornblende. The phenocrysts (fig. 8) are mainly feldspathic.



Figure 8: (a) A whaleback granite exposure at Tafkin Danlela ( $12^{\circ}39'43.5''\text{N}$ ,  $8^{\circ}23'13.73''\text{E}$ ). (b) A porphyritic granite showing a glomeroporphyritic texture at Dansure ( $12^{\circ}38'41.142''\text{N}$ ,  $8^{\circ}18'35.994''\text{E}$ )

#### *Coarse-Grained Granite*

The rocks are mesocratic (pinkish black) to gray with a coarse-grained texture (fig. 9a) occurring as boulders and inselbergs (fig. 9b) in places and composed of major minerals of feldspar, biotite and quartz.

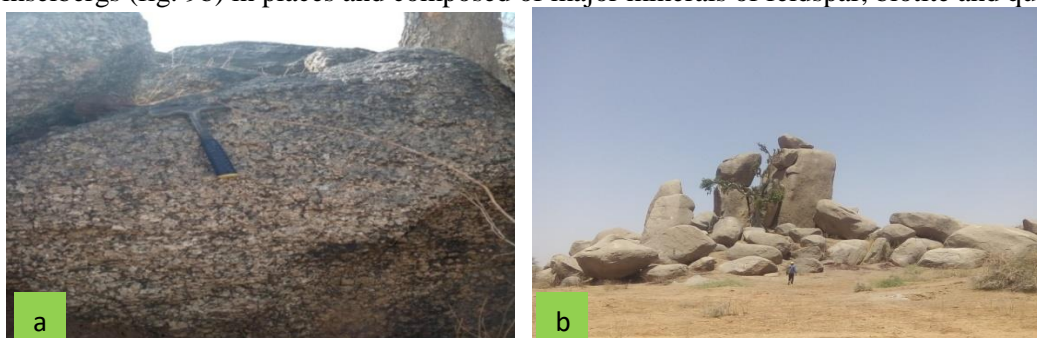


Figure 9: (a) Coarse-grained granite ( $12^{\circ}39'59.91''\text{N}$ ,  $8^{\circ}23'26.124''\text{E}$ ). (b) A granite exposure occurring as Inselberg around Faragaye ( $12^{\circ}39'21.84''\text{N}$ ,  $8^{\circ}18'14.31''\text{E}$ ).

#### *Fine to Medium-Grained Granite*



The rocks are leucocratic (pinkish dark to gray) with a fine to medium-grained texture (fig. 10) and essentially composed of feldspar, quartz, biotite and hornblende.



Figure 10: Fine to medium-grained granite ( $12^{\circ}39'34.2''\text{N}$ ,  $8^{\circ}20'39.408''\text{E}$ ).

#### Veins

Veins in the study area are mostly quartz veins, quartzo-feldspathic, aplites and pegmatites occurring as unmappable units of various dimensions mostly observed on the granites and the quartzites *in situ* (Fig. 11) and microscopically (Fig. 13c).



Figure 11: Pegmatite vein showing a sharp boundary with the granite ( $12^{\circ}39'34.2''\text{N}$ ,  $8^{\circ}20'39.408''\text{E}$ ).

#### Xenoliths

Xenoliths are foreign bodies not initially part of the rock but later on incorporated into the rock and are always believed to be older than the rock containing them. Xenoliths in the study area (Fig. 12) were mostly observed to be associated with the coarse porphyritic granitic rocks occurring as fine-grained granite.



Figure 12: A Xenolith on the granites ( $12^{\circ}39'15.24''\text{N}$ ,  $8^{\circ}18'21.654''\text{E}$ )

#### Microscopic Description

Twelve (12) representative samples were thin sectioned and subjected to petrographic study. The prepared slides were examined under polarising microscope to identify minerals and other features present unseen with a naked eye or lens. The petrography of the rocks in the area revealed the mineral composition, textures and microstructures of the various rock types.

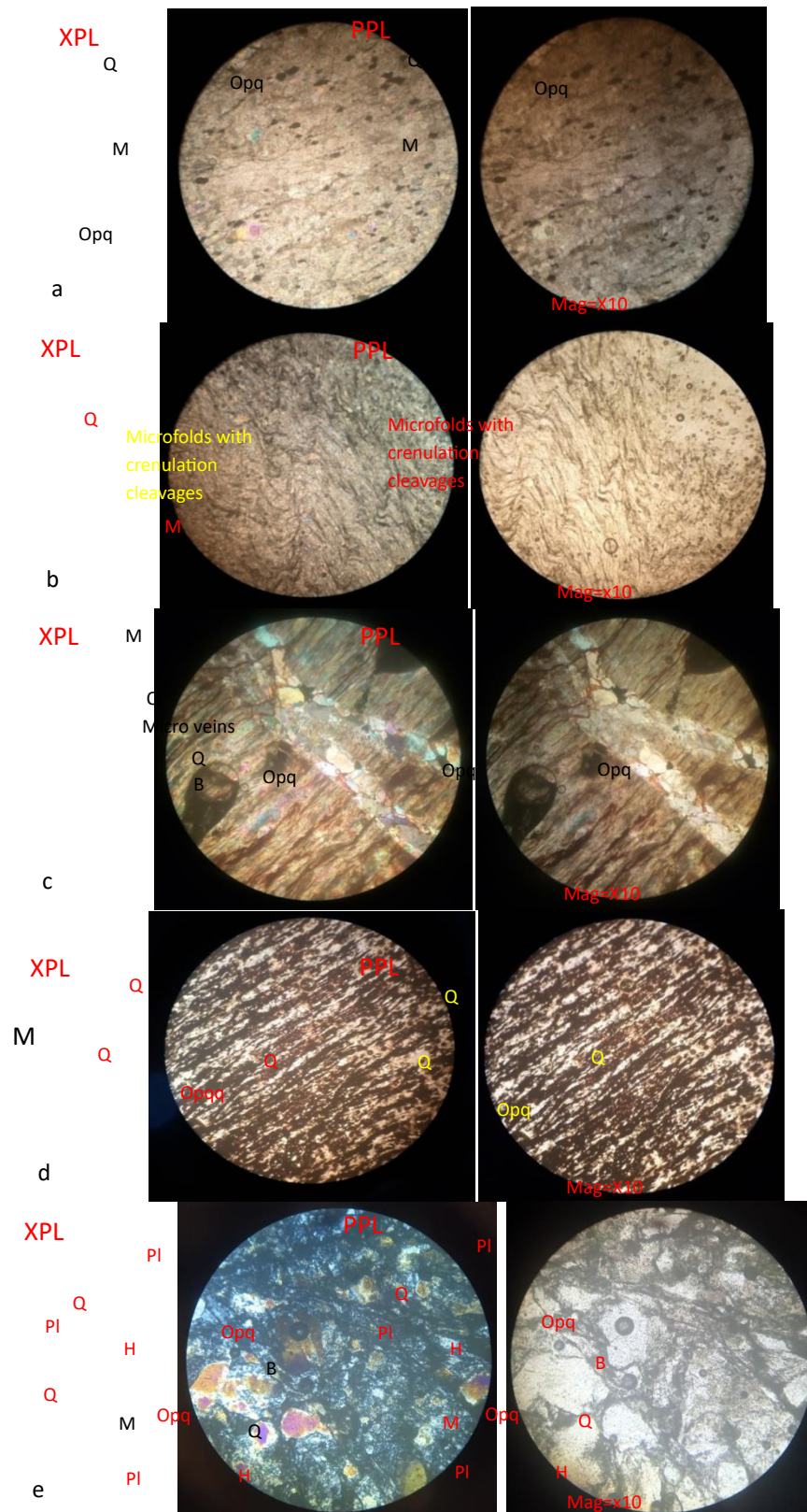


Figure 13: Photomicrographs of (a) Quartz-mica schist under cross polarised light (XPL) and plane polarised light (PPL). (b) schist showing crenulation under cross and plane polarised lights.



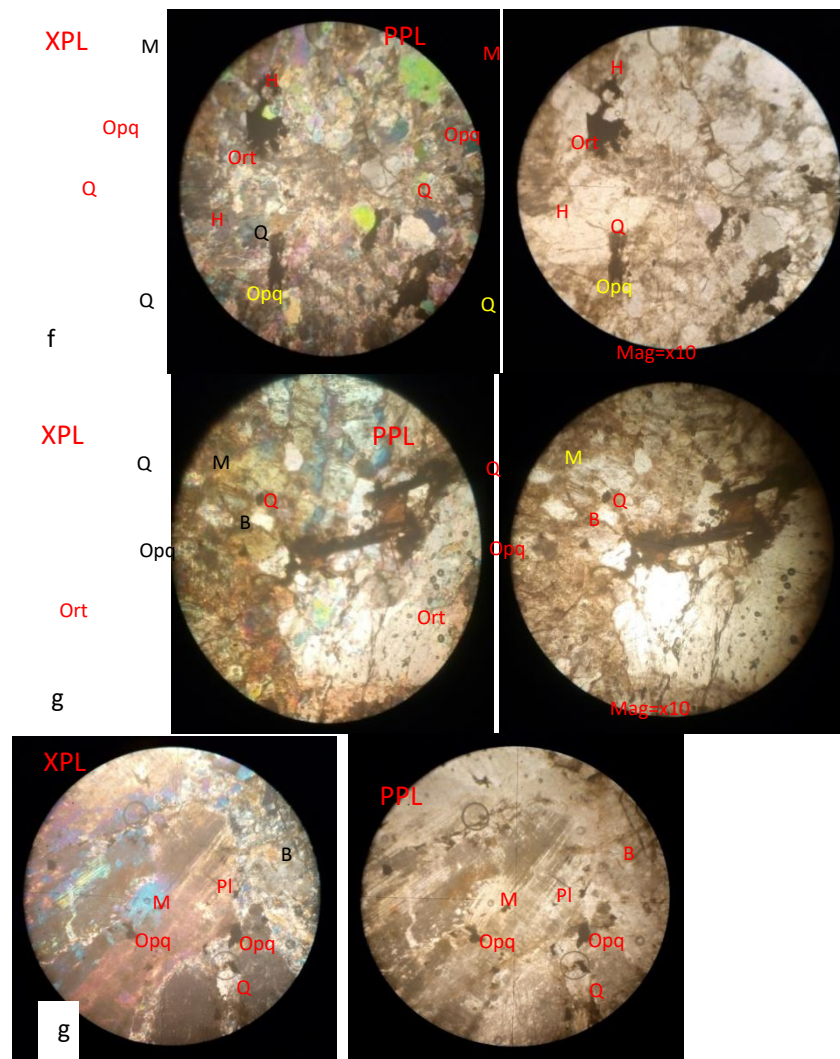


Figure 13 cont'd: Photomicrographs of (c) Quartzite (schistose) under cross and plane polars. (d) Ferruginous Quartzite under cross and plane polars. (e) Amphibolite under cross and plane polars. (f) Fine to medium-grained granite under cross and plane polars. (g) Coarse-grained granite under cross and plane polars. (h) Porphyritic granite under cross and plane polars. Legend: B= Biotite, Q=Quartz, M=Muscovite, H=hornblende, Opq=Opaque mineral, Ort=Orthoclase, P=Plagioclase and Mag=Magnification.

### Structures

The structures in the area include joints, folds, foliations and lineations showing the various levels of deformations (brittle and ductile). Measurements of dip and strike were made, readings were taken and Rose diagram was plotted to determine the direction of the trends. Two structural trends were inferred in the study area; the NNE-SSW which is the major and NE-SW being the minor (Fig. 14b).

### Joints

These are obviously the most prominent and abundant geological structures found on almost every outcrop. In the study area (Fig. 14a), two types were recognised; major and minor. Joints were ubiquitously observed to be associated with all the rock types especially the phyllitic schists and the quartzites (schistose) which were highly fractured and jointed.



Figure 14: (a) Systematic, non-systematic and cross joints on the carbonaceous schist ( $12^{\circ}39'40''\text{N}$ ,  $8^{\circ}24'12''\text{E}$ ) and the quartzite outcrop ( $12^{\circ}42'38''\text{N}$ ,  $8^{\circ}27'14.9''\text{E}$ ). (b) A Rose diagram of joints strike in the area.

### Faults

Faults are fractures where displacement occurred. The study area is a fault zone, a northernmost extension of the Kalangai dextral fault, one of the three fault systems in Nigeria. The fault in the area is exemplified by the quartzite ridges, breccias and mylonites (Fig. 15).



Figure 15: A mylonitised schist with boudinage structure around Tsohon Kafi ( $12^{\circ}39'40''\text{N}$ ,  $8^{\circ}24'12''\text{E}$ )

### Folds

Folds are bends or wave-like structures formed as a result of ductile deformation. Folds in the study area were mostly minor folds made of quartz veins (Fig. 16) as found in some locations.



Figure 16: A minor fold on the quartzites ( $12^{\circ}40'25.122''\text{N}$ ,  $8^{\circ}24'20.61''\text{E}$ ) and ( $12^{\circ}39'48.07''\text{N}$ ,  $8^{\circ}23'47.75''\text{E}$ )

### Foliations

Foliations are parallel planar fabric exemplified by the phyllitic structure, schistosity (Fig. 17) and boudins. Boudins are formed as a result of deformation of competent and incompetent rocks. They were associated with the quartzites as observed in the study area.



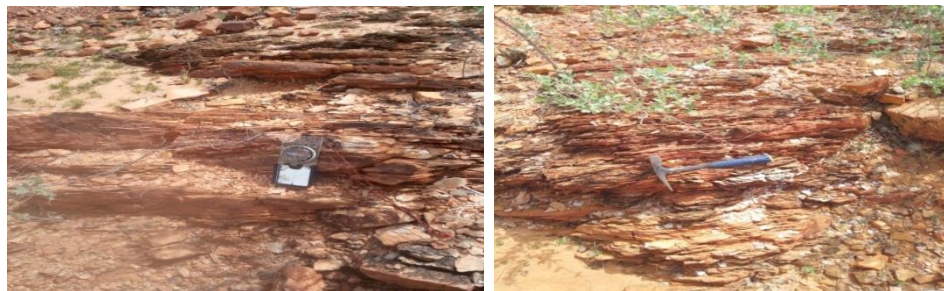


Figure 17: Quartz-mica-schist ( $12^{\circ}42'35.5''\text{N}$ ,  $8^{\circ}27'19.9''\text{E}$ ) and muscovite schist ( $12^{\circ}40'58''\text{N}$ ,  $8^{\circ}26'41''\text{E}$ ) outcrops showing foliation.

### Lineations

Lineations are linear fabric exemplified by crenulation. Crenulation is a pre-existing cleavage minutely folded. It was associated with the schists, particularly chlorite schists (Fig. 18) as shown microscopically (Fig. 13b).



Figure 18: A Schist showing crenulations at Fitare ( $12^{\circ}37'59''\text{N}$ ,  $8^{\circ}23'18''\text{E}$ ).

### Discussions

Field studies and thin-section revealed the mineralogy and textures of the different rock types in the area. The schists consist of muscovite schist, carbonaceous phyllitic schist, talc schist, chlorite schist, quartz-mica schist and are composed of muscovite, quartz, biotite and opaque minerals. The quartzites consist of massive and foliated (schistose quartzite) varieties and are purely composed of quartz with minor biotite and muscovite flakes. The quartz crystals have been mostly obliterated indicative of the metamorphic nature of the rocks. The amphibolite is also massive and is composed of minor quartz, hornblende, feldspar, biotite, muscovite and opaque minerals. On the other hand, the granites consist of fine to medium-grained, coarse-grained and porphyritic variety suggestive of different rates of cooling (Nelson, 2015) and are composed of essential minerals of quartz, feldspar, ferromagnesian minerals (such as biotite), muscovite, hornblende and opaque minerals as accessories. Moreover, the grey and pink varieties of the Kazaure granite and that of the Closepet granites are comparable, they have some common features. In both the cases, the grey variety usually contains xenoliths, whereas in the pink variety the xenoliths are either un-common or absent (Rao *et al*, 1972).

Furthermore, structures in the area consist of joints, faults, folds, foliations and lineations showing the various levels of deformations (brittle and ductile). According to Danbatta (1999; 2010), the rocks in the area have been subjected to at least two intense phases of ductile deformation (D1 and D2). This was further confirmed by the crenulations observed on the schists (Fig. 13b). Measurements of strike were plotted on Rose diagram to determine the general direction of the trends. Two structural trends were inferred in the study area; the NNE-SSW which is the major (Ibrahim, 2003; 2008) and NE-SW being the minor (Fig. 14b) representing imprints of the Pan-African orogeny. The plot further indicates that the stress regimes act in the NNW-SSE and NW-SE directions for the major and minor trends respectively. The structures could possibly serve as conduits for passage of hydrothermal fluids evident by silicification in the area (quartz-veins network) and are thus said to be significant in compartmentalisation of valuable mineral deposits and revealing diverse geological tapestry.

## Conclusion

Petrography and structures revealed the mineralogy, texture and evolution of the rocks in the study area which form part of the basement complex rocks of northwestern Nigeria. The rocks are products of tectonism evident by the structures possibly associated with the late stages of the Pan-African orogeny.

## Acknowledgements

The first author wishes to thank most profoundly Dr. A.A. Ibrahim and Prof. A.E. Ikpokonte of ABU Zaria for the supervision of the research. This work forms part of his M.Sc thesis, their guidance is highly appreciated. The support of Kazaure Emirate Council and individuals who have in one way or the other assisted in the success of the fieldwork is also appreciated.

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## SOCIAL MEDIA AS CORRELATE OF EFFECTIVE ACCOUNTING LEARNING IN SOUTH-EAST NIGERIAN UNIVERSITIES

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### Abstract

*The study investigated on the relationship between social media and effective accounting learning in the South East Nigerian universities. Specifically, the study analysed effect of WhatsApp and YouTube on effective learning of Accounting. Data was obtained through questionnaire administered to 525 students that offers Accounting courses from five states in the South-East geopolitical zone of Nigeria. Out of the entire questionnaires, 500 were filled and returned. Descriptive statistics, mean and standard deviation were used to analyze the questionnaire on a 5-point Likert scale, while Correlation coefficient was used to test the null hypothesis at 0.05 level of significant and to establish the extent of the relationship between the variables used. Reliability test was carried out with Cronbach Alpha and findings revealed that that, there is internal consistency of research instruments used. The Correlation result revealed that, there were positive and significant correlation between WhatsApp, YouTube and effective learning of Accounting in South-East Nigerian universities. Based on the findings, the study recommends that lecturers should effectively utilize social media platforms and also enlighten students on importance of social media in learning. Also the administrative authorities should provide free Network in tertiary institution to empower students effectively on use of social media in learning process.*

**Keywords:** Social Media, WhatsApp, YouTube, Accounting and Learning

### Introduction

Tertiary institutions aim to train scholars perfectly to drive competently on their different areas of specialization and also to promote changes in the values and attributes of scholars for positive contributions to the national development. Halidu (2016) asserts that in order to realize the vision of becoming one of the top economies in the world, Nigeria must produce world class manpower, possible only through world class tertiary institutions equipped not only with the requisite physical infrastructure and structural facilities but, above all, world class lecturers to impart current and in-depth knowledge, conduct research, publish the outcomes and produce personnel that is nationally competent and globally competitive. The online exchange of information is very vital for equipping tertiary institutions students with in-depth knowledge. It improves interpersonal communication skills, particularly between learners and instructors. Social media comprises of activities that involve socializing and networking online through words, pictures and videos. The study of Khan and Robertson (2016) suggest that university accounting students use social media for a number of academic-related purposes and students establish and maintain fluid mentor/mentee relationships around academic activities related interactions through the social media.

WhatsApp was founded by Jan Koum and Brian Acton in 2014. It operates as a separate app with a laser focus on building a messaging service that works fast and reliably across the world. Larson (2012) noted that use of WhatsApp in education is already making waves in the sector. To Musa (2015), through the WhatsApp app's user-friendly familiar interface, teachers can run online class to meet their teaching goals and help students meet their learning goals. YouTube is a website for sharing videos. It was developed by Steve Chen, Chad Harley and Jawed Karim on 14th February, 2005. Al-Ashram (2015) asserted that video-sharing website is one of the best and most important types of social media now used in the educational system. It is new innovative and interesting dimension in the traditional education system.

### Statement of the Problem

There is prevalent insensitivity of accounting students in use of social media for appropriate learning situations. Tertiary institution students in general rather prefer using handset and laptops charting and spending lots of time away from studying. According to Nwazor and Godwin-Maduike (2015) it is speculated that an average Nigerian youth spends about six to seven hours charting on the internet daily, some even do all night browsing. Reorienting the undergraduate students towards embracing the social media platform for effective learning of their different



disciplines of studies become paramount. This has spurred discussion among faculties, across disciplines and from various schools in relation to the effectiveness and stability of social media as a teaching and learning tool. The present study therefore investigates in the context by contributing to the pool of knowledge.

### **Objectives of the Study**

The main aim of the study is to determine the extent of relationship between social media and effective learning of Accounting in South-East Nigerian universities. Specifically, the study sought to:

1. Determine the extent of relationship between WhatsApp and effective learning of Accounting in South-East Nigerian universities.
2. Investigate the extent of correlation between YouTube and effective learning of Accounting in South-East Nigerian universities.

### **Research Hypotheses**

- H0<sub>1</sub> There is insignificant effect of WhatsApp on effective learning of Accounting in South-East Nigerian universities.
- H0<sub>2</sub> There is insignificant effect of YouTube on effective learning of Accounting in the South-East Nigerian universities

### **Review of Related Literature**

#### **Rationale for use of Social Media in Teaching and Learning Accounting**

##### **WhatsApp and Students Effectiveness in Learning of Accounting**

Reorienting the undergraduate Accounting students towards embracing the social media platform for effective learning of their disciplines of study has become paramount. This has spurred discussion among faculties, across disciplines and from various schools in relation to the effectiveness and stability of social media as a teaching and learning tool. To Larson (2012) WhatsApp supports free voice and video calls so that teachers and students can stay in touch, even outside stipulated study periods. Furthermore, teachers can also send timely reminders or notifications about important activities of the school to the students including important information on the teaching resources and the roles to be played by the students. Bryer and Zavattaro (2011) suggested that teachers can follow up with students' on-on-one to maintain the pace of their educational progress. This can be particularly beneficial to students who struggle to keep up with the rest of the class or are too shy to open up about struggles in an open classroom environment. Musa (2015) identified the following usefulness of WhatsApp in teaching

- (i) It stimulates a dynamic learning environment
- (ii) It facilitates rich interactions and regular learning even outside the classroom
- (iii) It encourages real time communication between teachers and students
- (iv) It fosters collaboration between students so they can learn better together
- (v) It enhances the sharing of educational resources to match the learning styles and needs of different students
- (vi) It is a familiar, comfortable interface that students love to use for learning
- (vii) It increases students' engagement through familiarity, convenience and ease of use
- (viii) It enables the teacher to resolve issues quickly and in a way that feels natural and seamless to users. Larson (2012) asserted that WhatsApp aid instructional delivery. WhatsApp enhances efficiency and effectiveness of teachers by allowing teachers to deliver their lesson, collaborate with other colleagues and give assignment to the students.

##### **YouTube and Students Effectiveness in Learning of Accounting**

The study of Jill, Daphne and Angela (2016) reveal that instructor generated YouTube videos improve student performance in a principle of Accounting class. Cheta and Yinka (2017) noted that teachers' YouTube clips can promote a classroom discussion which is an improved and robust method to teaching, thereby allowing students to create, edit and upload and discuss their own videos. This itself is an even more powerful application of teaching. In another instance, Cheta and Yinka (2017) posited that teachers' use of YouTube have great benefits to instruction. It enables students to be more interested in what the teacher is teaching as the students are more interested in exciting activities and the students are more likely to pay attention when they watch such videos than reading walls of text in books and notes. Al-Arfag (2012) enunciated that YouTube enable the teacher to understand the students' context (past, present and future), establish and respond to the students' existing level of knowledge, provide adequate and

appropriate practice over time, relate the content to real-life situations, so that the students can understand the context and gain some knowledge. The use of YouTube enables the teacher to break down the learning materials into different stages or adopt step by step approach. This enables the students to easily understand what the teacher teaches. YouTube helps teachers to do that for better conceptual understanding of both teachers and students. Ayiah and Kuumah (2011) asserted that YouTube have a great impact on the effectiveness of teachers and how they discharge their responsibilities. It is new innovative and interesting dimension in the traditional education system.

### **Review of Empirical Studies**

Al-Ashram (2015) conducted a study to identify the impact of the use of social media on university youth, and understand the factors that drive university youth and motivate them to use social media. The study found that the mostly used social media are Facebook, YouTube, followed by Twitter in third place; all participants use Facebook once a week. Most of the participants agreed that the use of social media, especially Facebook, aims mainly to know new individuals and work to build new relationships, as they indicated that social media has become an essential part of their daily activities.

The study of Khan and Robertson (2016) explored use of social media by university accounting degree students to support their academic activities in an informal setting. It explores the impact these media have on learning outcomes. Findings of the study reveal that university accounting degree students use social media for a number of academic-related purposes. Students establish and maintain fluid mentor/mentee relationships around academic activities related interactions through the social media and also the use of Social Media is significantly associated with students' grades Morrison et al. (2017) investigated on the utilization of social media in the classroom by business teacher educators in Nigeria. The findings indicated that social media is only being marginally implemented in business teacher education in Nigeria. The finding also showed that a significant number of business teacher educators would like to see the use of social media expanded by becoming more informed as to instructional alternatives.

Adegoke et al. (2017) investigated on student's use of different social media tools, their perceptions and attitudes towards these tools, their preference of social media for instructional purpose, and acceptance of social media among, pre-service teachers in Nigeria and Rwanda. The findings of the study revealed that pre-service teachers in both countries have adequate knowledge of different type of social media sites.

Ezeabi et al. (2019) investigated on the influence of social media on academic performance of business education students in public universities in South-East States of Nigeria. The findings of the study showed that social media influences the students' academic performance positively and negatively in business education.

### **Methodology**

This study was carried out in South-East geopolitical zone in Nigeria. It adopted descriptive survey research design using a structured questionnaire to solicit the opinion of the respondents. The population of the study were the ten (10) accredited public universities in the South-East Nigeria under the Nigerian University Commission (NUC) in the states of Abia, Anambra, Ebonyi, Enugu and Imo. A multistage sampling approach was employed; firstly, the ten public universities in the five states were divided into five clusters and each state have two public universities. Out of the five clusters one university that offer Accounting courses was selected purposively from each state constituted a total sample size of five universities. The sampled universities therefor include Abia State University Uturu, Imo State University Owerri, University of Nigeria Nsukka, Nnamdi Azikiwe University Awka, Alex Ekwueme University Ndufu-Alike Ebonyi State. Purposive sampling of one hundred and five (105) students consisting of third year and final year students were selected from each of the five sampled universities. This gave the entire sample size of 525 students. A total of five hundred and twenty-five (525) questionnaires were administered to the respondent and out of which 500 were filled and returned. Responses of the respondents emanated from the question on 5-point Likert rating scale of Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. The scale was subjected to item analysis to ensure its validity and reliability. Reliability test was carried out with Cronbach Alpha to determine the internal consistency of the instrument. The reliability test revealed an average reliability coefficient of 0.80 which indicated internal consistency on the questionnaire used. The mean descriptive statistics was used to answer the two research questions while Person correlation statistics was used to test the hypotheses at 0.5 level of significance.

## Results

**Research Question one:** To what extent does use of WhatsApp enhance effective learning of Accounting in the South-East Nigerian universities

**Table 4.1 Respondent Responses to Research Question One**

	Extent of use of WhatsApp in Effective Learning of Accounting in the South-East Nigeria.	TOTAL	X	SD
1	Accounting students use WhatsApp frequently to communicate with one another on areas of difficulty in Accounting.	500	4.70	0.641
2	Students share Accounting supplementary materials with one another on WhatsApp.	500	4.09	1.054
3	It enables Accounting lecturers to integrate videos in teaching practical areas of Accounting.	500	3.18	1.261
4	It enables Accounting lectures to initiate group discussion in problem areas of the discipline with immediate feedback from the students.	500	3.79	0.990

*Source: Authors compilation*

Table 4.1 presents the extent of use of WhatsApp in enhancing effective learning of Accounting in the South-East Nigeria. Analysis showed that the value of the mean rating of the respondents ranged from 3.18 to 4.70 on a 5 point likert scale. All the mean rating are all above 3.0 reference mean. The finding indicates that the extent to which use of WhatsApp effectively enhanced learning of Accounting in the South-East Nigeria is to an high extent. The standard deviation value which ranged from 0.641 - 1.261 showed that the respondents responses are spread around the mean. The respondents' opinion are therefore consistent with one another.

**Table 4.2**

**Results Showing Correlation Relationship Between use of WhatsApp and Effective learning of Accounting in South- East**

Variables	N	R (Correlation coefficient)	r (P-value)	Remark
Effective learning of Accounting	500	0.748	0.000	Reject the null hypothesis
Use of WhatsApp	500			

*Source: SPSS*

Analysis of table 4.2 revealed that the correlation coefficient is 0.748, which shows that the extent of extent to which use of WhatsApp enhance effective learning of Accounting in the South-East Nigeria is positively and highly correlated at 74.8%. Results also showed that the observed correlation coefficient value of 0.000 is significant (at  $P < 0.05$ ), this is because the probability value is less than 0.05. Results therefor led to the rejection of the null hypothesis one and lead to the conclusion that use of WhatsApp enhances effective learning of Accounting in the South-East Nigeria. The finding is in consonants with Khan and Robertson (2016) whose in their study revealed that university accounting degree students use social media for a number of academic-related purposes. Students establish and maintain fluid mentor/mentee relationships around academic activities related interactions through the social media and also the use of Social Media is significantly associated with students' grades. Larson (2012) noted that the use of WhatsApp in education is already making waves in the educational sector. In addition, in the coming years, WhatsApp in education will help democratize learning and empower teachers as well as educational institutions to disseminate knowledge to more students than would ever be possible with the traditional, in-person education system Larson (2012).

## Research Question Two

To what extent does use of YouTube enhance effective learning of Accounting in South-East Nigeria

**Table 4.3 Respondent Responses to Research Question Two**

	Extent of use of YouTube to enhance effective learning of Accounting in South-East Nigeria	TOTAL	X	SD
1	YouTube enables students to gain access to free and high quality Accounting materials.	500	3.60	0.916
2	It enables Accounting lectures to provide audio-visual imputes to learning resources.	500	4.0	0.632
3	It provides the platform for lecturers to demonstrate the lessons practically	500	4.70	0.459
4	It facilitates the display of solved accounting practical problems for ease retention for the students.	500	4.50	0.501

Table 4.3 presents the extent to which use of YouTube enhance effective learning of Accounting in South-East Nigeria. Analysis showed that the values of the mean rating to the four item questions ranged from 3.60 to 4.70 which are all above the expected mean of 3.0 on a 5point likert scale. This reveals that the extent to YouTube in enhancing effective learning of Accounting in South-East Nigeria is above the expected mean of 3.0. The standard deviation value which ranged from 0.459 – 0.916 showed that the respondents responses are spread around the mean and the opinion of the respondents are consistent with one another.

**Table 4.4**

**Results Showing Correlation Relationship Between extent of use of YouTube and Effective learning of Accounting in South-East Nigeria**

Variables	N	R (Correlation coefficient)	r (P-value)	Remark
Effective learning of Accounting	500	0.788	0.000	Reject the null hypothesis
Use of YouTube	500			

**Source SPSS**

Presented in table 4.4 above is the correlation relationship between extent of use of YouTube and effective learning of Accounting in South-East Nigeria. The correlation coefficient is 0.788 which shows that the extent of relationship between use of YouTube and effective learning of Accounting in South-East Nigeria is positively and highly correlated at 78.8%. Analysis also showed that the observed correlation coefficient of 0.000 is significant (at  $P < 0.05$ ), this is because the probability value is less than 0.05 at 5% level of significance. Results therefor led to the rejection of the null hypothesis two which lead to the conclusion that use of YouTube is significant in effective learning of Accounting in South-East Nigeria. The finding is in consonants with Ezeabi et al. (2019) whose research work revealed that social media influences the students' academic performance positively and negatively in business education, which is an integral part of Accounting.

## Conclusion and Recommendations

The present study concludes that use of WhatsApp, and YouTube platforms enhances effective learning of Accounting in tertiary institutions. The social media platforms enhance the effectiveness of lectures in demonstrating and solving practical areas of Accounting repeatedly for mastery also students' area of difficulty in the discipline are handled in group discussion among their peers. Thus the study establishes that there is existence of positive and significant correlation between use of WhatsApp and YouTube platforms in effective learning of Accounting in tertiary institutions in the South-East. Based on the findings of the study recommends that lectures should effectively utilize social media platform and also enlighten students on importance of social media in learning. Also the administrative authorities should provide free Network in tertiary institution to empower students to effectively use it in learning process.

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## LIBRARY SERVICES AND STUDENTS SATISFACTION WITH THE USE OF DONALD EKONG LIBRARY UNIVERSITY OF PORT HARCOURT

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### **Abstract**

*This work examines the library services and students satisfaction with the use of Donald Ekong library University of Port Harcourt. Two research questions and two null hypotheses were formulated to guide this study, hypotheses was tested at 0.05 level of significance. The study adopted correlational research design. Population of the study comprises 258 students of department of library and information science Universities of Port Harcourt, from which a sample size of 181 students were selected using stratified random sample technique. Data was collected using the questionnaire. Data collected was analysed using Pearson product-moment correlation coefficient (PPMC). The findings show that there is a significant relationship between the circulation service and students satisfaction with the use of academic library; also there is a significant relationship between the reference service and students satisfaction with the use of academic library. Based on the findings the study recommended that library management should take adequate measure to ensure effective registration of users, for efficient lending services, to enhance users satisfaction; and, that universities should employ more professional librarians to ensure adequate reference assistance to users, that will help to increase their satisfactory level.*

**Keywords: Library, Services Satisfaction & Donald Ekong Library**

### **Introduction**

Library services remain an important role of the librarian, aimed toward meeting the needs of its users. There are a number of services available in the library to meet the users need. Library users are the different categories of people that come to use library resources to satisfy their information needs. The term library users encompassed various terms such as patrons, clients, information users, information seekers, consumers, and readers. These terms can be used interchangeably because they are all apply to those seeking the services of a library. Library users based services are services offered to the library users by different types of libraries, these include: Circulation services, Reference services, Current-awareness services, reprographic services, selection dissemination of information services, internet services, opening hour services, seating/accommodation services, special services, provision of guide services, customers care services, display services, and maintenance services. Ekeng & Esin (2021) maintain that: Users' satisfaction simply mean how good users feel after dealing with a library.

Users' satisfaction imply the degree to which products or services provided by a library meet users' expectations. Therefore, well provided library users based services will likely increase the satisfactory level of library patron. The University of Port Harcourt is public university, located in Rivers state, Nigeria, established in 1975, and the University library known as Donald E. U. Ekong Library started in September 1976. University Senate in 2014, gave approval for the establishment of the Department of Library and Information Science. An office allocation was made available on the ground floor of the Donald E.U. Ekong Library. (University of Port Harcourt, 2023). In most of the universities library, students satisfaction with the use of library were affected by ineffective circulation services, inadequacy of reference services. Therefore, this study was conducted to identify the relationship between the library

services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt, with the view of promoting the satisfactory level of library users.

### **Statement of the Problem**

Library remains the brain box of every institution of higher learning, its main focus is to meet the information need of the users. Well provided users based services will enhance and promote the satisfactory level of the students users. Over the years, universities in Nigeria had made a great effort to improved in the method of services rendered to the users. Despite the effort put together, from the researchers personal observation through the information obtained from various literature, and finding as a result of interaction with librarians, there exist number of challenges facing the library users services, these include; ineffective circulation services: some library experience some difficulty in providing adequate charging and discharging services to their patron, this affect circulation services; Inadequacy of Reference services, most library have few professional librarians, this affect level of assistance to users. Therefore, this study of library services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt aimed to find out the best solution to solve these problems to help promote the students' satisfaction, and to meet the goal of the institution.

### **Aims and Objectives**

This study examines the relationship between the library services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt

#### **The specific objectives include to:**

1. Determine the relationship between the circulation services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt.
2. Ascertain the relationship between the reference services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt.

### **Research Questions**

The following questions were provided to guide this study

1. What is the relationship between the circulation services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt?
2. What is the relationship between the reference services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt?

### **Hypotheses**

#### **The following hypotheses were formulated to guide the study.**

1. There is no significant relationship between the circulation services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt.
2. There is no significant relationship between the reference services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt.

### **Review of Related Literature**

Tella (2021) maintained that library services are services provided by the library to the users. This includes instruction on how to access and use library materials. The Library services include: Circulation Service, Reference Service, Online reservation of books, and Recommendation of library material. All these services are geared toward meeting the users needs. Information users of all type desired effective and friendly services. Abdulhamid and Muhammad (2021) Maintain that the most common services provided by the library under circulation are lending service, registration of users and inter-library loan. They stated that the problems encountered in the circulation section of the library by users are inadequate staffing, lack of awareness about the activities of the section and absence of online circulation service's.

Similarly, with the above, Librarianship Studies & Information Technology (2022) stated that library circulation is the function of lending library materials to the users of the library. These include checking out library materials to library users, renewing the borrowed items, reserving checked out items for the patron, checking in materials returned, checking the materials for damage at the time of return, if found damaged then giving that to responsible staff for

repair and when repair is not possible then replacement, renewal of materials, receiving payment of fines for damaged and overdue materials and payment for subscription to the library and other charges, maintaining order in the stacks by re-shelving the library materials by call number given by classification system, such as Library of Congress Classification (LCC) or Dewey Decimal Classification (DDC) system. For circulation services to be effective, users need to be properly educated and aware about its activities. Kumar (2014) study revealed that services provided by the library to students include reference services to provide quick and in-depth answers to student questions. Kidd & Song (2008) maintain that reference service is service provided by libraries whereby patrons are assisted in the location and retrieval of information relevant to their information needs.

Ali (2020), stated that budget shortage is the first major challenge facing the implementation of reference services delivery in Nigerian libraries. Libraries are always directly affected whenever the parent organization suffers a budget cut. Zemengue (2021) pointed out that challenges to the efficient organization and functioning of the reference section include insufficient financial resources and a shortage of qualified librarian staff. This is a huge setback, and it is seriously affecting service delivery of reference services. Egunjobi, Ogunniyi and Ajakaye (2022) study identifies epileptic power supply, inadequate funding of the reference section, poor update on reference policies of the library, obsolete equipment and infrastructure, and poor internet access as the major challenges facing reference service provision in federal universities in Nigeria. And to solve these problems, they recommended that there should be constant training and retraining of library personnel in the reference section to upskill and learn the new method of reference service delivery. Reference service need special customers care quality in dealing with the users, this is to encourage them to look for more assistance whenever the need arises.

Onwuekwe (2022) viewed User satisfaction as the fulfilment of wishes, expectations and needs of the users. According to him, it is all about meeting the heart desire of students in using school library resources. The amount of information available will determine the level of student satisfaction in using of information resources. Iwhiwhu and Okorodudu (2012) maintain that users' satisfaction of library information resources and services is a way in which users judge the adequacy of the library information resources and services rendered to them and also if their expectations are provided to them.

### Methodology

The study adopted the correlational research design. The population of the study comprises 258 students of department of library and information science Universities of Port Harcourt. Sample size of 181 students was selected using stratified random sample techniques. 160 out of 181 questionnaires administered were successfully filled by the respondents and returned. A structured questionnaire was used for data collection. Data collected were analysed using the Pearson Product Moment Correlations (PPMC) Whereas the hypotheses were tested at 0.05 level of significance. The statistical package for social science (SSPSS) was used to determine the accuracy of the analysis. To determine the level of relationship between circulation services, reference service and Students satisfaction with the use of Donald Ekong library. A decision rule was taken for Pearson Product Moment Correlation as follows:

± 0.00-0.20.	Weak relationship
± 0.21-0.40.	Moderate relationship
± 0.41-0.60.	Strong relationship
± 0.61-0.80.	Very strong relationship
± 0.81-1.00	Perfect relationship

### Demographic Characteristics of Respondents:

#### Analysis of Demography

**Table 1: Gender of the Respondents**

Items	Frequency	Percentage
Male	104	65
Female	56	35
Cumulated	160	100

Table 1 revealed that 104(65%) of the respondents are male while 56(35%) are female. This means that majority of the students under study were male.



**Research question 1:** What is the relationship between the circulation services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt?

**Table 2: Relationship between circulation services and students satisfaction**

Correlations			
S/N	Items		
		Circulation Services	Student Satisfaction
1	Circulation services	Pearson Correlation	1
		N	160
2	Students satisfaction	Pearson Correlation	0.9494
		N	160

The result from research question one indicates that joint relationship between the circulation services and students satisfaction has a correlation coefficient of  $r=0.9494$  which means there is a perfect positive relationship between circulation services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt

**Research question 2:** What is the relationship between the reference services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt?

**Table 3: Relationship between reference services and students satisfaction**

Correlations			
S/N	Items		
		Reference services	Student satisfaction
1	Reference services	Pearson Correlation	1
		N	160
2	Students satisfaction	Pearson Correlation	0.9115
		N	160

The result from research question two indicates that joint relationship between the reference services and students satisfaction has a correlation coefficient of  $r=0.9115$  which means there is a perfect positive relationship between reference services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt

### Test of Research Hypotheses

**Hypothesis one:** There is no significant relationship between the circulation services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt.

**Table 4:** Summary of Pearson Product Moment Correlation between the circulation services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt.

Correlations			
Items		Circulation Services	Students Satisfaction
Circulation Services	Pearson Correlation	1	0.9494
	Sig. (2-tailed)		.00001
	N	160	160
Students Satisfaction	Pearson Correlation	0.9494	1
	Sig. (2-tailed)	.00001	
	N	160	160

\*\*. The result is significant at  $P < .05$  (2-tailed).

The results from table 4 above indicates the summary of Pearson Product Moment Correlation between the circulation services and student satisfaction. It indicates that joint relationship between the circulation service and student satisfaction has a correlation coefficient of  $r = 0.9494$  which indicates a high positive relationship, and it is statistically significant at 0.05 alpha level ( $r = 0.9494$ ,  $p = 0.0001 < 0.05$ ). Thus, the null hypothesis which was earlier stated that

there is no significant relationship between the circulation service and student satisfaction was rejected. This implies that there is a significant relationship between the circulation service and students satisfaction with the use of Donald Ekong library, University of Port Harcourt.

**Hypothesis two:** There is no significant relationship between the reference services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt.

**Table 5:** Summary of Pearson Product Moment Correlation between the reference services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt

Correlations			
Items		Circulation Services	Students Satisfaction
Reference Services	Pearson Correlation	1	0.9115
	Sig. (2-tailed)		.00001
	N	160	160
Students Satisfaction	Pearson Correlation	0.9115	1
	Sig. (2-tailed)	.00001	
	N	160	160

\*\*. The result is significant at  $P < .05$  (2-tailed).

The results from table 5 above indicates the summary of Pearson Product Moment Correlation between the reference services and student satisfaction. It indicates that joint relationship between the reference service and student satisfaction has a correlation coefficient of  $r = 0.9115$  which indicates a high positive relationship, and it is statistically significant at 0.05 alpha level ( $r = 0.9115$ ,  $p = 0.00001 < 0.05$ ). Thus, the null hypothesis which was earlier stated that there is no significant relationship between the reference service and student satisfaction was rejected. This implies that there is a significant relationship between the reference service and students satisfaction with the use of Donald Ekong library, University of Port Harcourt

### Discussion of Findings

- Relationship between the circulation services and students satisfaction with the use of Donald Ekong library, University of Port Harcourt. The result of hypothesis one indicates that there is a significant relationship between the circulation service and students satisfaction. In line with this study, the finding of Abdulhamid and Muhammad (2021) pointed out that the most common services provided by the library under circulation are lending service, registration of users and inter-library loan. This means that circulation services is necessary in meeting the need of the users. Therefore, proper documentation of library users, proper shelving of library resources help in service provision, and enhances users satisfaction
- Relationship between the reference services and students satisfaction with the use of Donald Ekong library, university of Port Harcourt. The result of hypothesis two indicates that there is a significant relationship between the reference service and students satisfaction. In line with this study, the finding of Kumar (2014) revealed that services provided by the library to students include to provide quick and in-depth answers to student questions. Assisting users in locating and retrieving of information relevant to their information needs, increases their satisfaction. References services should be treated with utmost concern toward rendering effective and efficient service to satisfy the information need of the users.

### Conclusion

Based on the findings of this study the following conclusions were reached. There is significant relationship between the circulation services and students satisfaction with the use of Donald Ekong library, university of Port Harcourt, therefore, adequate attention should be giving to circulation services if high users' satisfaction is to be achieved. There is significant relationship between the reference services and students satisfaction with the use of Donald Ekong library, university of Port Harcourt, therefore, well-trained professional reference librarian is needed in library for effective provision of the services. Therefore, circulation services, and reference services, had relationship with students satisfaction with use of academic library.

## Recommendations

The following recommendations were proffered based on the findings;

- Since the study revealed that there is significant relationship between the circulation services and students satisfaction, it is therefore recommended that library management should take adequate measure to ensure effective registration of users, for efficient lending services, to enhance users satisfaction.
- Since the study revealed that there is significant relationship between the reference services and students satisfaction, it is therefore recommended that universities should employ more professional librarians to ensure adequate reference assistance to users, that will help to increase their satisfactory level.

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