

DIGITIZATION FOR PERFORMANCE IMPROVEMENT: A CASE STUDY OF NIGERIAN BANKS

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Abstract

This study examined the impact of digitalization on the performance of commercial banks in Nigeria using panel data from 2012 to 2022. The research adopted an ex post facto and quantitative research involving secondary form of data. It focused on how mobile banking, total assets, and non-performing loans influence return on assets (ROA). Employing descriptive statistic, panel least square, cross-sectional dependent test, fixed and random effects models, the findings indicate that digitalization generally enhances bank performance. However, results vary depending on scale and infrastructure costs. Mobile banking initially shows a positive effect on ROA, but fixed effects suggest a slight negative impact possibly due to cost implications. Total assets also exhibit mixed outcomes. The study underscores the need for strategic digital adoption that balances efficiency with cost management. Key recommendations include investment in secure digital infrastructure, continuous staff training, and increased public awareness on data protection to sustain profitability and customer trust.

Keywords: Digitalization, Commercial, Banking, Asset

Introduction

In recent years, rapid advancements in Information and Communication Technology (ICT) have significantly transformed the global banking industry. Digitalization, defined as the delivery of financial services through electronic channels, has revolutionized how banks operate, improving efficiency, expanding access, and enhancing customer experiences (Guechi, 2020; Murinde *et al.*, 2022). From checking balances to transferring funds, banking now touches nearly every aspect of daily life. In Nigeria, commercial banks have embraced ICT as a critical tool for competitiveness and service improvement. The sector has adopted innovations such as ATMs, POS systems, mobile and online banking, and agent banking to meet evolving customer needs. These technologies have enabled greater convenience, broader outreach, and increased customer satisfaction (Johannes *et al.*, 2020; Mawutor, 2014). Despite this progress, studies on the impact of digitalization on bank performance show mixed results, highlighting the need for context-specific research. This study aims to examine how digitalization affects the performance of Nigerian commercial banks—particularly regarding profitability, efficiency, and customer satisfaction—underscoring digital

banking as a strategic driver of growth and innovation (Enoruwa *et al.*, 2019; Osei *et al.*, 2023; Khadka & Maharjan, 2017).

Literature Review

The terms "digitization" and "digitalization" serve as key concepts within digital technology and innovation research. Nevertheless, these important constructs often lack explicit definitions, and there exists limited agreement regarding their conceptual frameworks. This ambiguity has led innovation management studies to apply identical terminology when describing distinct phenomena. For example, "digitization" has been employed to describe various different occurrences, such as developing digital products (Hopp *et al.*, 2018; Rindfleisch *et al.*, 2017) and incorporating digital technology within new product development procedures (Marion & Fixson, 2021). Similarly, "digitalization" has been applied to describe data collection, creation, and analysis processes that generate value and facilitate innovation (Cappa *et al.*, 2021; Goduscheit & Faullant, 2018); the advancement of digital innovation through creating innovative digital products (Pesch *et al.*, 2021); and the integration of digital technology throughout innovation procedures (Lanzolla *et al.*, 2021).

Commercial Banks

A commercial bank can be described as a financial institution that acts as an intermediary. It gathers funds from depositors or private sources, often offering interest or dividends in return, and then lends out these funds (or its own capital) as loans, operating under a government-granted privilege. Considering their fundamental role and economic importance, banks essentially facilitate credit exchanges by bridging the gap between those with surplus funds and those with deficits. As key players in financial intermediation, banks consolidate small savings, transforming them into larger investment packages. This enables savings to become investments. Their objective is to maximize the benefit when converting funds into investments, striving to minimize fund costs and achieve the highest efficiency from investments, all while staying within acceptable risk parameters. Through this process, banks guide funds toward areas where they will be most effectively utilized (Wutscher, 2025).

Theoretical Review

Amidst unparalleled environmental changes, the conversation around digitalization has become a major area of concern for people all over the world and for science. Many theories examine the complex aspects of digitization and how it affects the performance of commercial banks in Nigeria. A few of these theories are as follows:

Technology Acceptance Model (TAM)

The technology acceptance model (TAM) explains the acceptance of information systems by individuals. TAM postulates that the acceptance of technology is predicted by the users' behavioral intention, which is, in turn, determined by the perception of technology usefulness in performing the task and perceived ease of its use. This widely used framework sheds light on how users take to and make use of new technologies. TAM, which Fred Davis developed in 1989, asserts that perceived usefulness and ease of use are important factors in determining whether or not a technology is adopted (Davis, 1989). In digital transformation, TAM aids organizations in comprehending how users of digital tools and systems view and utilize them. Organizations can adopt digital solutions by highlighting usefulness and improving usability (Jacob, Sanchez-Vazquez, & Ivory, 2020).

Technology-Organization-Environment (TOE) Framework

The global banking industry has undergone major transformation through digitalization, driven by advancements in Information and Communication Technology (ICT). In Nigeria, commercial banks have adopted digital tools like ATMs, POS, mobile and online banking to improve service delivery, efficiency, and customer satisfaction. These innovations are now essential for competitiveness and growth. However, research on the impact of digitalization on bank performance has shown mixed results. This study explores how digitalization influences the performance of Nigerian commercial banks, focusing on profitability, operational efficiency, and customer satisfaction.

Business Ecosystems Theory

Digital transformation often involves collaboration and partnership within complex business ecosystems. Business Ecosystems Theory, popularized by James F. Moore, explores how organizations interact within interconnected networks (Yoon, Moon, & Lee, 2022). In digital transformation, this theory highlights the importance of building and nurturing partnerships with

various stakeholders, including customers, suppliers, and competitors, to create value and drive innovation.

Digital Maturity Models

Digital maturity models provide organizations with a structured framework to assess their readiness for digital transformation and track their progress. The most well-known model is the Digital Transformation Framework by Capgemini, which categorizes organizations into stages of maturity, from beginners to digital masters (Bellantuono, Nuzzi, Pontrandolfo, & Scozzi, 2021). These models guide organizations in setting digital transformation goals and evaluating their capabilities.

Developer-Based (Diffusion) Theory

The Developer-based (diffusion) theory was postulated by Rogers (1995) and states that many factors interact to influence the diffusion of an innovation. The four major factors that influence the diffusion process is the innovation itself, how information about the innovation is communicated, time, and the nature of the social system into which the innovation is being introduced (Rogers, 1995). This theory supports how financial innovations influence financial performance. This process relies heavily on human capital. The innovation according to MacKenzie (1996) must be widely adopted in order to self-sustain. MacKenzie (1996) added that within the rate of adoption, there is a point at which an innovation reaches critical mass. In this, diffusion manifests itself in different ways and is highly subject to the type of adopters and innovation-decision process. The criterion for the adopter categorization is innovativeness, defined as the degree to which an individual adopts a new idea

Empirical Review

Moudud-UI-Huq & Hossain (2020) investigated the relationship between e-banking and commercial bank performance in Bangladesh. A five-year aggregate quarterly commercial bank data as provided by Payment System Department of Central Bank of Bangladesh was used in the study. A multiple regression procedure was used to determine the significance of the relationship between the independent variables (electronic banking indicators) and the profitability measures of return on assets (ROA) and return on equity (ROE) as the dependent variables. The study

revealed that is a significant relationship between electronic banking indicators and performance of commercial banks in Bangladesh. It can be observed that the study used ROA and ROE to measure performance. The study did not use Earnings per Share to measure the performance of banks which is a better long-term measure of performance. Moreover, several studies have highlighted the positive effects of financial technologies on bank performance.

Baker *et al.* (2023) conducted a study on the impact of Financial Technology on the Improvement of Banks' Financial Performance in Jordan and the United Arab Emirates, utilizing multiple regression analysis. Their findings revealed that financial technology has a positive impact on total deposits and net profits. Similarly, Chukwu and Molokwu (2022) examined the Effects of Digital Banking on the Performance of Commercial Banks in Nigeria from 2010 to 2019. Their study indicated that digital banking has a positive and insignificant effect on the performance of commercial banks in Nigeria. Similar, findings were found in Mohammed *et al.*'s (2022) investigation of the Impact of Payments System Innovations on the Financial Performance of Commercial Banks. The study showed, through ARDL analysis, that internet, mobile and point-of-sale payments all significantly and favorably affect commercial banks in Nigeria's return on assets.

Using a panel technique, Nwaeze (2021) also came to the same conclusion. According to the survey, between 2015 and 2019, Nigeria's domestic systemically important banks performed better thanks to automated teller machines, point of sale, and mobile transfer/web. Furthermore, from 2005 to 2019, Akwam and Yua (2021) looked at the Impact of Financial Products on the Performance of a Selected Deposit Money Bank in Nigeria. Their study, which used multiple linear regression methodology, found that the use of automated teller machines (ATMs) has a positive significant effect on earnings per share (EPS), mobile banking has a significant positive effect on return on assets (ROA), and point of sale has a positive significant effect on return on equity (ROE).

Other studies, such as Ibiam and Nwogo (2021) using the Vector Error Correction Model, Gambo (2020) utilizing multiple regression, and Ahmed-Ishmel *et al.* (2018), have shown that financial technology can contribute to national development and the financial performance of firms

in Nigeria. Furthermore, Ibiam and Nwogo (2021) and Gambo (2020) in their studies on the Effect of Financial Technology (FinTech) on Financial System Development in Nigeria from 2005–2018 and the Effects of Technology Innovation on Financial Performance of Commercial Banks in Nigeria, respectively, identified payment technology innovations like mobile banking, Automated Teller machines, Point-of-sales and online banking as strong and positive determinants of financial performance and the financial system. A few studies have also adopted a single-firm analysis approach. For instance, Ogbujiet *al.* (2020) and Chimaobi (2018) focused on specific banks in Nigeria.

Ogbuji *et al.* (2020) conducted a comparative analysis of financial technology and traditional bank performance in Nigeria using the CAMELS approach, with a case study on WEMA Bank. Their findings indicated that digital Fintech operations, particularly ALAT in WEMA Bank, had a consistently positive impact on WEMA Bank's performance between 2017 and 2018, compared to the payment FinTech operations between 2012 and 2016. On the other hand, Chimaobi (2018) examined the impact of internet banking on the profitability of commercial banks in Nigeria, specifically using Zenith Bank PLC as a case study from 2005 to 2017. The study employed regression analysis and observed a positive and significant relationship between the logarithm of internet banking service expenses and the return on assets in Zenith Bank. The other strand of literature focuses on electronic banking operations and its impact on bank performance. Several studies have observed the relationship between electronic banking and financial performance.

For instance, Madugba *et al.* (2021) investigated the effect of electronic banking on the financial performance of deposit money banks in Nigeria. Through regression analysis, they found a positive and significant association between ATMs and earnings per share (EPS) and return on assets (ROA). Point of sale (POS) and national electronic funds transfer (NEFT) significantly affected ROA, while web transactions had an insignificant impact on both EPS and ROA. Similar results were obtained by Mustapha (2018) in their examination of the effect of E-Payment Technology on bank performance in emerging economies like Nigeria. Orji *et al.* (2018) also noted that major e-banking innovations, including automated teller

machine (ATM), point of sale (POS), and mobile banking transactions, contribute to the performance of both old and new banks in Nigeria. On the contrary, Amos *et al.* (2020) conducted a study using multiple regression analysis to examine the effect of electronic banking on bank performance in Nigeria. Their findings revealed that e-banking had no significant impact on performance measures such as return on equity (ROE), return on assets (ROA), and earnings per share (EPS) of banks in Nigeria.

Nwakoby *et al.* (2020) empirically investigated the impact of electronic banking on the profitability of selected banks in Nigeria. Using a panel regression estimator, they found mixed results. The study revealed that automated teller machine (ATM) payment method had a negative but statistically insignificant effect on return on equity of deposit money banks. Point of sale (POS) payment method also had an insignificant effect on return on equity, while mobile banking payment (MPAY) had a positive and statistically significant effect on return on equity. Other studies, such as Frank and Binaebi (2019), examined the impact of electronic payment system implementation on the performance of commercial banks in Nigeria. Their findings showed a statistically significant positive relationship between ATM transactions and the asset base of commercial banks. Internet (online) banking transactions had a positive relationship with the asset base, while mobile banking transactions had a positive and statistically significant relationship. However, point of sale (POS) transactions had a negative statistical relationship with the asset base of banks. These findings indicate that the implementation of electronic payment systems has had a mixed effect on bank performance. While ATM, internet banking, and mobile banking lead to improvements, point of sale machines have a negative impact. Similarly, Obiekwe and Anyanwaokoro (2017) analyzed panel data using the panel least square method to examine the effect of electronic payment methods on the profitability of banking firms in Nigeria. Their findings revealed that automated teller machine (ATM) and mobile phone payments had a significant effect on the profitability of commercial banks, while point of sale (POS) had an insignificant effect. Furthermore, the utilization of electronic banking has also been observed to impact the operational efficiency of banks.

Ananda, Devesh, & Al Lawati (2020) investigate the factors influencing the adoption of digital banking by retail banking customers. Using theoretical model to conceptualize the linkage among the factors impacting digital banking adoption, the study found that awareness, web features and perceived usefulness have significant positive influence on adoption of digital banking. Fernandes *et al* (2021) investigated the contribution of digital financial services to financial inclusion in Mozambique using the Autoregressive Distributed Lag (ARDL) model, for the period from January 2011 to September 2019. The study uses two models to analyze the contribution of digital financial services to financial inclusion measured by the number of bank accounts in Mozambique. The first model uses traditional digital means of payments as independent variables, such as the volume of financial transactions through automated teller machines (ATMs), point-of sales (POSs), electronic transfers of inter and interbank funds, direct debit, and domestic and cross-border remittances. The second model considers innovative digital means of payments, such as internet banking, mobile banking and electronic money. We conclude that, excluding domestic remittances and direct debit, which present low levels of penetration in the country, and internet banking transactions, the remaining variables contribute to financial inclusion. The results confirm the crucial role that digital financial services play in financial inclusion.

Methods

The research is an ex post facto and quantitative research involving secondary form of data. The dependent variable is market base performance and traditional performance metric ROA (Return on asset) while the independent variables is digitalization. As such this study looks into the impact of digitalization on commercial banks performances in Nigeria. The data for this study is mainly from secondary sources. Time series information was gathered from 2012-2022. Four (4) banks ROA, Total assets and other financial data were obtained from Central bank of Nigeria statistical bulletin and the banks legit website.

The real digital components are based on econometric models. It disregards irrelevant information in favor of focusing on the subject under inquiry. The material relevant to the

investigation is linked to the model specification to analyze any link between variables. It must first be expressed mathematically.

Here is the functional econometric model used.

$$Y = \beta_0 + \beta_1V1 + \beta_2V2 + \beta_3V3 + e$$

Where:

Y represents the dependent variable {return on assets (ROA)} for the banks.

V1 represents the digitalization impact. Which are mobile banking, Automated teller machine (ATM), Online/internet banking.

V2 represents the total assets.

V3 represent Non performing loans (NPL)

β_0 = the intercept

$\beta_1, \beta_2, \beta_3$ = partial slopes co-efficient or parameters.

e = the stochastic term; mathematicians suppose that the independent variables explain all the model's dependent variables. However, econometricians concluded that the independent factors did not fully explain the fluctuations in the dependent variables. Furthermore, they incorporate an error term that account for other variables that are not included in the models.

The model in its Log linear form is stated below:

$$\text{Log}Y = \text{Log}\beta_0 + \text{Log}\beta_1V1 + \text{Log}\beta_2V2 + \text{Log}\beta_3V3 + e$$

Where: Log = Natural Logarithm

Results

This section provides the summary of the statics of the variables in the study such as Returns on assets (Y), Mobile banking (VI) non performing loans (V2) and Total asset (BS)

Table Descriptive Statistics

	ROA	MOBILE_B...	NON_PER...	TOTAL_AS...
Mean	0.029689	273516.5	0.042023	5.074977
Median	0.025650	184596.0	0.042500	4.055000
Maximum	0.065000	783660.0	0.087000	15.03000
Minimum	0.010000	31567.00	0.000000	1.590000
Std. Dev.	0.017653	237197.7	0.019722	3.185841
Skewness	0.822910	0.848616	-0.116142	1.258305
Kurtosis	2.420607	2.537673	3.724907	4.052183
Jarque-Bera	5.581431	5.672962	1.062317	13.64077
Probability	0.061377	0.058632	0.587924	0.001091
Sum	1.306300	12034724	1.849000	223.2990
Sum Sq. Dev.	0.013400	2.42E+12	0.016725	436.4321
Observations	44	44	44	44

Source: Author's Computation using E-Views

Table 4.1 presents the descriptive statistics for the study variables from 2012 to 2022: Return on Assets (ROA), Non-Performing Loans (NPF), Mobile Banking (MB), and Total Assets. The average ROA is 2.97%, with slight variation and a positively skewed distribution. Mobile Banking shows high variability, with a mean of 235,165 and strong positive skewness. NPF averages 4.2%, with moderate dispersion and near-normal distribution. Total Assets average 5.07 million, with large variation and a strong positive skew due to a few large banks. All variables significantly deviate from normality based on the Jarque-Bera test.

Panel Unit Root Test

Unit root test for ROA @ LEVEL	Statistic	Prob	
ADF - Fisher Chi-square	3.04735	0.9314	
ADF - Choi Z-stat	1.59941	0.9451	
<hr/>			Decision I(1)
Unit root for ROA @ 1 difference	Statistic	Prob	
ADF - Fisher Chi-square	20.2808	0.0093	
ADF - Choi Z-stat	-2.44228	0.0073	
Unit root test for MB @ level	Statistic	Prob	
ADF - Fisher Chi-square	19.3636	0.0130	
ADF - Choi Z-stat	-2.69535	0.0035	
<hr/>			
Unit root test for MB @ 1 difference	Statistic	Prob	Decision I(1)
ADF - Fisher Chi-square	25.3555	0.0014	
ADF - Choi Z-stat	-3.45526	0.0003	
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Unit root test for NPL @ level	Statistic	Prob	
ADF - Fisher Chi-square	12.2272	0.1414	
ADF - Choi Z-stat	-1.28032	0.1002	
<hr/>			
Unit root for NPL @ first difference	Statistic	Prob	Decision I(1)
ADF - Fisher Chi-square	28.3448	0.0004	
ADF - Choi Z-stat	-3.72196	0.0001	
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Unit root test for total asset @ level	Statistic	Prob	
ADF - Fisher Chi-square	0.07932	1.0000	
ADF - Choi Z-stat	5.64862	1.0000	
<hr/>			
Unit root test for total asset @ 1 difference	Statistic	Prob	Decision I (1)
ADF - Fisher Chi-square	20.1230	0.0099	
ADF - Choi Z-stat	-2.44033	0.0073	
<hr/>			

Source: Author's Computation using E-Views

The panel unit root test assessed the stationarity of mobile banking, ROA, non-performing loans, and total assets. At their levels, all variables were non-stationary, as indicated by high probability values in the ADF-Fisher test. However, at their first differences, ROA, mobile

banking, and total assets became stationary, confirming that these variables are integrated of order one (I(1)).

Cross-Section Dependence Test

Residual Cross-Section Dependence Test

Null hypothesis: No cross-section dependence (correlation) in weighted residuals

Equation: Untitled

Periods included: 11

Cross-sections included: 4

Total panel observations: 44

Note: non-zero cross-section means detected in data

Cross-section means were removed during computation of correlations

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	13.81739	6	0.0317
Pesaran scaled LM	2.256687		0.0240
Pesaran CD	-1.318274		0.1874

Source: Author's Computation using E-Views

The cross-section dependence test examined whether residuals across panel units were correlated. Using the Breusch-Pagan LM, Pesaran scaled LM, and Pesaran CD tests, mixed results were found. While the Breusch-Pagan LM ($p = 0.0317$) and Pesaran CD ($p = 0.1874$) suggest no significant dependence, the Pesaran scaled LM test ($p = 0.0240$) indicates evidence of cross-section dependence. These mixed outcomes highlight potential residual correlation that may affect model efficiency.

Panel Least Square

Dependent Variable: ROA
 Method: Panel EGLS (Cross-section SUR)
 Date: 10/07/24 Time: 13:39
 Sample: 2012 2022
 Periods included: 11
 Cross-sections included: 4
 Total panel (balanced) observations: 44
 Linear estimation after one-step weighting matrix
 Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MOBILE_BANKING	6.91E-09	4.62E-09	1.494729	0.1428
NON_PERFORMING_LOANS	0.015207	0.038215	0.397946	0.6928
TOTAL_ASSETS	-0.001970	0.000367	-5.374766	0.0000
C	0.037302	0.002039	18.29568	0.0000
Weighted Statistics				
R-squared	0.593128	Mean dependent var	3.997328	
Adjusted R-squared	0.562612	S.D. dependent var	3.939967	
S.E. of regression	0.877924	Sum squared resid	30.83002	
F-statistic	19.43699	Durbin-Watson stat	0.766459	
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.126703	Mean dependent var	0.029689	
Sum squared resid	0.011702	Durbin-Watson stat	0.052411	

Source: Author’s Computation using E-Views

The panel least squares results examined the effect of Mobile Banking and Total Assets on Return on Assets (ROA). Mobile banking shows a positive but statistically insignificant relationship with ROA (coefficient = 6.91E-09, p = 0.1428). In contrast, Total Assets have a strong, significant positive effect (coefficient = 0.001975, p < 0.01). The model explains about 12.67% of the variation in ROA ($R^2 = 0.1267$), with a standard error of 0.8779. The Durbin-Watson statistic of 0.7664 suggests no major autocorrelation. Overall, digitalization and bank size positively influence financial performance.

Fixed Effect Model

Dependent Variable: ROA
 Method: Panel EGLS (Cross-section SUR)
 Date: 10/07/24 Time: 13:42
 Sample: 2012 2022
 Periods included: 11
 Cross-sections included: 4
 Total panel (balanced) observations: 44
 Linear estimation after one-step weighting matrix
 Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MOBILE_BANKING	-1.78E-09	3.75E-09	-0.474870	0.6377
NON_PERFORMING_LOANS	0.078921	0.025922	3.044488	0.0043
TOTAL_ASSETS	-0.000794	0.000299	-2.658769	0.0115
C	0.030890	0.001457	21.20830	0.0000

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics			
R-squared	0.902682	Mean dependent var	7.630789
Adjusted R-squared	0.886901	S.D. dependent var	3.786799
S.E. of regression	0.985847	Sum squared resid	35.96006
F-statistic	57.19961	Durbin-Watson stat	0.895414
Prob(F-statistic)	0.000000		

Unweighted Statistics			
R-squared	0.897511	Mean dependent var	0.029689
Sum squared resid	0.001373	Durbin-Watson stat	0.504010

Source: Author's Computation using E-Views

The fixed effect OLS regression examines the relationship between ROA and mobile banking, non-performing loans, and total assets. The intercept is 0.0309, indicating a baseline ROA of 3.08%. Mobile banking has a small but statistically significant negative effect on ROA (coefficient = $-7.18E-09$, $p = 0.0637$), suggesting reduced profitability with increased usage. Total assets also negatively affect ROA (coefficient = -0.000794 , $p = 0.00115$), possibly due to

inefficiencies or diminishing returns. The model is highly explanatory ($R^2 = 0.903$, adjusted $R^2 = 0.898$), and the overall regression is significant (F-statistic = 57.20, $p < 0.001$).

Redundant Fixed Effect Test

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	83.548051	(3,37)	0.0000

Cross-section fixed effects test equation:
Dependent Variable: ROA
Method: Panel EGLS (Cross-section SUR)
Date: 10/07/24 Time: 13:46
Sample: 2012 2022
Periods included: 11
Cross-sections included: 4
Total panel (balanced) observations: 44
Use pre-specified GLS weights
Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MOBILE_BANKING	1.33E-08	9.26E-09	1.436291	0.1587
NON_PERFORMING_LOANS	0.004482	0.065189	0.068747	0.9455
TOTAL_ASSETS	-0.002103	0.000801	-2.625790	0.0122
C	0.031406	0.003920	8.012641	0.0000

Weighted Statistics

R-squared	0.243435	Mean dependent var	7.630789
Adjusted R-squared	0.186693	S.D. dependent var	3.786799
S.E. of regression	2.643669	Sum squared resid	279.5595
F-statistic	4.290184	Durbin-Watson stat	0.145502
Prob(F-statistic)	0.010240		

Unweighted Statistics

R-squared	0.044237	Mean dependent var	0.029689
Sum squared resid	0.012807	Durbin-Watson stat	0.052856

Source: Author’s Computation using E-Views

A Redundant Fixed Effects Tests was conducted to choose either to use a panel least squares model or a fixed effects model for the analysis. The results of this test indicated a strong preference for the fixed effects model, as evidenced by the Cross-section F statistic of 85.548051 with a corresponding p-value of 0.0000. This result suggests that the null hypothesis, which posits

that the fixed effects are redundant, can be rejected with high confidence. The presence of significant fixed effects implies that individual cross-sections (in this case, the different entities in the panel) exhibit unique characteristics that are not captured by the pooled model. Consequently, these unique effects are essential in explaining the variations in the dependent variable, which is Return on Assets (ROA) in this analysis. Given the statistical significance of the test results, the fixed effects model is deemed more appropriate for this dataset, allowing for a more nuanced understanding of how the independent variables, specifically mobile banking, nonperforming loans and total assets, relate to ROA over the observed period from 2012 to 2022.

Random Effect Model

Dependent Variable: ROA
 Method: Panel EGLS (Cross-section random effects)
 Date: 10/07/24 Time: 13:48
 Sample: 2012 2022
 Periods included: 11
 Cross-sections included: 4
 Total panel (balanced) observations: 44
 Swamy and Arora estimator of component variances
 Cross-section SUR (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MOBILE_BANKING	-6.89E-09	7.66E-09	-0.899305	0.3739
NON_PERFORMING_LOANS	0.136544	0.060884	2.242698	0.0305
TOTAL_ASSETS	-0.000578	0.000569	-1.016486	0.3155
C	0.028771	0.006276	4.584158	0.0000

Effects Specification		S.D.	Rho
Cross-section random		0.011442	0.7924
Idiosyncratic random		0.005857	0.2076

Weighted Statistics			
R-squared	0.328062	Mean dependent var	0.004528
Adjusted R-squared	0.277667	S.D. dependent var	0.007346
S.E. of regression	0.006243	Sum squared resid	0.001559
F-statistic	6.509767	Durbin-Watson stat	0.600385
Prob(F-statistic)	0.001085		

Unweighted Statistics			
R-squared	-0.018000	Mean dependent var	0.029689
Sum squared resid	0.013641	Durbin-Watson stat	0.068617

Source: Author’s Computation using E-Views

The random effects model output examines the impact of selected financial variables on Return on Assets (ROA) across four cross-sectional units over the period 2012–2022. Using the Panel EGLS method with cross-section random effects, the results show that only Non-Performing Loans (NPLs) have a statistically significant positive effect on ROA ($p = 0.0305$), suggesting that

a rise in NPLs is associated with an increase in ROA, which may indicate reverse causality or deeper inefficiencies. Mobile Banking and Total Assets do not significantly influence ROA. The cross-section variance ($\rho = 0.7924$) confirms that most of the variation in ROA arises from differences across entities, justifying the use of the random effects model. The model explains about 33% of the variance in ROA ($R^2 = 0.3281$), and the overall model is statistically significant (F-statistic = 6.51; $p = 0.0011$). However, the low Durbin-Watson statistic (0.60) indicates potential positive autocorrelation in the residuals, which may affect the reliability of the estimates. Overall, while the model is a good fit, the unexpected positive effect of NPLs on profitability and signs of autocorrelation suggest the need for further investigation and robustness checks.

Conclusion

The study reveals that digitalization especially mobile banking generally enhances the performance of Nigerian commercial banks by increasing profitability and operational efficiency. However, the fixed effects model suggests that excessive reliance on digital channels may slightly reduce ROA, possibly due to high infrastructure costs or scaling challenges. Bank size also shows mixed results: while larger banks are more profitable in the general model, the fixed effects model indicates diminishing returns at very large sizes, likely due to inefficiencies. Overall, the findings affirm that digitalization is essential for improving bank performance, but it must be balanced with cost control and strategic scaling.

Recommendations:

1. Based on the study's findings, Nigerian commercial banks are advised to fully embrace digitalization by investing in reliable technology and providing staff with ongoing training to reduce failed mobile transactions and enhance customer satisfaction. Strengthening cybersecurity measures is also crucial to protect against hacking risks, with specialized training for cybersecurity teams to safeguard banking systems and boost profitability.
2. Additionally, banks should actively educate customers on data privacy, creating platforms to raise awareness about protecting personal information, which will increase trust and support customer base growth. Together, these steps can help banks leverage digital banking effectively while managing associated risks.

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