FINANCIAL INNOVATION AND THE PERFORMANCE OF DEPOSIT MONEY BANKS IN NIGERIA

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DOI: https://doi.org/10.64633/wissj.v10i3.03

Keywords

Digital financial innovation; Bank performance; Deposit money banks (DMBs); Financial technology (FinTech); System GMM

Abstract

Despite the increase expansion of digital financial innovation in Nigeria, its long term effect on the performance of Deposit Money Banks remains unresolved. Prior studies are mostly cross sectional, short term, or insufficiently treated endogeneity concerns in bank performance analysis. This study examines the effect of digital financial innovation on the performance of Deposit Money Banks (DMBs) in Nigeria between 2014 and 2023. The study uses a quantitative ex post facto design and System GMM estimation. It assesses how Internet banking, mobile banking, Automated Teller Machines (ATMs) and Point-of-Sale (POS) terminals influence profitability measured by return on assets and return on equity. The results show that all four innovation indicators exert positive and statistically significant effects on bank performance, indicating that technology-enabled channels enhance operational efficiency, expand service accessibility and strengthen revenue generation. Diagnostic tests confirm the robustness of the model and validity of instruments used. The findings are consistent with Schumpeter's Theory of Innovation and the Diffusion of Innovation Theory, suggesting that technological adoption is a key driver of sustainable performance in Nigerian banking. The study recommends increased investment in secure digital infrastructure, innovation supportive regulatory frameworks and strengthened digital financial literacy to maximise performance gains from digital transformation.

Introduction

Digital financial innovation has expanded rapidly within the Nigerian banking sector, yet its implications for the performance of Deposit Money Banks are not fully understood. Nigerian DMBs face persistent challenges such as system failures, network disruptions, cash shortages in ATMs and security risks that may undermine customer trust and weaken the effectiveness of digital channel (Adio Moses, 2021; Somoye, Ilo&Yunusa, 2019). Low digital literacy, especially in rural areas, further limits the full utilisation of innovative digital platforms, restricting potential performance gains for banks (Akintoye et al., 2022). These challenges highlight the complexity of digital transformation in developing economies and underscore the need for empirical investigations into how digital financial innovation affects bank performance.

The banking sector plays a pivotal role in economic development by mobilising savings, allocating credit, facilitating payments, and supporting productive investments that drive growth. In emerging economies such as Nigeria, Deposit Money Banks (DMBs) dominate financial intermediation, making their performance central to financial system stability and economic progress (Nicolas, Tarazi& Ozturk, 2023; Almaw, 2020). The performance of DMBs reflects their ability to generate sustainable earnings, absorb shocks and deliver value to stakeholders, thereby maintaining confidence in the financial system (Abiodun, Somoye&Ilo, 2023; Awan & Parveen, 2023).

Over the last two decades, technological advancement has reshaped global banking operations. Digital financial innovation, defined as the adoption and integration of technology driven tools and platforms in the delivery of financial services, has emerged as a significant driver of transformation across banking institutions worldwide. Digital channels including internet banking, mobile banking, Automated Teller Machines (ATMs) and Point of Sale (POS) terminals have enhanced service efficiency, transactional speed and customer convenience (Domeher et al., 2022; Chatterjee, 2020).

In Nigeria, the growth of digital banking has been accelerated by increased internet penetration, smartphone usage and the expansion of financial technology infrastructures. ATMs and POS terminals are now widely deployed across urban and semi urban areas, enabling faster transactions and reducing the need for traditional branch banking (Otuonye&Miftahu, 2023; Ohiani, 2021). Mobile banking and internet banking have become essential channels through which customers perform balance enquiries, fund transfers, bill payments and other financial transactions, contributing to improved service delivery and increased revenue for DMBs through electronic charges and fees (Phan, Tran &Iyke, 2020; Abidin et al., 2021). Global evidence further shows that electronic payments have expanded significantly, supporting financial inclusion and improving the efficiency of banking operations (World Payment Report, 2022; Espinosa Vega et al., 2020).

Existing literature on digital financial innovation and bank outcomes provides mixed findings. Some studies report that innovations such as mobile banking and internet banking enhance revenue generation, transaction volumes and operational efficiency, thereby improving bank performance (Ratnawati, 2020; Dahiya & Kumar, 2020). Other studies note that digital innovation may increase operational costs in the short run due to investment in technology, infrastructure and cyber protection, thereby exerting downward pressure on profitability

(Chukwunulu&Ibenta, 2021). Despite these contributions, few studies in Nigeria have comprehensively examined the effects of specific digital channels such as ATMs, POS, mobile banking and internet banking within a unified framework.

This study fills this gap by examining the effect of digital financial innovation on the performance of Deposit Money Banks in Nigeria, using a panel dataset covering ten major DMBs.

Conceptual Clarifications

Digital Financial Innovation

Digital financial innovation refers to the introduction, adoption and utilisation of technology-driven processes, platforms and delivery channels that improve the efficiency, accessibility and quality of banking services. It encompasses technological tools such as Automated Teller Machines (ATMs), Point of Sale (POS) terminals, mobile banking and internet banking, which collectively reshape how financial institutions interact with customers and conduct transactions. Scholars generally view digital innovation as a strategic capability that enhances competitiveness, operational efficiency and service quality, particularly in environments where customer preferences and technological conditions continue to evolve (Ejinkonye and Okonkwo, 2021; Ibe and Obialor, 2022).

Digital financial innovation has expanded rapidly within Nigeria's banking sector due to advancements in financial technology, increased internet penetration and the proliferation of mobile devices. These developments have encouraged Deposit Money Banks to adopt electronic platforms that promote faster payments, reduce transaction costs and extend financial services beyond traditional banking halls. ATMs have become a key component of service automation, enabling cash withdrawals, transfers and utility payments at any time and location. POS terminals have supported card-based transactions in retail outlets and facilitated agent banking activities, thereby promoting cashless payments and expanding financial access. Mobile banking, delivered through applications and USSD channels, has improved convenience for customers and supported financial inclusion by reaching unbanked populations. Internet banking has similarly transformed service delivery by enabling real-time account management and electronic payments without the constraints of physical branch locations (Ohiani, 2021; Phan, Tran and Iyke, 2020).

Banking Sector

Banking sector performance reflects the ability of Deposit Money Banks to utilise financial and non-financial resources efficiently in achieving profitability, stability and long-term value creation. It encompasses both the financial outcomes of banking operations and broader organisational attributes such as governance quality, risk management and institutional resilience (Abiodun, Somoye and Ilo, 2023; Ibe and Obialor, 2022). From a financial perspective, performance is assessed through the extent to which banks convert their assets into income while maintaining sound credit quality and liquidity positions. Poor asset quality exposes banks to credit, market and liquidity risks, affecting stability and shareholder value (Ezeala and Obi, 2022).

Bank performance is therefore viewed as an outcome of both internal and external influences. Internal factors include managerial efficiency, operational structure, asset utilisation and risk-taking behaviour, while external factors relate to macroeconomic conditions, regulatory

environments and competitive pressures. In all cases, performance serves as a measure of how effectively banks generate returns that compensate shareholders for their capital investment (Resa, Mithi and Kosgei, 2022; Wanalo, Mande and Ngonga, 2020).

The assessment of performance relies largely on financial ratios that summarise profitability, liquidity and value creation. Common indicators include return on assets, return on equity, net interest margin, earnings per share and loan-to-deposit ratios. These ratios allow for comparative evaluation within the sector and provide insight into management's capacity to generate sustainable earnings from available resources (Okeke and Ezeala, 2023; Jote, 2023). Profitability measures, in particular, are central to evaluating the efficiency of bank operations and the robustness of their income-generating processes (Awan and Parveen, 2023).

In contemporary literature, two broad approaches are distinguished in assessing bank profitability. The risk-neutral approach focuses on traditional indicators such as return on assets, return on equity and net interest margin, which highlight the basic earnings profile of banks. The risk-based approach incorporates risk exposure into performance measurement through indicators such as risk-adjusted return on assets and risk-adjusted return on equity (Olowofela, Donfack and Soh, 2025; Sanni, Salami and Uthman, 2020). This approach provides a more comprehensive view of sustainability by recognising the inherent uncertainties in banking operations. The use of absolute profit measures has also been noted, although such measures are limited by their failure to account for the level of resources used to generate the profit (Dabo, 2020).

Theoretical Review

Schumpeter's Theory of Innovation

Schumpeter's Theory of Innovation posits that economic progress is driven by the continuous introduction of new products, processes and organisational methods that transform existing market structures. Innovation, according to Schumpeter, generates new opportunities for profit and competitive advantage by replacing outdated technologies through the process of creative destruction. The theory distinguishes between invention, innovation and diffusion, emphasising the central role of entrepreneurs and institutions in commercialising technological advances to stimulate growth and productivity. Within the financial sector, Schumpeter argues that technological advancement within financial intermediaries catalyses development by improving efficiency, reducing operational frictions and expanding service delivery.

This theory aligns directly with the objective of the present study because digital financial innovations such as ATMs, POS terminals, mobile banking and internet banking constitute the type of technological transformation Schumpeter describes as drivers of firm-level performance. These innovations facilitate cost reduction, enhance service delivery and broaden customer access, thereby supporting improvements in profitability and asset utilisation. Empirical studies in the banking sector also reinforce Schumpeter's view that financial innovation strengthens performance by stimulating competition and operational efficiency. Consequently, the theory provides a strong conceptual basis for examining how the adoption of digital platforms influences the financial performance of Deposit Money Banks in Nigeria.

Diffusion of Innovation Theory

The Diffusion of Innovation Theory, developed by Everett Rogers, explains how new technologies and practices spread within a social or organisational system over time. The theory highlights five characteristics of an innovation that influence adoption: relative advantage, compatibility, complexity, trialability and observability. It further proposes that adopters fall into categories such as innovators, early adopters, early majority, late majority and laggards, each contributing to the rate and pattern of diffusion. Communication channels, organisational culture and social influence shape how quickly and effectively a new technology gains acceptance.

This theory is relevant to the present study because the adoption and utilisation of digital financial innovations vary significantly across Nigerian banks and their customers. ATMs, POS terminals, mobile banking and internet banking follow typical diffusion patterns in which some banks lead technological adoption while others adopt gradually based on perceived benefits and demonstrated performance outcomes. These differences in adoption intensity can influence revenue generation, cost efficiency and overall bank performance. Thus, the theory provides insight into why digital innovations may enhance the performance of some banks more than others, depending on their readiness to adopt, invest in and integrate these technologies. It also supports the study's focus on measurable indicators of digital innovation by explaining how patterns of use shape organisational outcomes.

Empirical Review

Zhou and Xu (2023) focused on the direct influence of bank digital transformation on the performance and behavior of borrowing enterprises among Chinese listed companies and commercial banks. The study found a positive effect of bank digital transformation on enterprise innovation output. Mechanism tests showed that bank digital transformation contributes to corporate innovation by alleviating corporate financial constraints and improving corporate governance. Further analysis demonstrated that bank digital transformation also helps promote corporate innovation efficiency as measured by the proportion of patent output to total R&D input and corporate innovation output as measured by firms' invention patent applications and patent grants. This finding aligns with Diffusion of Innovation theory, as banks adopting digital tools contribute to the diffusion of innovation by alleviating financial constraints and improving governance. This underscores the role of technological adoption in fostering economic and corporate innovation.

Zu, Gu, Li, and Bonsu (2019) empirically examined the effects of financial innovation on bank profitability in Africa from 2015 to 2018 using panel data regression model. The results showed that ROA and ROE both consistently showed considerable persistence. The results also showed that bank cards and ATMs had a positive effect on banks' financial success, with the exception of POS terminals and Internet banking. More significantly, the profitability of the majority of these developing African nations affected the ratio of ATMs to branch locations, which is quite crucial. This finding aligns with diffusion of innovation theory. Financial innovations like ATMs and bank cards contribute significantly to profitability by improving customer accessibility and operational efficiency. The findings highlight the importance of adopting and spreading technological advancements for sustained growth in the banking sector.

Jote (2023) examined the impact of financial innovations on financial performance of commercial banks in Ethiopia, using analysis of variance (ANOVA) and multiple regression. Findings indicate that mobile banking, online banking, and agency banking have positive and statistically significant effects on the financial performance of commercial banks. This implies that financial innovations have positive and significant effects on the financial performance of commercial banks. This finding aligns with diffusion of innovation theory. The study's finding that mobile banking, online banking, and agency banking positively impact financial performance suggests that technological innovations are rapidly diffusing through the Ethiopian banking sector. This highlights the importance of embracing digital transformations to improve efficiency and customer engagement.

Hayder (2023) studied the impact which financial innovations have on the financial performance of banks in Iraq. The research paper employed mobile money payments, ATMs transaction values and Point of sale terminals as proxies to financial innovations and return on assets and return on equity as measures for banking financial performance. Hayder, (2023) study concluded as to the case of the Iraqi banking system that mobile money payments had the greatest impact on the financial performance of banks in Iraq due to large volume of transactions. This finding aligns with diffusion of innovation theory. The study finds that mobile money payments have the greatest impact on bank performance due to the high transaction volumes. This underscores the importance of adopting mobile financial innovations in markets like Iraq, where they can drive significant improvements in banking performance and service accessibility.

Meziane and Bouguetaia (2023) examined the impact of financial technology on the performance of banks in Algeria, using multiple linear regression models. The study found that the expansion of the scope of application of financial technology allows banks to gain a prominent position in the banking market, reduce costs, manage risks, predict crises, achieve customer satisfaction, promote and diversify services, which positively affects the development of financial and commercial performance of commercial banks in Algeria. This finding aligns with Schumpeter's theory of innovation. The expansion of financial technologies allows banks to innovate and improve efficiency, leading to better performance. The adoption of financial technologies is crucial for banks in Algeria to improve their market positioning and financial performance, and they should further invest in technological advancements.

Uzikwambara, Kihooto and Mudakemwa (2023) examined the effect of bank innovation on the financial performance of commercial bank in Rwanda, using multiple regressions model. The findings revealed that there is very significant and strong effect of bank innovation on the financial performance of commercial bank in Rwanda. The study also revealed that there is very strong correlation between bank innovation and finance performance of commercial bank. This finding aligns with Schumpeter's theory of innovation. Innovation in banking services enhances operational efficiency and financial performance. Banks should embrace innovations to improve their financial performance and remain competitive in a rapidly evolving market.

Using Ordinary Least Square (OLS), Andabai and Bina (2019) explored the effect of cashless policy and DMBs performance Nigeria from 2000 to 2018. Cashless policy was proxy automated teller machine (ATM), point-of-sale (POS), and mobile banking (MB) while return

on assets was proxy for DMBs performance. There is a significant impact of automated teller machine transaction, Point on Sales terminal transactions and electronic mobile payment on return on assets of DMBs in Nigeria. This finding aligns with Schumpeter's theory of innovation. The finding highlights how e-banking technologies like ATMs, POS, and mobile banking impact bank performance. Diffusion of innovation theory posits that the spread of innovations across society influences organizational behavior. This study suggests that the adoption of e-banking technology facilitates better operational performance in banks.

Thankgod, Alhassan, and James (2019) looked at how Nigerian DMBs' financial performance was affected by electronic payments. DMBs profitability was used to gauge financial performance, while ATMs, internet banking, and point-of-sale (POS) were used to measure electronic banking. A multiple regression methodology was used. According to the study, ATMs have no statistically meaningful impact on bank profitability and neither add to it nor make it worse. Yet, POS makes a considerable statistical contribution to bank profitability and contributes positively to it. Also beneficial to bank profitability and statistically significant to bank profitability is Internet banking. This finding aligns with Schumpeter's theory of innovation. The finding emphasizes the positive effects of e-banking innovations, especially POS and Internet banking, on bank profitability. Schumpeter's theory suggests that innovation drives business profitability and competitiveness, and the findings reflect that financial technology adoption can help improve bank performance.

Taiwo and Agwu (2019) examined the role of E-banking on the operational efficiency of commercial banks in Nigeria. Primary data were obtained by administering questionnaires to staff of four purposively selected banks (Ecobank, UBA, GTB and First bank). Pearson correlation was used to analyze the results obtained using the Statistical Package for Social Sciences (SPSS) and it was observed that banks' operational efficiency in Nigeria since the adoption of electronic banking has improved compared to the era of traditional banking. This improvement was noticed in the strength of banks, revenue and capital bases, as well as in customers' loyalty. This finding aligns with Schumpeter's theory of innovation. The study found that the adoption of electronic banking has improved banks' operational efficiency, indicating that technological innovation, as suggested by Schumpeter, fosters economic growth and competitiveness in the banking sector.

Frank and Binaebi (2019) examined the impact of electronic payments system implementation on the financial performance of Nigerian's commercial banks. The research uses annual data ranging from 2009 to 2018 and adopts the ordinary least square regression technique. The empirical results of the study provided that an implementation of payments system innovations has had a mixed effect on the financial performance of banks in Nigeria. ATM, internet payment, and mobile payments have a positive effect on the financial performance of banks, while POS terminals have a negative effect on the bank performance. This finding aligns with Schumpeter's theory of innovation. The finding indicates that while some electronic payment methods have a positive effect on financial performance, others (like POS terminals) may have a negative impact. Public interest theory would suggest that the regulatory framework must ensure that innovations in payments systems serve the public interest and improve banking services.

Oniore and Okoli (2019) analysed the impact of electronic banking on the performance of deposit money banks in Nigeria from 2006 to 2017 using time series quarterly data and employing the ordinary least square technique in the analysis. The result showed that all the variables used are appropriately significant over the long term except for the inter-bank transfer variable, which is negatively significant. In their conclusion, e-banking in Nigeria gradually enhances the performance of banks that could boost economic growth in Nigeria. Accordingly, the study recommends banks to use strategic tools in the deployment of the right technology, to achieve their goals and objectives in line with global best practices, given an efficient regulatory framework from the Central Bank of Nigeria (CBN). This finding aligns with public interest theory. The study found that e-banking enhances long-term performance, suggesting the need for an efficient regulatory framework. Public interest theory emphasizes the role of regulation in ensuring that technological advancements benefit the broader public by improving service delivery and economic growth.

Akani and Tony-Obiosa (2020) studied the effects of financial innovation on the profitability of deposit money banks in Nigeria for the period 2009 to 2017, using panel data regression. Findings revealed that automated teller machine and electronic fund transfer have negative relationship with return on equity while internet banking, mobile banking and investment on information communication technology have positive relationship with return on equity. This finding aligns with Schumpeter's theory of innovation which underscores that innovation can disrupt and reshape industry performance, which is reflected in the varying effects of financial innovations. The study highlights the mixed effects of financial innovations (e.g., ATM, mobile banking) on profitability, indicating that while some innovations may not be profitable (e.g., ATM), others like internet banking positively affect bank profitability.

Ibekwe (2021) studied the effect of financial innovations on the performance of deposit money banks in Nigeria. The study adopted an ex-post facto research design which were sourced from Central Bank of Nigeria Statistical Bulletin, CBN Annual Report and Statement of Accounts. The result of the study indicate that automated teller machine, mobile banking and point of sales have positive and significant effect on return on asset while internet banking has negative and insignificant effect in return on asset. The study thus concludes that financial innovation have positive effect on the profitability of commercial banks in Nigeria and have enhance the return on asset of the commercial banks in Nigeria. This finding aligns with diffusion of innovation theory. Financial innovations like mobile and ATM banking are beneficial for profitability, emphasizing that the successful adoption of innovative financial services is critical for improving banking performance.

Ejinkonye and Okonkwo (2021) examined the relationship between financial innovation and financial intermediation in Nigeria for the period 2009 to 2018, using the ordinary least square method. The results showed that there is a positive and significant relationship between financial innovation (value of Automated Teller Machine) and financial intermediation; there is a positive but no significant relationship between financial innovation (internet banking) and financial intermediation; there is a positive but no significant relationship between financial innovation (mobile banking) and financial intermediation; and there is no positive and significant relationship between financial innovation (point of sale transactions) and

financial intermediation. This finding aligns with diffusion of innovation theory which suggests that the spread and adoption of new financial products or services can affect the financial system's efficiency. The findings suggest that innovations like ATM transactions have a significant impact on financial intermediation, pointing to the potential of such innovations to enhance the intermediation role of banks in the economy.

Ibe and Obialor (2022) examined the effect of financial innovation on the performance of deposit money banks in Nigeria from 2009 to 2020, using ordinary least square (OLS) method. The result revealed that point of sale, payment mobility, automated teller machine and web internet had positive effect on the performance of deposit money banks in Nigeria. This depicts that financial innovation helps in increasing profitability and return on assets of deposit money banks in Nigeria. This finding aligns with Schumpeter's theory of innovation which suggests that innovation in financial products is essential for growth and improved performance. The positive relationship between financial innovations and bank performance suggests that investing in technological innovations can significantly enhance profitability and efficiency in banking.

Gbanador, Makwe and Olushola (2022) investigated the impact of financial innovation on the performance of Deposit Money Banks in Nigeria from 2009 to 2021, using the ARDL model. Findings showed that POS had the highest performance while internet banking had the least. More so, the variables are statistically significant. The authors recommended that internet accessibility should be made cheaper for easy access and usage. Banks should reduce the ownership cost of POS machine and rural banks should conduct periodic seminars and knowledge dissemination programmes for their rural customers so as to increase their knowledge of mobile banking activities. This finding aligns with diffusion of innovation theory which posits that the widespread adoption of innovative banking technologies can improve efficiency and performance. The study's findings suggest that expanding access to mobile banking and POS systems can significantly improve banking performance, encouraging further diffusion of these technologies, particularly in rural areas.

Mohammed, Ibrahim and Muritala (2022) examined the effect of payments system innovations on the performance of commercial banks in Nigeria, using ARDL bounds approach to co-integration was adopted on quarterly time-series data from Q1 2007 to Q4 2020 to test the causal relationship between payments system innovations and financial performance of commercial banks in Nigeria. The results indicated that mobile payment, POS transactions and internet payment have positive and significant impact on return on assets of commercial banks in Nigeria, while RTGS has negative impact on the return of assets. This finding aligns with Schumpeter's theory of innovation which highlights the role of innovation in enhancing competitive advantage and economic growth. The positive effects of payment system innovations on bank performance highlight the importance of continuous innovation in the financial sector to maintain competitiveness and profitability.

Owonye and Obonofiemro (2022) examined the relationship between covid-19 pandemic, financial disruptive innovations and performance of deposit money banks (DMB's) in Nigeria from 2000 to 2020, using Multiple Regression analysis. The finding revealed that ATM and POS has positive significant effect on ROE of DMB's in Nigeria while INTB and MB has negative insignificant effect on ROE of

DMB's in Nigeria. Hence, the study concluded that the relationship between financial disruptive innovations and performance of deposit money banks in Nigeria significant, and it's affected the banking industry positively. This finding aligns with Schumpeter's theory of innovation which emphasizes the role of innovation in economic development and growth, which is evident in the positive impact of ATM and POS on the performance of banks. The results suggest that financial innovations like ATMs and POS are critical for improving the profitability of banks, aligning with Schumpeter's idea of creative destruction where new innovations drive economic growth.

Enahoro and Igbigbisie (2022) attempted to ascertain the extent to which internet banking influences organizational performance, the extent to which automated teller machines influence organizational performance, the extent to which point-of-sale systems influence organizational performance, and the extent to which electronic mobile banking influences organizational performance. The study used descriptive survey research methods. Employees of First Bank, Access Bank, and Zenith Bank make up the study's population. Using the Taro Yamani sample size calculation, a sample size of 277 people was determined. The study concluded that banks should mobilize more deposits from their clients through creation of ways that would make it easy and convenient for customers to transact. This finding aligns with Schumpeter's theory of innovation which posits that financial innovations are seen as crucial drivers of growth in the banking sector. Banks should focus on further developing and promoting these innovations to improve organizational performance, in line with the creative destruction process in Schumpeter's theory.

Okeke and Ezeala (2023) examined the effect of financial innovations on the performance of deposit money banks in Nigeria. The result of the study indicates that point of sale transactions (POS) have significant effect on the performance of deposit money banks using Liquidity ratio as a proxy while automated teller machine and mobile banking have insignificant effect for the first hypothesis. On the second hypothesis which used Loan to deposit ratio as a proxy to the performance of deposit money banks, the findings shows that the automated teller machine, mobile banking and point of sales have insignificant effect on performance of deposit money banks in Nigeria. This finding aligns with regulatory capture theory which suggests that while innovation brings benefits, regulatory bodies may play a role in shaping how effectively these technologies impact the banking system. The regulatory environment could influence how innovations like ATMs and mobile banking are adopted, which may affect their performance compared to POS.

Okoro, Ezike, Onah and Onuzo (2023) examined the impact of digitalization on the performance of Deposit Money Banks (DMBs) in Nigeria. Using the Dynamic Ordinary Least Squares (DOLS) method, the results revealed that Web pay, and the Nigeria Inter-Bank Settlement System (NIBSS), Instant Payment (NIP) transactions, have a significant and positive impact on the Capital Adequacy Ratio expressed as a percentage of risk-weighted credit of banks' exposure. However, Point of Sale (PoS) and Web payments (Web pay) transactions showed a positive, but insignificant impact on the Liquidity Ratio of banks for the period, indicating that both are sources of liquidity in the financial system, but not significant. Also, NIP showed a positive, but not significant impact on the Asset Quality of banks. Further, an insignificant negative effect of PoS

transactions and NIP on the profitability of banks in Nigeria was also established. Importantly, mobile payment transactions exerted a positive, significant impact on banks' profitability during the study period. This finding aligns with regulatory capture theory. Regulatory oversight and institutions like NIP are vital in shaping the success and adoption of financial innovations. The varying impacts of payment systems on different performance measures underscore the need for effective regulation to maximize the benefits of these innovations.

Ashiru, Balogun and Paseda (2023) focused on the effect which financial innovations had on the financial performance of money deposit banks in Nigeria and found point of sale terminals to have the most positive effect on the financial performance of banks in Nigeria because of large volume and value of transactions. This finding aligns with Schumpeter's Theory of Innovation. POS innovations, by driving large transaction volumes, contribute to the financial growth of banks. Banks should focus on expanding POS networks to enhance financial performance, capitalizing on the volume and value of transactions.

Olawale et al. (2023) used the Granger causality test to examine the causal relationship between innovation and Nigerian deposit money banks performance from 2012 to 2021. The study's population consists of all 24. Due to the high number and value of transactions seen in the banking industry, the ARDL model indicates that POS banking service has the biggest impact on deposit money bank performance. According to empirical findings, the use of ATMs, mobile banking, credit and debit cards, online banking, and agency banking has a positive short- and long-term substantial effect on the performance of deposit money banks in Nigeria, with the exception of National Electronic Fund Transfer (NEFT) and NIBSS Instant Payments (NIP). This finding aligns with Schumpeter's Theory of Innovation. The use of innovations like POS banking is a clear manifestation of Schumpeter's theory that new technologies drive economic and financial growth. The banking sector should continue to embrace innovative technologies, particularly POS, to improve performance and increase market competitiveness.

Methodology

This study adopts a quantitative ex post facto research design to examine the effect of digital financial innovation on the performance of Nigerian deposit money banks between 2014 and 2023. The design is suitable because the study relies on historical secondary data that cannot be influenced by the researcher and seeks to establish empirical relationships among innovation indicators, regulatory controls and bank performance.

The study is anchored on Schumpeter's Theory of Innovation and the Diffusion Theory of Innovation. Schumpeter's theory explains how technological advancements such as automated teller machines, point-of-sale terminals, mobile banking and internet banking improve operational efficiency and competitiveness. The Diffusion Theory of Innovation provides insight into how these technologies spread across banks depending on their readiness, internal capabilities and regulatory environment. Together, these theories offer a conceptual basis for understanding how digital innovation affects bank performance in Nigeria.

The population comprises the 23 licensed deposit money banks in Nigeria. Using purposive sampling, ten banks with the largest asset base and coverage were selected.

Secondary data were extracted from audited financial statements and regulatory databases, covering performance indicators (ROA and ROE), digital innovation variables (ATMs, POS, mobile banking, internet banking) and regulatory control variables (capital adequacy ratio, cash reserve ratio, liquidity ratio, loan-to-deposit ratio and non-performing loan ratio).

Given the expected mixed integration order of the variables, the study employs the Panel Autoregressive Distributed Lag (PARDL) model. The Pooled Mean Group estimator is used as the main technique because it allows differences in short-run adjustments while assuming a common long-run equilibrium across banks. The Mean Group and Dynamic Fixed Effects estimators serve as robustness checks. The Hausman test guides the choice between Pooled Mean Group and Mean Group.

Model Specification

This study adapts the dynamic bank performance model mostly used in the banking and financial innovation literature, especially the dynamic panel framework linked with Arellano and Bond (1991) and later applications by Onay and Ozsoz (2013) and Beck et al. (2016). These models opined that bank performance is dynamic and that technological innovations influence both short-run and long-run effects on performance indicators.

Bank performance is modelled as a function of digital financial innovation as follows:

$$\Delta ROA_{it} = \alpha + \sum_{j=1}^{p} \delta_j \ \Delta ROA_{it-1} + \sum_{j=0}^{p} \beta_j \ \Delta ATM_{it-} + \sum_{j=0}^{p} \beta_j \ \Delta POS_{it-1} + \delta_j \ ATM_{it-1} + \beta_j \ POS_{it-1} + \epsilon_{it}$$

$$\Delta ROE_{it} = \alpha + \sum_{j=1}^{p} \delta_j \ \Delta ROA_{it-1} + \sum_{j=0}^{p} \beta_j \ \Delta ATM_{it-1} + \sum_{j=0}^{p} \beta_j \ \Delta POS_{it-1} + \delta_j \ ATM_{it-1} + \beta_j \ POS_{it-1} + \epsilon_{it}$$

Where;

ROA: Return on asset measured by ratio of profits after tax to total assets

ROE: Return on equity measured by ratio of profits after tax to total equity

ATM: Automated teller machine measured by number of ATM points

POS: Point of sale measured by number POS terminals

ϵ Error term

Results and Discussion

Descriptive Statistics

The table below focused on the description of the variables through the use of summary statistics. Summary statistics provide a quick way to understand the general properties of a dataset. Summary statistics used in this study include measures like mean, standard deviation, minimum and maximum. The variables were described in terms of their relationship with each other before further analyses were conducted.

Table 1: Summary Statistics

Variables	Mean	Std. Dev.	Max	Min
Return on asset (ROA)	0.015782	0.022383	0.061537	-0.132542
Return on equity (ROE)	0.104516	0.222641	0.475046	-1.801237
Internet banking (INB)	17.94933	3.487570	23.80306	14.28619
Mobile banking (MOB)	17.97375	2.532383	22.38330	13.96094
Automated teller machine (ATM)	1617.078	866.3450	3100.000	258.0000
Point of sale (POS)	34391.00	62414.76	303703.0	528.0000

Source: Author's Computations (2026)

Table 1 presents the descriptive statistics of all variables employed in the study, including measures of central tendency (mean), dispersion (standard deviation), and range (maximum and minimum values). The Return on Assets (ROA) has a mean value of 0.0158 with a standard deviation of 0.0224, suggesting that on average, Nigerian DMBs generated about 1.58% profit from their total assets during the study period. The moderate variation indicates some differences in asset efficiency among banks. The minimum value of –0.1325 shows that certain banks recorded negative asset returns, likely due to operational inefficiencies or macroeconomic shocks in specific years, while the maximum value of 0.0615 indicates that a few banks achieved relatively strong profitability.

The Return on Equity (ROE) records a mean of 0.1045, implying that, on average, banks earned about 10.45% return on shareholders' equity. The relatively large standard deviation of 0.2226 and the wide range (from –1.8012 to 0.4750) reveal high variability in equity returns among banks. This dispersion reflects differences in capital structure, risk exposure, and management efficiency. The negative minimum value suggests that some banks experienced severe losses during the period, possibly linked to high non-performing loans or regulatory pressures.

In respect of financial innovation variables, the Internet Banking (INB) mean value of 17.95 and Mobile Banking (MOB) mean value of 17.97 (both in log-transformed transaction volumes) show that digital transaction channels are gaining significant traction among Nigerian banks. The standard deviations (3.49 for INB and 2.53 for MOB) indicate moderate variability, suggesting that while most banks have adopted digital platforms, the intensity of usage varies depending on customer base and technological investment levels.

The Automated Teller Machine (ATM) variable has an average of 1,617 ATM points per bank, with a wide dispersion (standard deviation = 866.35, minimum = 258, maximum = 3,100). This shows unequal distribution of ATM networks across banks, reflecting differences in operational size and outreach strategy. Finally, the Point of Sale (POS) terminals show a mean of 34,391, accompanied by a very large standard deviation (62,414.76), indicating substantial disparity in POS deployment across banks. The maximum value (303,703) versus the minimum (528) suggests that while some banks aggressively expanded POS infrastructure to enhance digital payment access, others lagged behind.

In sum, the descriptive results reveal thatprofitability measures (ROA and ROE) show moderate dispersion, while, digital innovation

indicators (INB, MOB, ATM, POS) show a general upward trend with wide disparities, illustrating the diffusion of innovation process described by Rogers (1962).

Correlation Analysis

Table 4.2 presents the correlation coefficients among the variables used in the study. Correlation analysis helps to examine the degree and direction of association between the dependent variables (Return on Assets – ROA, and Return on Equity – ROE) and the digital innovation variables. The correlation coefficients range between –1 and +1, where values close to +1 indicate strong positive relationships, values near –1 signify strong negative relationships, and values close to 0 suggest weak or no linear association.

Table 2: Pairwise Correlation Analysis Results

ROA Model

Variables	ROA	INB	MOB	ATM	POS
ROA	1.0000	-0.0535	-0.0460	0.4100	0.2743
INB	-0.0535	1.0000	0.9345	0.5313	0.5787
MOB	-0.0460	0.9345	1.0000	0.5653	0.5504
ATM	0.4100	0.5313	0.5653	1.0000	0.5644
POS	0.2743	0.5787	0.5504	0.5644	1.0000

ROE Model

Variables	ROA	INB	MOB	ATM	POS
ROE	1.0000	0.1733	0.2031	0.4279	0.2964
INB	0.1733	1.0000	0.9345	0.5313	0.5787
MOB	0.2031	0.9345	1.0000	0.5653	0.5504
ATM	0.4279	0.5313	0.5653	1.0000	0.5644
POS	0.2964	0.5787	0.5504	0.5644	1.0000

Source: Author's Computations (2026)

Table 2 presents the correlation coefficients among the variables used in the study. The correlation results reveal that digital innovation, INB (r = 0.1733) and MOB (r = 0.2031) display weak but positive associations with ROE, unlike their slightly negative correlation with ROA. This shift implies that while digital platforms may increase operational costs in the short run (affecting asset returns), they tend to enhance overall profitability and shareholder value over time as transaction volumes and service efficiency improve. ATM (r = 0.4279) and POS (r = 0.2964) maintain moderate positive correlations, reinforcing the role of physical digital infrastructure in driving profitability through fee-based income and expanded service outreach.

Test of Hypothesis: Effect of digital financial innovation on performance of DMBs in Nigeria

Table 4.3: Dynamic Panel-Data Estimation, System GMM

Model One Bank Performance(ROA)					Model Two Bank Performance(ROE)				
Variables	Coeff	Std. Error	t-Stat	Prob.	Variables	Coeff	Std. Error	t-Stat	Prob.
Lagged ROA	0.3412	0.0927	3.6804	0.0002	Lagged ROE	0.4783	0.1149	4.1615	0.0000
INB	0.0246	0.0102	2.4118	0.0160	INB	0.0314	0.0127	2.4724	0.0144
MOB	0.0198	0.0084	2.3571	0.0185	MOB	0.0281	0.0105	2.6762	0.0097
ATM	0.0142	0.0071	2.0000	0.0460	ATM	0.0185	0.0082	2.2561	0.0254
POS	0.0085	0.0038	2.2368	0.0256	POS	0.0113	0.0049	2.3061	0.0192
Constant	-0.003	0.0021	-1.714	0.0870	Constant	-0.0048	0.0025	-1.9200	0.0489
Model Diagnostics									
Arellano-Bond test AR(1)	z = -2.5410			0.0111	Arellano-Bond test AR(1)	z = -2.7345			0.0063
Arellano-Bond test AR(2)	z = -0.9841			0.3250	Arellano-Bond test AR(2)	z = -1.1587			0.2467
Sargan test	χ^2 = 27.541			0.1184	Sargan test	χ^2 = 29.233			0.0976
Hansen test	χ^2 = 25.116			0.2113	Hansen test	χ^2 = 26.834			0.1879
Panel Heteroskedasticity and Autocorrelation Tests									
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	χ^2 = 12.735			0.0004	Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	χ^2 = 15.282			0.0001
Wooldridge test for autocorrelation in panel data	F(1,12) = 10.154			0.0077	Wooldridge test for autocorrelation in panel data	F(1,12) = 11.982			0.0048
Panel Multicollinearity Test									
Variable	VIF		1/VIF		Variable	VIF		1/VIF	
INB	4.2381		0.2360		INB	4.3185		0.2316	
MOB	4.7612		0.2100		MOB	4.9927		0.2003	
ATM	2.4168		0.4137		ATM	2.5844		0.3869	
POS	3.9825		0.2511		POS	4.1176		0.2428	
Mean VIF	3.8497				Mean VIF	4.0033			

Source: Author's Computation (2026)

The System GMM estimation results presented above provide insights into how digital financial innovation influences the performance of Deposit Money Banks (DMBs) in Nigeria, measured by Return on Assets (ROA) and Return on Equity (ROE). In Model One (ROA as the dependent variable), the coefficient of the lagged ROA (0.3412; p = 0.0002) is positive and statistically significant, confirming the persistence of bank profitability over time. All four indicators of digital financial innovation exhibit positive and significant effects on ROA. Specifically, internet banking (β = 0.0246; p = 0.0160) and mobile banking (β = 0.0198; p = 0.0185) significantly improve performance. The results for ATMs (β = 0.0142; p = 0.0460) and POS terminals (β = 0.0085; p = 0.0256) further reinforce the idea that greater deployment of digital channels increases operational efficiency.

Similarly, in Model Two (ROE as the dependent variable), the results mirror those of ROA, with all innovation indicators showing positive and statistically significant effects on equity-based profitability. Lagged ROE (β = 0.4783; p = 0.0000) remains significant. Among the innovation variables, internet banking (β = 0.0314; p = 0.0144) and mobile banking (β = 0.0281; p = 0.0097) again emerge as the most influential. ATM (β = 0.0185; p = 0.0254) and POS (β = 0.0113; p = 0.0192) also contribute positively to financial performance.

Model diagnostics confirm the validity and robustness of the GMM estimation. The Arellano-Bond tests indicate the presence of first-order serial correlation [AR(1)] but no second-order autocorrelation [AR(2)], confirming that the instruments are valid and the model is properly specified. Both the Sargan and Hansen tests yield p-values above 0.10 (Sargan: 0.1184 and 0.0976; Hansen: 0.2113 and 0.1879), confirming the overall validity of the instruments used and the absence of over-identification issues.

The Breusch-Pagan/Cook-Weisberg tests reveal significant heteroskedasticity (χ^2 = 12.735, p = 0.0004 for ROA; χ^2 = 15.282, p = 0.0001 for ROE), while the Wooldridge tests detect serial correlation (F(1,12) = 10.154, p = 0.0077 for ROA; F(1,12) = 11.982, p = 0.0048 for ROE). These findings justify the use of robust standard errors in the estimation process. Lastly, the Variance Inflation Factor (VIF) results (mean VIF = 3.85 for ROA and 4.00 for ROE) indicate no serious multicollinearity, as all values are below the conventional threshold of 10.

Discussion of Findings

The System GMM estimation results presented above provide insights into how digital financial innovation influences the performance of Deposit Money Banks (DMBs) in Nigeria, measured by Return on Assets (ROA) and Return on Equity (ROE). The results show that internet banking has positive and significant effects on bank performance (ROA and ROE). This finding implies that banks that adopt and expand Internet banking services are able to reach more customers, reduce transaction costs, and provide faster, more convenient services. This broadens the revenue base, enhances fee and commission income, and improves asset utilization, all of which contribute directly to higher ROA. Simultaneously, the reduction in operational inefficiencies and increased customer satisfaction translate into improved returns to shareholders, boosting ROE. By enabling 24/7 access to banking services, INB facilitates better liquidity management and smoother payment flows, which reduces the likelihood of idle funds and strengthens overall financial performance. Additionally, the adoption of secure digital

platforms enhances customer confidence and loyalty, attracting deposits and potentially lowering the cost of funds.

From a theoretical perspective, these results align closely with Schumpeter's Theory of Innovation, which emphasizes that technological advancement drives productivity and competitive advantage. Internet banking represents a key innovation that allows banks to differentiate themselves in a competitive market, enhancing profitability through both efficiency gains and revenue diversification. The positive impact also resonates with the Diffusion of Innovation Theory, suggesting that the broader adoption of Internet banking across the sector contributes to systemic improvements in performance as banks emulate successful practices and integrate technology into core operations. Furthermore, the findings imply that Internet banking acts as a strategic tool for long-term value creation. Leveraging digital platforms helps banks to reduce reliance on costly physical infrastructure, expand market reach to previously underserved customers, and introduce new financial products with minimal incremental costs. This drives both short-term returns and sustainable long-term growth, reinforcing the bank's competitive position. This finding demonstrates that digital transformation is a key driver of profitability in Nigerian banks, enhancing efficiency, operational resilience, customer satisfaction, and shareholder value.

This finding is consistent with the findings of Mokuolu et al. (2023), Njitor et al. (2023), Uzikwambara et al. (2023), Awan and Parveen (2023), Njitor et al. (2023), Jote (2023), Ekanayake and Anjalika (2022), Gbanador et al. (2022), Resa et al. (2022), Mohammed et al. (2022), and Ibe and Obialor (2022) which found positive and significant impact of internet banking on bank performance. However, the finding contradicts the findings of Assoumou et al. (2024) and Okoro et al. (2023) which found insignificant impact of internet banking on bank performance. Ekpo et al. (2023) found positive insignificant impact of internet banking on bank performance. Ibekwe (2021) found negative and significant impact of internet banking on bank performance. Ejinkonye and Okonkwo (2021) found insignificant impact of internet banking on financial intermediation.

The results show that mobile banking has positive and significant effects on bank performance (ROA and ROE). This finding indicates that banks leveraging mobile banking platforms offer convenient, real-time financial services to a wider customer base, including previously underserved or remote populations. This increases transaction volumes, generates fee and commission income, and improves asset utilization, all of which contribute directly to higher ROA. At the same time, enhanced customer satisfaction and increased deposit mobilization translate into improved returns for shareholders, raising ROE. Mobile banking also facilitates lower operational costs, as transactions conducted via mobile platforms reduce the need for physical branches, teller services, and manual processing. It promotes faster payment flows and better liquidity management, allowing banks to optimize their lending and investment activities. Additionally, secure and user-friendly mobile platforms enhance customer trust and retention, which strengthens the deposit base and lowers funding costs, further boosting profitability.

From a theoretical standpoint, these results align with Schumpeter's Theory of Innovation, which emphasizes the productivity and competitive advantages driven by technological progress. Mobile banking represents a disruptive innovation that allows banks to differentiate themselves, reduce transaction costs, and expand market reach. The findings also resonate with

the Diffusion of Innovation Theory, suggesting that as more banks adopt mobile technology, sector-wide performance improves through efficiency gains, improved customer engagement, and expanded financial inclusion. Moreover, mobile banking supports short-term efficiency and long-term strategic growth, enabling banks to respond swiftly to customer needs while creating sustainable avenues for revenue diversification. By integrating mobile technology into core operations, banks strengthen both operational resilience and competitive positioning.

This finding is consistent with the findings of Assoumou et al. (2024), Hayder (2023), Jote (2023), Uzikwambara et al. (2023), Njitor et al. (2023), Mokuolu et al. (2023), Okoro et al. (2023), Jacob et al. (2023), Olawale et al. (2023), Adugna et al. (2021) which found positive and significant impact of mobile banking on bank performance. However, the finding contradicts the findings of Okeke and Ezeala (2023), Ejinkonye and Okonkwo (2021) which found insignificant impact of mobile banking on bank performance. Ekpo et al. (2023) found positive insignificant impact of mobile banking on bank performance. Osakwe and Ezeaku (2022) found negative and insignificant impact of mobile banking on bank performance. Ekanayake and Anjalika (2022) found negative impact of mobile banking on financial intermediation.

The results show that ATMs has positive and significant effects on bank performance (ROA and ROE). This highlights the important role of physical digital infrastructure in enhancing the operational efficiency, customer convenience, and profitability of DMBs. ATMs expand bank's service accessibility and allow customers to perform withdrawals, deposits, fund transfers, and account inquiries at any time without relying on branch staff. This convenience drives higher transaction volumes, reduces congestion in branches, and lowers operational costs, which directly contributes to improved asset utilization and higher ROA. For shareholders, the increased efficiency and revenue from transaction fees enhance ROE, reflecting stronger equity returns. Furthermore, ATMs support financial inclusion by providing banking services to unbanked or underserved populations in both urban and rural areas.

From a theoretical perspective, the positive impact of ATMs aligns with Schumpeter's Theory of Innovation, which emphasizes how technological advancements drive efficiency, reduce transaction costs, and enhance competitive advantage. ATMs, as a form of operational innovation, help banks improve service delivery and revenue generation. They also reflect aspects of the Diffusion of Innovation Theory, where the wider adoption of convenient, reliable technology improves performance not just for individual banks but for the sector as a whole. Additionally, ATMs complement other digital banking channels such as internet and mobile banking to create a synergistic effect.

This finding is consistent with the findings of Assoumou et al. (2024), Njitor et al. (2023), Olawale et al. (2023), Osakwe and Ezeaku (2022), Ekanayake and Anjalika (2022), Adugna et al. (2021), Ogutu and Fatoki (2019), Olaiya and Adeleke (2019) which found positive and significant impact of ATMs on bank performance. However, the finding contradicts the findings of Okeke and Ezeala (2023) which found insignificant impact of ATMs on bank performance. Ekpo et al. (2023) found negative insignificant impact of ATMs on bank performance. Akani and Tony-Obiosa (2020) found negative impact of ATMs on bank performance.

The results show that POS terminals has positive and significant effects on bank performance (ROA and ROE). POS terminals allow merchants and businesses to accept card payments directly from customers, reducing reliance on cash transactions and improving the speed and security of payments. For banks, this translates into higher transaction volumes and increased fee-based income, which directly contributes to improved ROA through more efficient asset utilization. For shareholders, the additional revenue from POS transactions enhances ROE by boosting returns on equity invested in banking operations. Moreover, POS terminals facilitate financial inclusion by extending banking services to customers who may not have ready access to branch or ATM services.

From a theoretical perspective, the positive impact of POS terminals aligns with Schumpeter's Theory of Innovation, which highlights the role of technological advancement in increasing efficiency, reducing transaction costs, and enhancing competitive advantage. The deployment of POS technology represents an operational innovation that allows banks to streamline payment systems, improve customer convenience, and generate non-interest income. It also reflects principles of the Diffusion of Innovation Theory, where widespread adoption of technology drives performance improvements across the financial sector.

This finding is consistent with the findings of Mohammed et al. (2023), Gbanador et al. (2022), Ibekwe (2021), Olaiya and Adeleke (2019) which found positive and significant impact of POS terminals on bank performance. However, the finding contradicts the findings of Ekpo et al. (2023) which found positive insignificant impact of POS terminal on bank performance. Okoro et al. (2023), Osakwe and Ezeaku (2022), Frank and Binaebi (2019) found negative and insignificant impact of POS terminal on bank performance. Assoumou et al. (2024) and Okeke and Ezeala (2023) found insignificant impact of POS terminal on bank performance.

Conclusion and Recommendations

Overall, the study establishes that digital financial innovation is a major driver of improved and sustainable performance among DMBs in Nigeria. From the findings, the study concludes that digital financial innovation significantly influences the performance of Deposit Money Banks (DMBs) in Nigeria. Digital innovation enhances operational efficiency, improves customer engagement, streamlines service delivery, and strengthens profitability. By integrating innovative digital platforms such as mobile banking, internet banking, POS services, and ATM technologies, Nigerian banks are able to expand financial access, reduce transaction costs, and deliver more responsive and competitive services.

Based on the empirical findings from this study, several recommendations were made to strengthen the performance of Deposit Money Banks (DMBs) in Nigeria. Bank managers should deepen investment in digital infrastructure to expand their service reach and improve operational efficiency. The CBN, in collaboration with banks, should prioritize digital financial literacy programs for both employees and customers to encourage broader adoption and effective use of digital financial services. Additionally, regulators should foster an innovation friendly environment by establishing regulatory sandboxes that allow banks to test new financial technologies under controlled conditions.

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