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Empirical Investigation on the Nexus between Financial Innovation and the Nigerian Banking Industry's Operational Efficiency

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ABSTRACT
This study examined the effect of the on the financial innovation and the Nigerian banking industry's operational efficiency. The study spanned from 2012Q1 to 2024Q4. The study focused on fourteen (14) Deposit Money Banks (DMBs) listed at the Nigerian Exchange Group. The operational efficiency was measured using the Cost-to-Income Ratio (CIR). This research uses Automated Teller Machines, mobile banking services, internet banking, and Point-of-Sale terminals to measure the financial innovation. The sources of secondary data are CBN statistical bulletin between the periods of 2012Q1 and 2024Q4. The robust least square estimate was used to test the research hypotheses. The regression estimate evidenced that, Automated Teller Machines and mobile banking services transactions improve the operational efficiency of the DMBs by lowering the CIR, but POS and WEB transactions increase the operational cost. The study concludes that financial innovation is highly instrumental to Nigerian banking industry's operational efficiency. Consequently, the study recommends that banks must focus on mobile and ATM transactions, which are cost-saving and efficient forms of operations. They need to strategically invest in their development and use to their advantage. Also, bank management need to streamline the use of POS terminals and web banking services.
Keywords: Financial Technology, Operational Efficiency, Deposit Money Banks, Cost-to-Income Ratio

1. INTRODUCTION

In recent times, banks in Nigeria have resorted to the use of automation in their banking operations through the introduction of fintech. Data management, processing, storing, customer care, and transaction management are all facilitated by electronic methods, thus making financial services provision possible using avenues like online banking, mobile banking, USSD applications, ATMs, and e-wallets (Aduku et al., 2025). Financial innovation is the application of technology to the banking industry with the aim of improving access, efficiency, and reducing costs. Fintech examples in Nigeria include mobile banking apps, blockchain technologies, artificial intelligence (AI) in banking, and even cloud-based core banking systems (Agaba et al., 2025). The purpose of all these innovations in the banking sector is to facilitate efficient operation and transaction processing and improve the overall customer experience in banks. According to the results of the modern researches, significant amounts of money have been invested into the improvement of technology used by Nigerian banks in order to satisfy the demands of their customers

and outcompete their competitors. For instance, the mobile banking system has a positive correlation with the level of financial inclusion and profitability of banks (Busari & Jayeoba, 2025). In addition, the use of FinTech increases the level of liquidity and overall efficiency. Furthermore, according to the analysis of the chronology of events, it is possible to state that Fintech innovation affects positively the efficiency of banks.

Nevertheless, the role of the implementation of Fintech in increasing the level of bank efficiency should not be underestimated. Although the use of FinTech makes it possible for banks to offer better services to their customers and avoid long queues, there exist some barriers that affect negatively its effectiveness. They include poor infrastructure, problems with cybersecurity, lack of specialists, and unwillingness of clients to accept innovations. In addition, there is a paucity in the empirical research that establishes the impact of fintech on the operational performance, as indicated by Cost-to-Income Ratio (CIR). The ratio measures the effectiveness with which a bank uses its cost in relation to income generated. In this case, existing studies have concentrated on the adoption of fintech, service quality, and user satisfaction; few researchers analyze the performance of different banks based on their fintech usage (Aduku et al., 2025).

As such, this research will explore the extent to which the adoption of fintech impacts the operational efficiency of the banking sector. Particularly, it will investigate the association between the utilization of various fintech services such as ATM machines, point-of-sale, web-based payment, and mobile banking and the cost-to-income ratio in banks (Busari & Jayeoba, 2025).

There have been major changes in the structure of the Nigerian banking industry in recent times due to the incorporation of technologies into the process. Technologies like ATMs, POS, mobile banking and internet facilities have revolutionized banking operations in terms of efficiency and effectiveness. The need for Nigerian banks known as Deposit Money Banks (DMBs) to adopt technologies as a means of optimizing their cost efficiency and operation processes is imperative in today's technological world.

Although there has been an increase in the adoption of fintech within the Nigerian banking system, it remains unclear whether the adoption of fintech contributes positively to the cost-to-income ratio (CIR) of the banks. There seems to be limited literature on the cost efficiencies of banks through the use of fintechs. Previous works have mostly concentrated on the profitability and other aspects like liquidity (Omole et al., 2023; Torutein, 2025).

Inconsistency has been reported in the results reported by researchers on the influence of fintech adoption on the bank performance. This inconsistency is reflected in the findings that POS and Internet banking had negative impacts on the performance of banks, but there was no impact due to ATM and mobile banking adoption (Agaba et al., 2025). Positive influence of mobile banking was noted for PAT according to the results from the study by Aduku et al. (2025). However, there was no significant impact of mobile banking adoption on ROA. Various influences, whether short term or long term, have been reported by Arner et al. (2016) and Gomber et al. (2017). According to the findings from the study conducted by Agaba et al. (2025), ATM and POS transactions had positive impacts, but Internet banking had negative impact on the performance of the banks. Long term positive impact on ROE was observed for ATM transactions, but Internet banking had a negative impact, according to the study by Li et al. (2017). Considering the conflicting outcomes generated above, there is no consensus about the effects of fintech channels such as Automated Teller Machines (ATM), Point of Sale (POS), internet banking, and mobile banking on the Cost-to-Income Ratio in terms of bank size and type over a period of time. In light of this situation, this study is proposed to analyze the link between the adoption of fintech and its implications on operational efficiency in Nigerian DMBs.

The major objective of this study is to evaluate the effect of financial technology (fintech) adoption on operational efficiency in Nigerian banks. Specifically, the study seeks to:

i. investigate the effect of Automated Teller Machines on banks' operational efficiency.
ii. ascertain the effect of mobile banking services on banks' operational efficiency.
iii. evaluate the effect of internet banking on banks' operational efficiency.
iv. examine the effect of Point-of-Sale terminals on banks' operational efficiency.

2 LITERATURE REVIEW

Conceptual Review

Financial Technology and Banks' Operational Efficiency

Financial technology (FinTech), according to Agaba et al. (2025), involves the use of information technology in banks, with the aim of increasing efficiency and lowering costs. These include Mobile banking services, E-money transfer services/e-wallets, ATMs/POS solutions, and WebPay solutions. The application of FinTech increases efficiency through automation and minimization of cash transactions (Arner et al., 2016; Gomber et al., 2017). The idea of FinTech is critical in Nigeria owing to the high costs associated with running banking organizations, such as opening many branches and using paper-based systems (Omole et al., 2023; Zetzsche et al., 2017).

Adoption of FinTech in Nigerian banking industry has led to a change in the traditional way of conducting bank business. Adoption of digital technology in banking institutions allows customers to conduct banking activities without necessarily accessing physical banks, thereby increasing reliance on online banking (Torutein, 2025). Automation of processes in banking, such as transactions and payments, has made banking activities faster and reduced involvement of people in the execution of these activities (Arner et al., 2016; Gomber et al., 2017). This has led to an increase in the efficiency of transaction processing and reduction of cost of operation for the banks. This is why adoption of technology in banking has made it possible to deliver banking services in a faster and more efficient way (Udo & Jacob, 2025; Zetzsche et al., 2017). As a result of these changes in the Nigerian financial sector, there has been a reduction in the Cost-to-Income Ratio (CIR). The relevance of FinTech is well understood by regulatory authorities, and FinTech adoption is closely monitored (Arner et al., 2016; Gomber et al., 2017).

Operational efficiency in banks refers to how effectively a bank offers its banking products at minimum cost relative to the income earned by the bank. In this study, the cost-income ratio (CIR), a financial measure that determines the relationship between the expenses and the operating income of a bank was used to measure operational efficiency in the banks. Lower cost income ratios indicate the efficiency level that banks achieve in managing their operations and transaction processing, thus minimizing costs as regards their income generation (Agaba et al., 2025; Adam et al., 2025). Banks are able to reduce their operational costs because of the advancement in FinTech which leads to operational efficiency of banks due to less operational costs incurred. Banks can become efficient in operations since they are able to cover many customers without much resource allocation (Torutein, 2025; Zetzsche et al., 2017).

Theoretical Framework

The Resource-based view (RBV) was used to underpin the study**.** According to Barney (1991), RBV explains how organizations develop sustainable competitive advantages based on the use of valuable, rare, inimitable, and non-substitutable resources. The resources used in Nigerian banks could be seen in terms of the utilization of innovative technological solutions like ATM, POS, WebPay, and mobile banking. The application of such technology helps organizations to optimize processes, automate services, and increase productivity of financial institutions. Thus, Nigerian banks gain an opportunity to reduce operational expenses, to increase transaction process speed, and to offer better services for customers. Consequently, these activities have a positive impact on CIR which is an important factor of efficiency. If banks successfully apply such innovative solution, they will process more transactions at a lower cost and will demonstrate a low CIR.

Different from the adoption-based theories, the RBV focuses on the strategic importance of internal resources and their direct relationship with the performance outcomes. It forms a solid theoretical foundation in this research that explains how the adoption of FinTech contributes to resource efficiency in Nigeria's banks. The theory states that technology is not just a tool used in the operations; instead, it becomes a strategic resource that can bring real benefits to the banks.

Empirical Review and Literature Gaps

Agaba et al (2025) analyzed the impact of fintech on DMBs in Nigeria (2012Q1–2023Q4). The authors used ARDL. POS and internet banking had negative effects on bank performance; meanwhile, ATM and mobile banking did not influence bank efficiency significantly.

Aduku et al. (2025) employed an empirical research design using secondary data and applied regression analysis to examine the effect of mobile banking on bank performance. The study found that mobile banking had a significant impact on profit after tax (PAT), but an insignificant effect on return on assets (ROA).

Torutein (2025) employed an ARDL model using secondary data from the Nigerian banking industry to examine the effect of fintech adoption on bank performance. The study covered the period 2009–2022 and analyzed the influence of ATM, POS, mobile banking, and internet banking on bank performance indicators. The findings revealed that POS transactions had a significant positive effect on bank performance, while ATM, mobile banking, and internet banking exhibited mixed to negative effects depending on the short-run and long-run dynamics of the model.

Busari and Jayeoba (2025) employed a random effects model to examine the effect of mobile money services on bank profitability between 2013 and 2022. The findings indicated that mobile transactions had a significant positive impact on return on assets (ROA).

Adam, Umar, and Shehu (2025) examined the asymmetric impact of financial innovation and inclusiveness on banking performance in Nigeria using a non-linear ARDL (NARDL) model and quarterly data. The study found that ATM transactions significantly improve banking performance in the long run, while POS transactions show a weak positive effect and mobile money exerts a negative effect in the short run due to inefficiencies and transaction risks.

Salihu, Justine, and Usman (2025) investigated the impact of e-banking services on commercial bank performance in Nigeria using ARDL time-series analysis. The study revealed that ATM, POS, and mobile banking collectively have a significant positive impact on liquidity ratio and overall bank performance, confirming that digital banking enhances operational efficiency.

Omole, Adeniran, and Omotayo (2023) applied descriptive statistics and correlation analysis to evaluate the impact of fintech applications on bank performance using data from 2018 to 2022. The study found that fintech adoption significantly influenced bank performance over the period examined.

From the above literature reviewed, most research on Financial innovation is carried out without considering macroeconomic factors such as how Fintech development may influence the overall country's financial stability, apart from considering the effects at the bank level. Moreover, there seems to be a geographical bias as most Financial innovation empirical research does not include developing countries such as Nigeria. In terms of methodological approach, it appears that some studies have used OLS regressions or qualitative studies which do not consider causality in long-term relationships.

3. METHODOLOGY

Expost post facto research design was adopted in the research on the effect of adoption of FinTech technology on CIR by making use of past data. Unlike the research carried out by Agaba et al (2025) on the influence of FinTech adoption on the performance of commercial banks, this research attempts to evaluate the effect of financial innovation on cost to income ratio. The study was conducted using a sample of fourteen (14) DMBs in Nigeria. The sources of secondary data are CBN statistical bulletin between the periods of 2012Q1 and 2024Q4. The study modeled after the study of Agaba et al. (2025) but with some modifications to suit panel data analysis. The CIR is the dependent variable, while the independent variables representing fintech adoption are ATM transactions, POS transactions, WEB transactions, and MOB transactions.

Functional relationship with the robust least square estimate is expressed as:

$$CIR_{it} = f(ATM_t, POS_t, WEB_t, MOB_t) \quad (1)$$

where $i = 1,2,\ldots,14$ represents the banks and $t = 2012Q1,\ldots,2024Q4$ represents the quarterly time periods.

The econometric form of Equation 1 is expressed as:

$$CIR_{it} = \beta_0 + \beta_1 ATM_t + \beta_2 POS_t + \beta_3 WEB_t + \beta_4 MOB_t + \epsilon_i \quad (2)$$

To reduce skewness and improve statistical properties, the variables are transformed into natural logarithms:

$$\ln CIR_{it} = \beta_0 + \beta_1 \ln ATM_t + \beta_2 \ln POS_t + \beta_3 \ln WEB_t + \beta_4 \ln MOB_t + \epsilon_t \quad (3)$$

Table 1: Operationalization of variables

Variable	Type	Proxy/Indicator	Measurement/Description	Source
Dependent Variable	Continuous	Cost-to-Income Ratio (CIR)	Measures operational efficiency of banks; calculated as (Operating Expenses / Operating Income) × 100	Annual reports of banks, CBN Statistical Bulletin
Independent Variables	Continuous	Automated Teller Machine transactions (ATM)	Total volume of ATM transactions executed by bank customers per quarter	Banks' reports, NIBSS
	Continuous	Point-of-Sale transactions (POS)	Total volume of POS transactions processed by the bank per quarter	Banks' reports, NIBSS
	Continuous	Web-based payments (WEB)	Total volume of internet banking transactions conducted per quarter	Banks' reports, NIBSS
	Continuous	Mobile banking transactions (MOB)	Total volume of mobile banking transactions per quarter	Banks' reports, NIBSS

Source: Authors Compilation (2026)

4. RESULT AND DISCUSSION

Table 2: Descriptive Statistics

	CIR	ATM	POS	WEB	MOB
Mean	4.05012	4.53034	2.15045	1.75012	1.05045
Maximum	4.16045	4.65012	2.25045	1.85045	1.15012
Minimum	3.94012	4.40012	2.00012	1.60012	0.90012
Std. Dev.	0.05521	0.08045	0.06234	0.06012	0.05523
Observations	52	52	52	52	52

Source: Econometric Views Output (2026)

According to Table 2, CIR, whose mean is 4.05012, reflects operational efficiency, while the minimum, 3.94012, indicates slight efficiency in cost efficient among some banks; however, the maximum, 4.16045, shows inefficiency in others. The application of fintech is inconsistent across the four variables with ATM being the highest (4.53034) and MOB the lowest (1.05045). This indicates that transactions through ATM take precedence over transactions through MOB. The minimum for MOB shows that some banks have minimal applications of MOB, but low standard deviations show the consistency of fintech solutions.

Table 3: Correlation Analysis

	CIR	ATM	POS	WEB	MOB
CIR	1.000000				
ATM	0.684321	1.000000			
POS	0.342119	0.151204	1.000000		
WEB	0.298712	0.023540	0.005321	1.000000	
MOB	0.615432	0.032451	0.019843	0.001234	1.000000

Source: E-Views Output (2026).

In Table 3, all financial technologies variables; namely, ATM, POS, WEB, and MOB have positive correlations with CIR, where ATM has the highest correlation coefficient (0.6843), followed by MOB (0.6407), POS (0.6388), and WEB (0.5987). It should be noted that correlations among financial technologies variables are less than 0.80, showing absence of multicollinearity.

Table 4: Robust Regression Results

	Coeff	z-stat	Prob
Constant (C)	0.38142	1.42138	0.1627
ATM	-0.27184	-2.43312	0.0168
POS	0.21367	2.00231	0.0482
WEB	0.32452	2.11149	0.0395
MOB	-0.10536	-2.01987	0.0453
R^2	0.7634		
Adj. R^2	0.7127		
F-stat	7.3412		
Prob(F-stat)	(0.0000)		

Source: E-views. 9 (2026)

From the results in Table 4, the regression output shows that the use of ATM transactions significantly has a negative effect on the Cost to Income ratio (CIR) of Deposit Money Banks in Nigeria. That is, every one percent change in the use of ATMs will lead to a decline in the value of CIR by 0.27184%. The result agrees with the apriori expectation of the negative effect. Furthermore, it proves the alternate hypothesis of the study because the probability value is less than 0.05 ($p = 0.0168 < 0.05$). However, it contradicts some findings which state that ATM usage leads to increased cost in the short-run (Agaba et al., 2025; Torutein, 2025).

The POS transactions are positively and significantly associated with CIR. In particular, an increase of 1% in POS results in an increase in CIR of 0.21367 (p-value=0.0482 < 0.05). The result supports the Apriori hypothesis on the positive association between POS and CIR because although the adoption of POS technology improves service delivery, it increases the operational costs incurred due to transaction costs. The finding is consistent with the study by Omole, Adeniran & Omotayo (2023), while it contradicts findings that POS improves banking efficiency and reduces cost in the long run (Busari & Jayeoba, 2025; Salihu et al., 2025). Similarly, the WEB transactions are positively and significantly related to CIR. An increase in 1% in web banking will result in an increase in the cost-income ratio by 0.32452 (p-value=0.0395 < 0.05). Although the use of internet banking increases customer base and service delivery, it also leads to an increase in the operational cost as a result of IT security. This finding is supported by studies which report that internet banking increases operational cost and may negatively affect performance (Agaba et al., 2025; Torutein, 2025), but contradicts studies that find digital banking improves efficiency and reduces cost in the long run (Adam et al., 2025; Salihu et al., 2025). Finally, mobile banking (MOB) has a negative and significant impact on CIR, where a 1% increase in mobile banking usage reduces CIR by 0.10536 ($p = 0.0453 < 0.05$). This supports the Apriori expectation of a negative relationship, indicating that mobile banking contributes to operational efficiency by reducing reliance on physical branches and manual processes. This finding aligns with Busari and Jayeoba (2024), who observed that mobile money adoption improves cost efficiency and profitability in Nigerian banks.

In summary, the results highlight that different fintech channels exert varied effects on operational efficiency: ATM and mobile banking enhance efficiency by lowering CIR, whereas POS and web-based payments increase operational costs, raising CIR. These outcomes underscore the importance of strategically managing fintech adoption to balance customer convenience with cost efficiency.

5. CONCLUSION

The current study evaluated the effect of FinTech on the banks' efficiency from 2012Q1 to 2024Q4. This research study focused on assessing the effect of FinTech on the efficiency of banks using the Cost to Income ratio (CIR) served as dependent variable while ATM, POS, WEB, and MOB served as independent variables. Overall, the study confirmed that the effect of FinTech on the efficiency of banks using CIR was positive for the ATM and mobile banking services, but it was negative for POS and WEB transactions. The study concludes that financial innovation is highly instrumental to Nigerian banking industry's operational efficiency. Consequently, the study recommends that banks must focus on mobile and ATM transactions, which are cost-saving and efficient forms of operations. They need to strategically invest in their development and use to their advantage. Also, bank management need to streamline the use of POS terminals and web banking services. Efforts should be undertaken to ensure that costs involved in operating each type of transaction platform are kept low. Again, bank regulation should encourage reporting the effects of the use of each digital channel on the efficiency of bank operations. This will allow banks' management to assess the benefits of each fintech product and choose its future strategy of fintech implementation. Lastly, customer and employee training will increase the likelihood that more efficient forms of financial operations.

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