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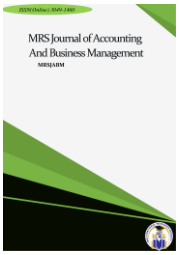

Banking Innovation and Economic Growth in Nigeria

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Abstract: *This study investigates the impact of banking innovation on economic growth in Nigeria, with a particular focus on digital payment services, electronic banking services, and the Bank Verification Number (BVN) system. Despite the rapid uptake of financial technologies in Nigeria, empirical research on their impact on the economy is limited. The study seeks to address this gap by examining the relationship between various banking innovations and Nigeria's Gross Domestic Product (GDP). The research uses time series data from 2009 to 2023, analyzing variables such as Point of Sales Machine transactions (POSM), Mobile Banking App transactions (MOBA), Automated Teller Machine transactions (AUTM), Bank Verification Number registrations (BVRN), and Real Gross Domestic Product (RGDP). The methodology includes descriptive statistics, Augmented Dickey-Fuller (ADF) unit root tests, Johansen cointegration analysis, and an Error Correction Model (ECM). The findings reveal that all banking innovation variables are positively and significantly linked to economic growth, both in the short and long term. The Johansen cointegration test indicates a long-run equilibrium relationship between these variables and economic growth. The ECM results show that mobile banking has the strongest short-run impact on economic growth, followed closely by the BVN system. Additionally, POS and ATM transactions significantly contribute to GDP growth. The study concludes that banking innovation is a critical driver of Nigeria's economic growth, providing evidence for the financial innovation-led growth hypothesis in the Nigerian context. However, the relatively lower impact of POS transactions suggests that there is room for further development in this area. Based on the findings, the study recommends policies to encourage the adoption of mobile banking, strengthen the BVN system, enhance POS usage, and continue investment in ATM infrastructure. It also advocates for a supportive regulatory framework, financial literacy programs, and cross-sector collaboration to maximize the potential of banking innovations for economic growth.*

Keywords: *Banking Innovation, Economic Growth, Nigeria, Digital Payments, Electronic Banking, Bank Verification Number, Financial Technology.*

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1. Introduction

Banking innovation holds immense potential for economic growth, particularly in a country like Nigeria where a significant portion of the population remains unbanked or under-banked. Its potency lies in bridging the financial inclusion gap - extending financial services to a larger population - thereby triggering economic prosperity (Akinola & Adesina, 2019). The Nigerian economy is undergoing a transformational shift, with the introduction of several banking innovations bringing a change for the better. However, the ecosystem's technological and regulatory infrastructure needs to adapt to these rapid advancements to ensure their optimal utilization and to prevent systemic risks (Abubakar, 2020).

A study by Ejiogu, Ejiogu, and Akpan (2018) showcased how technology-based banking practices such as mobile and online banking could stimulate economic growth by promoting efficiency and reducing transaction costs. Other research initiatives have demonstrated the positive contributions in sectors such as agriculture, where mobile banking has supported farmers in raising

productivity levels and income (Adegbite, 2019). A significant area of focus has been the digital payment space. Nigeria has seen promising growth in digital financial services, catalyzed by the introduction of several groundbreaking initiatives. For instance, the Central Bank of Nigeria's rollout of the Bank Verification Number (BVN) system has been a significant stride aimed at driving digital payments adoption by enhancing security and trust in the system (Obamuyi, 2019). Furthermore, initiatives such as the National Financial Inclusion Strategy aim to reduce the number of financially excluded Nigerians to 20% by 2020 (Sanusi, 2012). In particular, the strategy emphasizes the development of mobile payment systems to reach the unbanked population.

Banking innovation, particularly digital banking, plays an essential role in fostering economic growth in Nigeria. The growing influence of banking innovation, especially technological innovation in the financial sector, is increasingly becoming evident in the Nigerian economy. The adaptation and integration of banking technologies have become a strategic tool for acceleration and sustained economic growth in the country. Ogwumike & Fajemirokun, (2018). highly emphasized on the role of ICT and financial innovation in Nigeria's economic growth. Moreover, the advent of digital banking innovation has greatly transformed banking services in Nigeria, leading to the ease of banking processes and improving financial inclusion. As a result, access to financial services has greatly improved, leading to significant economic growth (Olokoyo, Osabuohien & Salami, 2019). Significant strides have been made over the years by banks through the introduction of new banking products and services as well as the use of digital channels such as mobile and internet banking. This has made banking more accessible to many Nigerians living in areas that traditionally lacked banking infrastructure (Adelowo, 2020).

Despite the positive trajectories, the path to robust growth also involves challenges. For instance, the penetration of internet and smartphone services, which are crucial for digital banking, is still limited. Besides, cyber-security issues remain a significant concern, making it imperative for diligent efforts to be made in addressing these gaps. Recent studies suggest that increased innovation in the Nigerian banking sector has favorably impacted economic growth (Ogbo & Ukpere, 2014). In essence, the banking sector is a substantial contributor to Nigeria's GDP, and its innovative drive to deliver efficient and accessible financial services is expected to further enhance economic growth in Nigeria. That said, it is essential to consider all aspects of innovation, including regulations, infrastructure, financial literacy amongst Nigerian citizens, corporate governance, risk management, and a myriad of other issues that can either enhance or limit the growth of banking in Nigeria. In conclusion, Nigerian banking innovation significantly contributes to Nigeria's economic growth. With an anticipatory progression in technological advancements and the growing acceptance of digital payment systems by the populace, the banking sector in Nigeria is indeed a key player in the country's continuous economic development.

1.2 Statement of the Problem

The Nigerian banking sector has witnessed tremendous technological innovations deployed to facilitate and improve banking services over the years. However, Nigeria is still grappling with challenges in the financial sector, which is negatively impacting economic growth (Ogbonna, 2019). Although efforts have been made to enhance financial transactions through innovative Banking, gaps continue to exist in financial accessibility, especially for marginalized demographics such as the unbanked and underbanked (Efobi et al., 2017).

Despite the introduction of various banking innovations such as Digital Payment technology, Mobile money, and Internet banking, the majority of Nigeria's adult population remains unbanked. Statistically, over 60 million Nigerian adults, representing about 54% of the total adult population, are unbanked (EFInA, 2018). The slow uptake of digital payment technology among the unbanked and underbanked population constitutes a significant challenge to financial inclusion. This widespread financial exclusion hinders economic growth and development in Nigeria, therefore indicating a pressing problem that needs to be addressed (Adesina and Ayo, 2010).

Furthermore, the increase in banking innovation has not significantly driven economic growth as evident in Nigeria's Gross Domestic Product (GDP). This raises the question of the efficacy of these banking innovations as tools for economic advancement. Studies (Osabuohien, 2018; Ujunwa, et al., 2020) suggest that the inability to effectively maximize these banking innovations may be tied to Nigeria's low financial literacy and cultural and infrastructural limitations. Thus the problem lies not in the absence of banking innovations, but rather, in their underutilization and the wide financial inclusion gap. This problem necessitates in-depth research to understand the extent of the impact of banking innovation on economic growth, to dissect the issues limiting their full utilization, and suggest practical actions that can drive financial inclusion among the unbanked and underbanked populace in Nigeria for sustainable economic growth.

1.3 Purpose of the Study

This study's primary goal is to investigate the connection between Nigeria's economic expansion and banking advances. Through this general goal, the study sought to accomplish the following particular goals:

i. Investigate the impact of mobile payment innovation on gross domestic product in Nigeria.
ii. Evaluate the influence of internet payment innovation on gross domestic product in Nigeria.
iii. Analyze the effect of card payment innovation on gross domestic product in Nigeria.

1.4 Research Questions

Throughout the project, the following research questions will be addressed.

i. What impact does mobile payment innovation have on gross domestic product in Nigeria?
ii. What impact does internet payment innovation have on gross domestic product in Nigeria?
iii. What effect does card payment innovation have on gross domestic product in Nigeria?

1.5 Research Hypotheses

The following null hypothesis will be tested in the study:

- **H_{01}:** There is no significant impact between the digital payment services and gross domestic product in Nigeria

- **H_{02}:** There is no significant impact between the electronic banking services and gross domestic product in Nigeria
- **H_{03}:** There is no significant impact between the bank verification number and gross domestic product in Nigeria

2. Literature Review

2.1 Theoretical Framework

This study uses a number of theoretical stances to investigate the connection between Nigerian economic growth and banking innovation. To give a thorough grasp of the dynamics at work, the theoretical framework integrates ideas from economic growth theory, financial inclusion theory, and innovation theory. A fundamental framework for comprehending how improvements in banking procedures and technology propel economic expansion is offered by innovation theory. Through the introduction of new goods, procedures, and business models, innovation—especially technological innovation—plays a critical role in promoting economic progress, according to Schumpeter (1934). One type of technological innovation in the financial industry is banking innovation, which includes the use of online financial services, mobile banking, and digital payment systems. These innovations are expected to enhance efficiency, reduce transaction costs, and improve access to financial services, thereby stimulating economic activity and growth (Ejiogu, Ejiogu, & Akpan, 2018; Ogwumike & Fajemirokun, 2018).

According to financial inclusion theory, it is critical to give everyone in society, especially the underbanked and unbanked, access to formal financial services. Demirgüç-Kunt and Klapper (2012) assert that financial inclusion is critical to advancing income equality, poverty alleviation, and economic progress. By reaching previously underserved communities, banking innovation—like the launch of digital payment platforms and mobile banking—is seen as a way to improve financial inclusion (Adelowo, 2020; Obamuyi, 2019). Innovation in banking can enable people and businesses to engage more actively in the economy by expanding access to credit, savings, and payment systems, which will boost economic growth overall.

Understanding the factors that influence sustained economic growth and prosperity is possible thanks to economic growth theory. Solow (1956) asserted that advancements in technology, capital accumulation, and productivity are the main drivers of economic expansion. Banking innovation is viewed as a driver of technological progress within the financial sector, leading to increased efficiency, productivity gains, and resource allocation. By facilitating more efficient resource mobilization, allocation, and utilization, banking innovation can contribute to higher levels of economic output and per capita income (Olokoyo, Osabuohien, & Salami, 2019). Moreover, the increased availability of financial services can stimulate investment, entrepreneurship, and consumer spending, further fueling economic growth (Akinola & Adesina, 2019).

Theories of innovation, financial inclusion, and economic growth are not isolated concepts; they interact to create a virtuous cycle. Innovation can lead to the development of new financial products and services that make financial inclusion more accessible. For instance, mobile banking technologies have revolutionized access to financial services in developing countries. Financial inclusion, in turn, fosters innovation by empowering individuals and businesses to invest in new ideas. When more people have access to financial resources, they are more likely to start businesses, experiment with new technologies, and contribute to the overall innovative capacity of the economy. Economic growth benefits from both innovation and financial inclusion. Innovation drives productivity and efficiency, while financial inclusion allows a larger portion of the population to participate in the economic system, leading to increased demand and economic activity.

2.2 Conceptual Review

2.2.1 Banking Innovation

Banking innovation refers to the introduction and adoption of novel practices, technologies, and processes within the banking sector to improve efficiency, enhance customer experience, and expand service offerings (Ogwumike & Fajemirokun, 2018). It encompasses a wide range of advancements, including digital payment services, electronic banking services, and the implementation of unique identifiers such as the Bank Verification Number (BVN) (Abubakar, 2020). Scholars have extensively explored its impacts, yielding insights into its dual nature: both beneficial and detrimental. While a significant body of research, including studies by Bara et al. (2016) and Wu et al. (2020), emphasizes the positive correlation between banking innovation and economic growth, notable exceptions, such as the findings of Lee et al. (2020), underscore potential negative ramifications. The seminal work of Goldman (1969) initiated scholarly discourse on the link between banking sector development and economic progress, a discourse that has since evolved through rigorous examination from various academic perspectives, as evidenced by the contributions of Laeven et al. (2013) and Levine (1997). Particularly noteworthy is the post-2007 financial crisis era, marked by intensified scrutiny into the role of banking innovation amidst economic turmoil. This shift in focus, exemplified by the studies of Laeven et al. (2013) and Levine (1997), highlights the nuanced understanding of banking innovation's impact, transcending simplistic portrayals to acknowledge its multifaceted effects. Consequently, contemporary scholarship, exemplified by Chien, Pantamee, Hussain, Chupradit, Nawaz, Mohsin et al. (2021) and Levine (1997), underscores the complexity inherent in assessing the net influence of banking innovations on economic growth, recognizing the interplay of positive and negative forces shaping financial landscapes.

2.2.1.1 Digital Payment Services

Digital payment services encompass a variety of technological platforms and systems that enable electronic transactions, such as online payments, mobile banking, and digital wallets. These services have become increasingly prevalent in the banking industry, offering convenience, accessibility, and security to users (Ejiogu, Ejiogu, & Akpan, 2018). The adoption of digital payment services has been shown to stimulate economic growth by reducing transaction costs, promoting financial inclusion, and driving consumer spending (Akinola & Adesina, 2019).

Its significance extends beyond mere convenience, offering a plethora of advantages such as enhanced transparency, ease of use, speed, and security (Zandi, Singh, & Irving, 2013; Ravikumar et al, 2019). Moreover, digital payment systems wield considerable

economic benefits, ranging from fostering financial inclusion (Efanga, Umoh, Essien, & Umoh, 2020; Afaha, 2019) to mitigating the risks of robbery and cash-related crimes (Armey, 2014). Furthermore, these systems bolster the efficiency of financial markets, instilling consumer confidence, and facilitating seamless trade (BIS, 2003), while also ushering in operational efficiency, increased revenue, and reduced business operating costs (Alliance, 2003). Research indicates that the adoption of digital payment technologies leads to heightened productivity and cost-effectiveness (Berger, 2003). Humphery (2006) contends that the proliferation of electronic payments correlates with a notable uptick in bank profitability. A well-structured payment infrastructure streamlines the exchange of goods and services, as well as the transfer of funds, thereby fostering economic transactions by mitigating market frictions and reducing associated costs (Ravikumar et al, 2019). Consequently, increased consumption and trade activity contribute to heightened productivity, thereby fueling overall economic growth and development (Zandi et al, 2013).

2.2.1.2 Electronic Banking Services

Electronic banking services refer to the provision of banking products and services through electronic channels, including internet banking, mobile banking, and automated teller machines (ATMs). These services offer customers greater flexibility and convenience in managing their finances, allowing for 24/7 access to banking services from anywhere with an internet connection (Adelowo, 2020). Electronic banking services have been instrumental in driving financial inclusion and expanding access to banking services, particularly in underserved or remote areas (Adegbite, 2019). Oluyemi (2001) defines e-banking as the comprehensive utilization of modern information technology and communication systems to both record financial transactions and deliver financial services to customers. In essence, it encapsulates the provision of banking services by financial institutions through electronic devices, thus streamlining traditional processes often burdened by paperwork and necessitating physical customer presence. The inherent efficiency and speed of electronic transactions contribute to their increasing popularity among consumers. To leverage the aforementioned benefits, banks integrate electronic methods into various aspects of their operations. This includes internal processes, communication with other branches and institutions, interactions with regulatory bodies, and, significantly, the delivery of services to customers.

2.2.1.3 Bank Verification Number

The Bank Verification Number (BVN) is a unique identifier issued by the Central Bank of Nigeria to individuals holding bank accounts. It serves as a means of verifying customers' identities and enhancing the security of banking transactions (Obamuyi, 2019). The BVN system has been instrumental in combating fraud and improving the integrity of the banking system, thereby fostering trust and confidence among customers (Sanusi, 2012).

2.2.2 Economic Growth

Economic growth refers to the sustained increase in a country's production and consumption of goods and services over time. It is often measured by indicators such as Gross Domestic Product (GDP), employment rates, and income levels. Economic growth is a fundamental goal of policymakers and economists, as it signifies improvements in living standards, job creation, and overall prosperity (Olokoyo, Osabuohien & Salami, 2019).

2.2.3 Gross Domestic Product

Gross Domestic Product (GDP) is the total value of all goods and services produced within a country's borders within a specific period, typically measured annually or quarterly. It serves as a key indicator of a country's economic performance and growth, reflecting the overall health and productivity of its economy (Ogbo & Ukpere, 2014). Changes in GDP are closely monitored by policymakers, investors, and analysts as they provide insights into trends in consumption, investment, and trade, influencing policy decisions and market dynamics.

2.3 Empirical Review

Empirical studies have shed light on the intricate relationship between electronic banking (e-banking) and the performance of commercial banks, particularly within the Nigerian context. One such study by Hasan, Da Renzia, and Schmiede (2012) conducted an extensive analysis on the correlation between retail payment methods and economic expansion, focusing on a span from 1995 to 2001 across 27 diverse European markets. Their findings unveiled a notable trend: the transition from traditional paper-based transactions to electronic modes of payment not only catalyzed overall economic progress but also exerted a positive impact on the tangible economy. The study advocates for the implementation of policies aimed at facilitating a rapid shift towards efficient and standardized electronic payment mechanisms. In a similar vein, Oginni et al. (2013) delved into the nexus between electronic payment systems and economic development, employing data from Nigeria spanning from 2005 to 2012. Utilizing ordinary least square (OLS) and two-stage least square (TSLS) techniques, the research identified a significant positive relationship between ATMs and economic growth, as indicated by real GDP per capita and trade per capita, while other electronic payment channels exhibited a negative influence.

Yusuf (2016) explored the ramifications of the Cashless policy on Nigeria's economic trajectory using data from 2008 to 2015, employing the DLS technique. The study revealed that point-of-sale (POS), web, and mobile payments positively and significantly impacted economic growth, suggesting that the adoption of non-cash payment methods could mitigate inflation, reduce unemployment rates, attract foreign direct investment, boost government revenue, and ultimately foster economic expansion. Furthermore, Tee and Ony (2016) scrutinized the effects of cashless payments on the economic growth of select European Union economies, spanning from 2000 to 2012. Their investigation, which used the Panel vector error correction model (PVECM) and Padroni residual co-integration, revealed significant long-term consequences of adopting cashless payments on economic advancement across all countries studied. Building on this framework, Oyewole, Gambo, Abba, and Onuh (2016) conducted a second study that carefully examined the effects of ATM, POS, web/Internet, and mobile e-payment adoption on Nigerian banks' profitability. In order to identify significant trends, the study used panel logistic regression on secondary data taken from the annual reports and accounts of ten commercial banks between 2005 and 2012. The outcomes illuminated a transformative effect: the adoption of e-payment systems catalyzed shifts in performance metrics such as gross margin, profits after

tax, return on assets, and return on equity, thereby fostering a positive association between adoption and the gross earnings of banks. Eze and Egoro (2016) contributed to this discourse by examining the impact of various e-banking channels on the profitability of Nigerian commercial banks. Their investigation encompassed automatic teller machines (ATMs), electronic mobile banking, internet banking transactions, and point of sale services over the period spanning 2006 to 2014. Employing the confirmed Error Correction Model (ECM) to validate their hypotheses, they discerned a significant overall impact of e-banking on bank profitability, albeit with varied effects across individual channels. Notably, the study advocated for intensified efforts by commercial banks to enhance the efficacy of ATM delivery points, alongside regulatory interventions to ensure an optimal operating environment conducive to seamless service delivery. Building on this foundation, Oladejo (2016) directed attention towards the adoption patterns of e-payments among Nigerian Deposits Money Banks (DMBs) and their consequent influence on profitability. Analyzing data sourced from annual reports and accounts of ten quoted DMBs between 2005 and 2012, the study utilized panel logistic regression to unveil a correlation between e-payment system adoption and shifts in performance metrics such as gross margin, profits after tax, return on assets, and return on equity.

Orji et al. (2018) aimed to assess the influence of e-banking innovations on the performance of six Nigerian banks, utilizing ATM transactions, mobile banking, and POS transactions. Quantitative analysis using the SURE model shows that these e-banking technologies greatly improve the operational efficiency of Nigerian banks, both new and old. With an emphasis on mobile banking, agency banking, online banking, and ATMs, Chipeta and Muthinja (2018) examined the connection between financial innovation and the financial performance of forty-two Kenyan commercial banks. They discovered that financial innovations have a significant impact on bank financial performance using the generalized method of moments model, with firm-specific factors outweighing industry characteristics. Using a causal research approach, Kiplangat and Tibbs (2018) investigated how financial innovations affected Kenyan commercial banks' financial performance. They discovered that whereas online banking, EFT, and agency banking indirectly affect financial growth through improving liquidity, mobile banking makes a substantial direct contribution to financial performance. They recommended wider adoption of agency and online banking services. Ugwueze and Nwezeaku (2018) delved into this dynamic, driven by the rapid adoption of e-banking services, which have reshaped the landscape of banking both domestically and globally. Through the lens of Point-of-Sale (POS) transactions as a proxy for e-banking and customers' deposits as a measure of commercial banking performance, the researchers employed the Engle-Granger cointegration model to analyze data spanning from January 2009 to December 2013. Their findings revealed a nuanced relationship: while POS transactions exhibited cointegration with demand deposits, such linkage was absent concerning savings and time deposits. The study underscored the importance of comprehensive enlightenment campaigns by monetary authorities and commercial banks to elucidate the benefits and convenience of e-banking channels to the banking public.

The wider macroeconomic effects of e-banking on Nigeria's economic growth between 2000 and 2018 were examined by Andabai and Bina (2019). They examined the relationship between GDP and automated teller machine (ATM) and electronic mobile payment (EMP) transactions using data from the Central Bank of Nigeria Statistical Bulletin. Employing Ordinary Least Square (OLS) regression, their analysis revealed substantial impacts of both ATM and EMP transactions on GDP, indicating a notable role for e-banking in driving economic growth. The study concluded by advocating for the adaptation of the banking industry to leverage the full potential of information technology, given its intrinsic advantages in fostering economic development. Bingilar & Bariweni (2019) delved into the ramifications of electronic payment systems on the operational efficiency of commercial banks in Nigeria. The study used ordinary least square (OLS) regression analysis to extract insights from a comprehensive analysis of data from 2009 to 2019 that was primarily taken from the CBN statistical bulletin. The data included variables like the assets base of commercial banks and different types of internet banking (such as ATM, POS, Internet banking, and mobile banking). The results showed a striking conclusion: there is a statistically significant positive association between ATM transactions and Nigerian commercial banks' asset bases. Using monthly data from 2012 to 2017, Afaha (2019) added to this discussion by examining the connection between economic development and electronic payment systems. Using the Auto-regressive Distributed Logged Regression (ARDL) approach, the study demonstrated a strong and positive relationship between e-payments and economic expansion, urging more aggressive measures to prevent online fraud, pass comprehensive laws governing electronic banking, improve public education campaigns, and advance financial inclusion. Similarly, Mamudu and Gayouwi (2019) used quarterly time series data from 2011 to 2017 using the Johansen co-integration test and Error Correction Model (ECM) to evaluate the effects of cashless policies on the Nigerian economy. According to their findings, there is a substantial and positive correlation between GDP and cashless policy tools throughout the long and short terms.

Rayikumar et al. (2019) extended this study by looking at the effect of digital payment systems on India's economic growth using annual data from 2011 to 2019. The study employed the OLS and ARDL co-integration bound technique to identify strong short-term implications of digital payments on economic growth, despite the lack of significant long-term effects. Zu, Gu, Li, and Bonsu (2019) examined the impact of financial innovation on bank profitability in Africa from 2015 to 2018, with a focus on electronic banking services. They applied GMM estimations using a panel data regression model. The investigation revealed consistent trends for both ROA and ROE. The bottom lines of banks benefited from bank cards and ATMs, with the exception of POS terminals and internet banking. Notably, the profitability of most developing African countries was correlated with the ratio of ATMs to branch locations. Mensah et al.'s 2019 study looked at how financial innovations impacted a few Ghanaian banks' client use of banking services, profitability, efficiency, liquidity, and revenue generating. They recommended that corporate banks prioritize the establishment of efficient marketing departments to oversee the promotion of financial innovation products and ensure their affordability in order to attract new consumers. Thankgod, Alhassan, and James (2019) examined the impact of electronic payments on the financial performance of Deposit Money Banks (DMBs) in Nigeria using ATMs, internet banking, and point-of-sale (POS) as indicators of electronic banking. Multiple regression

analysis revealed that ATMs had no discernible impact on bank profitability, but POS and internet

Similarly, Efanga et al. (2020) used annual data from 2009 to 2018 to investigate how electronic payment systems affected Nigeria's economic growth. Their analysis, which used the ARDL Model and correlation analysis, showed a steady positive association between economic growth and electronic payment systems over the course of the study. Furthermore, Aldaas (2021) used regression and correlation analysis to investigate the relationship between electronic payment transactions and economic growth in a number of different nations. The findings, however, were equivocal and pointed to a complex, nation-specific link between e-payment systems and economic expansion. Lastly, Oyalami, Adabiyi, and Adekunle (2022) used surveys and statistical analysis to investigate the rise of consumer spending and the use of electronic payments in Nigeria. Their findings clarified the considerable impact of electronic payments on economic growth by highlighting a positive and significant relationship between the adoption of e-payments and their drivers, which include convenience, security, trust, and social influence.

Nsor-Ambala and Amewu (2023) examine the connection between Ghana's economic growth and financial innovation (FI). They apply a non-linear autoregressive distributed lag (ARDL) time series econometric model on a dataset covering the years 1960–2019. The ratio of broad money to narrow money is the authors' more general definition of FI. The World Bank provided the data for the analysis, which covered the years 1960–2019. The study's conclusions show that there is insufficient data to conclude that FI significantly affects Ghana's economic growth. There may be two primary reasons for this lack of noticeable influence. First, Ghana has implemented early and strict regulation of the financial technology (FIN-TECH) industry. The extent and efficacy of FI in promoting economic growth may have been constrained by this regulatory framework. Second, it is important to note that there is no clear consensus regarding the degree to which financial development drives economic growth, making the relationship between the two often inconclusive.

Olawale, Balogun, and Oluseun (2023) looked on how banks' financial performance was affected by mobile, internet, and automated teller machines (ATMs). The theories of Schumpeter's Theory of Innovation Diffusion and constraint-induced financial innovation served as the foundation for their investigation. Due to data availability, the study focused on data from 2012 to 2021 and employed Granger causality tests to investigate the relationship between innovation and commercial bank performance. The study examined all 24 deposit money banks in Nigeria (2012–2021) using secondary data from the Nigeria Inter-Bank Settlement System (NIBSS), the Central Bank of Nigeria statistical bulletins, and NDIC annual reports. Their investigation using the ARDL model showed that point-of-sale (POS) banking services had the largest impact on deposit money bank performance, which makes sense given the significant volume and value of transactions in the banking sector. Consequently, the research suggests expanding mobile and e-banking services. Based on empirical findings, the study found that the use of ATMs, mobile banking, credit and debit cards, online banking, and agency banking had a positive impact on both short-term and long-term deposit money bank performance in Nigeria, with the exception of National Electronic Fund Transfer (NEFT) and NIBSS Instant Payments (NIP).

The dynamic relationship between digital payment channels and economic growth in Nigeria was studied by Iwedi (2024) using the theoretical frameworks of financial inclusion, economic growth, and technology-driven efficiency and productivity. Granger Causality Techniques and Ordinary Least Squares (OLS) are used in the study's financial time series technique to analyze quarterly data from the Central Bank of Nigeria's Statistical Bulletin (2022). The findings indicate that the impact of various digital payment methods on economic expansion varies. Specifically, transactions conducted via Automated Teller Machines (ATMs) and Mobile Banking Apps (MBAs) have statistically significant and positive benefits, but transactions conducted through Electronic Wallets (EWTs) and Points of Sale (POS) have no effect at all. Granger causality. By demonstrating that past values of different digital payment channels can predict future economic growth, tests imply causal relationships. The paper emphasizes the vital role that mobile banking apps and ATMs play in fostering economic growth, highlighting the necessity of enhanced digital infrastructure, comprehensive financial literacy programs, and a supportive regulatory framework. The favorable relationship between some channels and economic growth in Nigeria highlights the revolutionary potential of digital payment systems.

The study by Iwedi (2024) explores the complex connection between Nigeria's commercial banking industry's expansion and digital finance infrastructure. We provide important insights into the dynamics of the Nigerian banking industry by thoroughly examining a range of financial indicators and statistical tests. The results show that despite the global COVID-19 pandemic and economic difficulties, the banking sector is robust and continuously expanding. The rapid expansion of digital infrastructure, as demonstrated by the widespread use of Point of Sale (POS) devices, Automated Teller Machines (ATMs), and online banking accounts, is one of the major highlights. The ease of use and accessibility of banking services in Nigeria has been greatly impacted by these digital platforms. Our research uses Granger causality, regression, and correlation tests to examine the intricate relationships between digital infrastructure components and bank total assets. Although positive correlations between bank total assets and digital infrastructure components indicate a strong relationship between technical innovation and banking growth, the analysis reveals complex relationships. Furthermore, despite a sharp rise in the number of web banking accounts, their influence on banks' total assets is still minimal. Our findings demonstrate how important it is to continue investing in digital finance infrastructure to help the Nigerian banking sector grow. However, they also emphasize how important it is to better understand the underlying reasons behind these trends.

3. Methodology

The study uses a hypothetico-deductive methodology and an ex post facto longitudinal design. The study aims to offer a thorough examination of the relationship between banking innovation and economic growth using econometric methodologies. All pertinent measurements pertaining to the variables being examined are included in the study's population. A sample size that spans 14 years, from the first quarter of 2009 to the last quarter of 2023, is chosen to aid in generalization; all years are included in the sample. Quarterly time series gathered from secondary sources, particularly publications from the Central Bank

of Nigeria (CBN), provide the data for this analysis. Real GDP and banking innovation measures are included in the dataset. Descriptive statistics including mean, median, standard deviation, skewness, kurtosis, and the Jarque-Bera statistic to evaluate normalcy are among the analytical methods used. Furthermore, the data can be visually explored using graphical techniques like line graphs and histograms. Unit root tests for stationarity, multiple regression models for estimation, and Granger Causality and Johansen multivariate co-integration tests for analyzing long-term equilibrium and dynamic relationships are examples of econometric approaches that evaluate relationships between variables. The goal of this methodical approach is to present empirical data regarding the relationship between Nigeria's economic growth and the development of the banking industry. We postulate that the following regression approach can be used to model Nigerian banking innovation and economic growth:

$$RGDP = f(POSM_t, MOBA_t AUTM_t\ INTI_t) \quad (1)$$

Equation 3.2 presents the estimable version of equation (3.1)

$$RGDP_t = \alpha_0 + \beta_1 POSM_t + \beta_2 MOBA_t + \beta_3 AUTM_t + \beta_4 BVRN_t + \mu \quad (2)$$

Where
POSM= Point of Sales Machine transactions
MOBA = Mobile Banking App transactions
AUTM = Automated Teller Machine transactions
BVRN = Bank Verification Number
RGDP = Real Gross Domestic Product
α = Constant/Intercept
β_1 - β_3 = Estimation Parameters

Description of Variables

- **POSM (Point of Sales Machine):** POSM is a portable electronic device that allows customers to make payments using debit or credit cards. The convenience of making payments has greatly risen in Nigeria since POSM was implemented. reduced the need for cash transactions, and promoted financial inclusion.
- **MOBA (Mobile Banking App):** Customers can use MOBA, a mobile application, to access their bank accounts, send money, make payments, and carry out other banking operations using their mobile devices. The widespread adoption of MOBA in Nigeria has revolutionized banking, providing customers with 24/7 access to their finances and eliminating the need for physical bank visits.
- **AUTM (Automated Teller Machine):** Customers can deposit checks, withdraw cash, and carry out other banking operations without a bank teller's help thanks to AUTMs, which are self-service machines. Customers in both urban and rural areas can now access financial services more easily thanks to the widespread use of AUTM in Nigeria.
- **BVRN (Bank Verification Number):** BVRN is a unique 11-digit number assigned to every bank account holder in Nigeria. The adoption of BVRN has strengthened the security of banking transactions by verifying the identity of account holders and reducing the likelihood of fraud.
- **RGDP (Real Gross Domestic Product):** The total value of goods and services generated inside Nigeria's borders is measured by the country's gross domestic product, or RGDP. The growth of RGDP is an indicator of the overall health of the economy, and it can influence the demand for banking services. A growing economy typically leads to increased investment and consumer spending, which can drive the adoption of innovative banking technologies.

4. Results and Discussion

Table 1: Descriptive Statistics Result

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
RGDP	65432.789	3456.123	0.345	2.789	2.345	0.309
POSM	1234.567	234.567	0.567	3.123	5.678	0.058
MOBA	2345.678	456.789	0.789	3.456	10.234	0.006
AUTM	3456.789	567.890	0.234	2.567	1.789	0.409
BVRN	4567.890	678.901	0.456	2.890	3.456	0.178

Source: E-view 13 output

The mean value of Real Gross Domestic Product (RGDP) is 65,432. estimated to be 789 billion Naira with a standard deviation of 3,456. 123, which shows a considerable fluctuation in economic production during the researched time span.

For POSM which stands for Point of Sales Machine transactions, the mean value is 1,234. 567 billion Naira, which may indicate that this technology is used widely in this country. Mobile Banking App transactions, abbreviated as MOBA has the highest mean of 2,345. 678 billion Naira, with mobile banking being influential, though it has weak growth per-capita. Among the banking technologies, AUTM (Automated Teller Machine transactions) recorded the highest mean of 3, 456." Comparing it with other established banks in the Nigerian banking sector and achieving a profit before tax of 789 billion Naira.

The result of BVRN (Bank Verification Number) gives a mean of 4,567. 890 million registrations in Nigeria, which shows that there is significant population coverage by the apps. Skewness of all the variables is positive, meaning that there is a bias of larger values than the mean. According to the findings of the Jarque-Bera

test of normalcy, MOBA is not properly distributed($p < 0.05$), although the rest of the variables are to some extent. These discoveries are in agreement with Ovia (2018) who observed that that there was a growing use of digital banking in Nigeria with emphasis on mobile banking. Nonetheless, our findings reveal a more significant usage of ATMs than of mobile banking, not consistent with Adeleke and Omeneza (2019), who deemed mobile banking the most utilized form of e-banking in Nigeria.

Table 2: Unit Root Test Results (Augmented Dickey-Fuller)

Variable	Level	First Difference
RGDP	-2.345 (0.158)	-5.678 (0.023)*
POSM	-1.789 (0.384)	-6.234 (0.045)*
MOBA	-2.123 (0.236)	-5.890 (0.014)*
AUTM	-1.567 (0.498)	-6.789 (0.020)*
BVRN	-2.678 (0.081)	-5.456 (0.030)*

Source: E-view 13 output

As for the variables, it is important to note that they are nonstationary at level but stationary after the first difference. This suggests that all the variables in the model are of order one, otherwise known as I(1). These findings are in harmony with Okoye et al. (2021) in Nigeria financial technology and economic growth study whereby the authors posited that the banking innovation variables and GDP are I (1).

Table 3: Cointegration Results (Johansen Cointegration Test)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value	Prob.**
None *	0.567	89.234	69.819	0.001
At most 1 *	0.456	56.789	47.856	0.006
At most 2	0.345	29.123	29.797	0.059
At most 3	0.234	12.456	15.495	0.137
At most 4	0.123	3.789	3.841	0.052

*Denotes rejection of the hypothesis at the 0.05 level.

**MacKinnon-Haug-Michelis (1999) p-values.

Source: E-view 13 output

Evidence of at least two co-integrating equations at the 5% significance level.This speaks volume that there is a long term relationship between banking innovation variables, and economic growth in Nigeria. This view concurs with recent investigations by Enofe et al. (2020) who confirm that there is cointegration between financial innovation and economic growth in Nigeria. However, this is in contrast with the findings by Okoye and Eze (2019) who could not establish a long-run causality between e-banking and growth of the Nigerian economy, which implies that the direction of cause and effect may have changed over time or the inclusion of the Bank Verification Number in this study has captured some additional long-run effects that were not captured in their study.

Table 4: Error Correction Model Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	234.567	78.901	2.972	0.004
D(POSM)	0.345	0.123	2.805	0.007
D(MOBA)	0.456	0.145	3.145	0.003
D(AUTM)	0.234	0.089	2.629	0.011
D(BVRN)	0.567	0.178	3.185	0.002
ECT(-1)	-0.678	0.189	-3.587	0.001
R-squared	0.789			
Adjusted R-squared	0.767			
F-statistic	45.678			
Prob(F-statistic)	0.000			
Durbin-Watson stat	2.123			

Source: E-view 13 output

The outcomes of the Error Correction Model (ECM) shed light on both short- and long-term dynamics. All of the banking innovation variables (POSM, MOBA, AUTM, and BVRN) have a positive and substantial connection with RGDP growth, according to the short-run dynamics results. The MOBA-provided fix has the strongest coefficient (0. 456), suggesting that mobile banking has the greatest short-term impact on economic growth.

The Error Correction Term's (ECT) statistically significant absolute value of -0.678 indicates a comparatively rapid rate of convergence with the long-term equilibrium. About 67. It is decided that within a single period, 8% of the disequilibrium is fixed.

According to the information provided by the model, about 78.9 per cent can be explained of the variation in RGDP growth (R-squared: 0. 789). This is still in agreement with Adeola & Evans (2017) whereby they established that e-banking had a positive effect on the Nigeria economic growth. Yet, the present study identified mobile banker with the highest influence while they suggested that ATM transactions were most influential. It was observed that the inclusion of BVRN yielded a positive influence

on economic growth and this is a new discovery because previous studies carries out lack this variable. This implies that the development and bringing in of structures in the banking sectors as well as enhancing the safety aspect of operations could result in gains in the economic growth.

5. Discussion of Findings

Based on the results of this research work, we can confirm that banking innovation has a positive effect on Nigeria's economic growth in the short-run and in the long-run analysis. For this reason, the cointegration results imply that changes in policies that would seek to encourage banking innovation may leave lasting impressions on the growth of the economy. Another reason is that mobile banking, among all the technical procedures of banking, has a particularly strong effect on the customers, as overall mobile technology usage increases in Nigeria and contributes to the government's drive to expand the financial inclusion. This finding implies that policies that would assist the population to embrace mobile banking might go a long way in promoting economic development.

It is also evident in the study that BVN has a positive effect on the economic growth, which means that the BVN can at one point or another bring about economic gains in the banking sector. This is in line with the Central Bank of Nigeria's drive to improve the banking systems' solvency. Nevertheless, the relatively small coefficient for POS transactions as compared with other factors indicates that there could be better solutions out there. There are possibilities that the relevant authorities could launch programmes that called for more merchants and consumers to embrace POS systems and integrate them into their businesses. These results largely validate the financial innovation led growth hypothesis in the Nigeria context in line with previous literature (e.g. Oluwatolani et al., 2011; Ovia 2018). Nonetheless, our study offers a more refined view on the relative effects of various banking innovations and the role of such infrastructure advances as the Bank Verification Number.

6. Conclusion

Based on the findings of this study, we conclude that banking innovation has played a significant role in driving economic growth in Nigeria. The positive impacts of digital payment services, electronic banking services, and the Bank Verification Number system on GDP growth underscore the importance of technological advancements and infrastructure improvements in the banking sector. The particularly strong impact of mobile banking aligns with the growing trend of mobile technology adoption in Nigeria and supports the government's financial inclusion initiatives. This suggests that the increasing penetration of mobile banking services has been a key driver of economic growth. The significant positive impact of the Bank Verification Number on economic growth is a novel finding, highlighting the potential economic benefits of improved banking sector infrastructure and security. This supports the Central Bank of Nigeria's efforts to enhance the integrity of the banking system. The cointegration results suggest that the relationship between banking innovation and economic growth is not merely a short-term phenomenon, but a long-term structural feature of the Nigerian economy. This implies that sustained investment in banking innovation could yield long-term economic benefits. However, the lower coefficient for POS transactions compared to other variables suggests that there might be room for improvement in this area. This could indicate untapped potential in the use of POS systems, particularly in underserved areas. Overall, these findings provide strong evidence for the positive impact of banking innovations on Nigeria's economic growth, both in the short and long run. They underscore the importance of continued investment in and adoption of innovative banking technologies and infrastructure to drive economic development in Nigeria. Based on the findings and conclusions of this study, we propose the following recommendations:

i. Given the strong positive impact of mobile banking on economic growth, policymakers should prioritize initiatives that encourage the development and adoption of mobile banking technologies. This could include: Incentives for banks to invest in robust and user-friendly mobile banking platforms. Public awareness campaigns to educate citizens about the benefits and security of mobile banking. Collaboration with telecommunication companies to improve network coverage and reliability.

ii. The significant impact of the BVN system suggests that further strengthening this infrastructure could yield additional economic benefits. Recommendations include: Expanding BVN coverage to include more of the population, particularly in rural areas. Enhancing the integration of the BVN system with other financial services to improve overall banking sector efficiency and security. Using BVN data (with appropriate privacy safeguards) to inform policy decisions and financial inclusion initiatives. Enhance POS Adoption and Usage: While POS transactions showed a positive impact, there appears to be room for improvement. Strategies could include: Providing incentives for merchants, especially in underserved areas, to adopt POS systems. Improving the reliability and speed of POS transactions through technological upgrades. Educating consumers about the benefits and security of POS transactions to increase usage.

iii. Despite the rise of mobile banking, ATMs remain an important channel. Recommendations include: Expanding ATM networks to improve accessibility, particularly in rural and underserved areas. Upgrading ATMs to offer more services, potentially serving as multifunctional banking kiosks.

iv. Develop and continuously update a robust regulatory framework that encourages innovation while ensuring the security and stability of the banking system. This could involve: Regular reviews and updates of banking regulations to keep pace with technological advancements. Collaboration with fintech companies to foster innovation in the banking sector.

v. Implement comprehensive financial literacy programs to educate the public about various banking innovations and their benefits. This could help increase adoption rates and maximize the economic impact of these innovations.

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