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Effect of Digital Banking Platforms on Financial Inclusion in Nigeria: (2009-2023)

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ABSTRACT: This study investigated the Effect of Digital Banking Platforms on Financial Inclusion in Nigeria (2009-2023), with focus on Automated Teller Machines (ATM), Mobile Banking (MOB), Internet Banking (INB), and Point of Sale (POS) transactions. Using annual data from 2009 to 2023 and employing the Robust regression analysis (M-estimation), the study examines how these digital payment options affect the number of account holders (NAH) as a proxy for financial inclusion. The study adopted the *ex-post facto* research design. The data sources are the Central Bank of Nigeria (CBN) Statistical Bulletin, Nigeria Inter-Bank Settlement System Plc (NIBSS), and the World Bank Data Bank. The diagnostic tests, including multicollinearity (VIF/TOV), Heteroskedasticity (Breusch-Pagan-Godfrey), and specification error (Ramsey RESET), confirm the reliability and validity of the regression model. Empirical results reveal that ATM and INB have significant positive effects on financial inclusion, while POS shows a significant negative impact. MOB shows a positive but insignificant effect. The study concluded that digital banking infrastructure particularly ATMs and internet banking plays a vital role in promoting financial inclusion. It recommends that banks and financial institutions should invest more in user-centered internet and mobile banking platforms with robust security and easy onboarding processes. Also, fintech and technology developers need to design digital financial tools that align with account ownership goals, particularly in underserved areas. This research contributes to the growing body of knowledge on financial technology by highlighting the role of specific modern payment systems in expanding access to formal banking in Nigeria

Keywords: Digital banking platform, Financial inclusion.

INTRODUCTION

The evolution of digital banking marks a significant milestone in the transformation of the global financial landscape. Digital banking simply entails the use of internet-enabled platforms, mobile applications, automated teller machines (ATMs), point-of-sale (POS) systems, and other electronic channels to deliver banking services without the need for physical bank visits. This innovation offers a wide range of services such as fund transfers, bill payments, account management, loan applications, and real-time transaction tracking, all accessible through digital devices. The shift from traditional brick-and-mortar banking to digital platforms is driven by the need for convenience, speed,

security, and broader access to financial services (Ozili, 2025; Kumari, 2021).

In today's increasingly digital world, financial institutions are leveraging technology to enhance customer experience, reduce operational costs, and increase competitiveness. According to Ananwude (2018), digital payment options involve the use of data and communication technologies through which financial institutions conduct transactions and maintain engagement with customers. Similarly, Ogbonna, Okaro, and Igwe (2019) emphasize the growing array of electronic financial transaction tools that now facilitate real-time banking interactions. Justifiably, digital banking has proven particularly valuable in regions with underdeveloped financial infrastructure. As noted by Kumari (2021), modern digital banking solutions such as mobile banking and electronic wallets—enable financial inclusion by reaching populations in remote or underserved areas who might otherwise lack access to conventional banking services. As noted by Obidike, Onyeka, & Nduka (2022), these innovations not only provide easier access to funds but also support economic activities by enabling small businesses and individuals to transact, save, and invest more efficiently.

Globally, the expansion of digital banking has shown varied impacts. While Europe and Asia have recorded strong adoption, Latin America faces barriers tied to infrastructure and digital literacy (Ozili, 2025). In Africa (Nigeria to be specific), however, mobile banking has emerged as a transformative tool for inclusion, owing to high mobile phone penetration and the proliferation of fintech solutions. In Nigeria, digital financial services such as mobile wallets, agency banking, and mobile banking platforms are enabling more people to save, transfer, and access credit without visiting a traditional bank branch (Mulili, 2022; Agaba & Christine, 2023; Ekwunife, Nduka & Ogini, 2022). Iwedi (2023) stressed that the emergence of digital banking platforms have proven effective in extending banking services to remote communities and underserved demographics. The rise of mobile money and agent banking has significantly lowered the cost of transactions and improved access to savings, credit, insurance, and other financial products. However, most Nigerians still continue to grapple with a significant financial inclusion gap. According to recent estimates from the World Bank (2023), over 40% of adults remain outside the formal financial system. Contributing factors include limited banking infrastructure in rural areas, low financial literacy, high poverty levels, and inadequate digital literacy.

To address these challenges, the Central Bank of Nigeria (CBN) launched the National Financial Inclusion Strategy (NFIS) in 2012 and introduced several policy reforms, including the cashless policy aimed at reducing reliance on cash and promoting electronic payments. The policy has led to rapid expansion in digital payment channels, with a surge in mobile banking apps, agent banking, mobile banking, and fintech innovations.

Statement of the Problem

In recent years, the adoption of digital banking channels, including Automated Teller Machines (ATMs), mobile banking, Internet banking, and Point of Sale (POS) systems, has gained traction as a significant driver of financial inclusion globally. These innovations hold the promise of improving accessibility to financial services, particularly in remote regions. However, despite the potential, several barriers remain that limit the full realization of digital banking's impact on financial inclusion. Factors such as inadequate infrastructure, low digital literacy, and high

transaction costs continue to impede the widespread benefits of digital banking, especially in developing economies.

Several studies have highlighted these challenges. Gakuru, Adyanga, and Ocan (2025) noted that while online banking offers transformative opportunities for advancing financial inclusion, it faces considerable challenges like limited access to technology, especially in rural areas, which hinder its full implementation. Similarly, Ozili (2025) and Rahman (2024) emphasize the significant role of technological innovations in enhancing financial inclusion, yet these advancements are not without barriers, including regulatory issues, lack of digital literacy, and persistent infrastructural constraints.

In the Nigerian context, despite progress in expanding digital banking services, the effective integration of these technologies into the daily financial activities of the population remains uneven. Studies by Nwude, Donatus, and Udeh (2020), and Ene, Abba, and Fatokun (2020) indicate that while digital banking tools such as ATMs and POS devices have increased in number, they have not been fully utilized to bridge the financial inclusion gap, particularly among rural populations. This is partly due to accessibility and usability challenges, which continue to limit the impact of these tools on increasing the number of account holders.

A key limitation in existing studies is the inconsistency in the temporal analysis of digital banking's impact on financial inclusion. Most studies have used annual or less frequent data intervals, which can mask short-term variations and trends in digital banking adoption and its influence on financial inclusion. In contrast, this study aims to provide a more granular understanding by adopting a quarterly data approach, which allows for a more detailed examination of how digital banking channels influence the number of account holders per one thousand kilometers over time. By utilizing quarterly data from 2009 to 2023 sourced from the Central Bank of Nigeria (CBN) and the World Bank, this study aims to offer insights into the fluctuations and patterns of digital banking adoption and its effect on financial inclusion in Nigeria. Thus, this study not only aims to explore the role of digital banking in financial inclusion but also highlights the need for more frequent, detailed data analysis to capture the dynamic effects of digital banking on financial inclusion.

Objectives of the Study

The main objective of this study is to examine the effect of digital banking on financial inclusion in Nigeria. Specifically, this study seeks to:

i. Examine the effect of Automated Teller Machine (ATM) operations on the Number of Account Holders in Nigeria.
ii. Explore the effect of Mobile Banking operations on the Number of Account holders.
iii. Ascertain the effect of Internet Banking operations on the Number of Account holders.
iv. Determine the effect of Point of Sale (POS) operations on the Number of Account Holders.

Statement of Hypotheses

The research hypotheses tested in the course of this work are:

HO_1: Automated Teller Machine (ATM) has no significant effect on the Number of Account Holders.

HO_2: Mobile Banking has no significant effect on the Number of Account Holders.

HO_3: Internet Banking has no significant effect on the Number of Account Holders.

HO_4: Point of Sale (POS) has no significant effect on the Number of Account Holders.

LITERATURE REVIEW

Automated Teller Machine (ATM):

The Automated Teller Machine (ATM) is one of the earliest forms of digital banking that transformed how customers access banking services. ATMs provide a convenient and accessible means for customers to carry out basic banking transactions, such as withdrawing cash, checking balances, and transferring funds. ATMs are often located in strategic areas such as shopping centers, airports, and gas stations, making banking services more widely accessible, even in regions with limited bank branches. This widespread network of ATMs has significantly contributed to improving financial inclusion by offering financial services to previously underserved populations, especially in remote areas where traditional banking services were not available (Mala & Vasanthi, 2017). Furthermore, ATMs reduce the need for physical presence at bank branches, saving time and transaction costs, thus facilitating broader access to financial services.

Mobile Banking:

Mobile banking, the use of mobile phones to access and manage banking services, has rapidly gained traction in Nigeria and across developing nations. Mobile banking platforms, such as *Mobile Money* services, enable users to conduct financial transactions, such as transferring money, paying bills, and accessing loans, without needing to visit a physical bank. This digital channel is particularly effective in rural and remote areas, where traditional banking infrastructure is sparse. According to Kumari (2021), mobile banking plays a significant role in promoting financial inclusion by overcoming geographical constraints. With increasing mobile phone penetration in Nigeria, mobile banking serves as a key tool for enhancing access to financial services, particularly for the unbanked population (Ananwude, 2018). Through mobile banking, individuals can easily participate in the formal economy, thus improving their financial inclusion status (Ogunewe, Ananwude & Nduka, 2020).

Internet Banking:

Internet banking, also known as online banking allows customers to access their bank accounts and perform transactions via the internet using computers or mobile devices. This channel provides a range of banking services, including fund transfers, bill payments, account management, and loan applications, all accessible from the comfort of one's home or office. Internet banking is particularly beneficial for urban populations with reliable internet connectivity and access to digital devices. In terms of financial inclusion, internet banking can drive broader economic participation by reducing barriers to entry and offering efficient and cost-effective financial services (Ogbonna, Okaro, & Igwe, 2019; Nduka, Ananwude & Osakwe, 2019). However, its success in promoting financial inclusion in Nigeria is contingent upon addressing challenges related to internet access and digital literacy, especially in rural areas.

Point of Sale (POS):

The Point of Sale (POS) system allows businesses and merchants to accept payments via debit or credit cards, making it easier for individuals to conduct transactions

electronically. POS machines are integrated with payment systems to authorize card-based transactions. The adoption of POS terminals has been a crucial element in improving financial inclusion in Nigeria, as it enables individuals, especially those in the informal sector, to make secure payments without relying on cash (Ananwude, 2018). POS systems also allow customers to withdraw cash or check balances, further enhancing access to banking services. The expansion of POS terminals in urban and rural areas has created opportunities for more people to access financial services, especially in areas where traditional banking infrastructure is limited.

Appraisal of Regulatory and Policy Landscape of Digital Banking in Nigeria

The regulatory and policy landscape of Digital Banking in Nigeria has been instrumental in promoting the growth of digital banking and fostering financial inclusion. The Central Bank of Nigeria (CBN), as the apex regulatory authority, has introduced several frameworks and strategic policies aimed at driving inclusive financial access through digital channels. According to the CBN Financial Inclusion Report (2023), the implementation of the *National Financial Inclusion Strategy (NFIS)* has been central to efforts geared toward reducing the percentage of financially excluded Nigerians by leveraging digital banking solutions such as mobile money, agent banking, and electronic payments. This strategy supports a multi-stakeholder approach involving banks, fintechs, mobile network operators, and other non-bank financial institutions to reach underserved and rural populations.

Further, the CBN's *Regulatory Framework for Mobile Money Services* provides clear operational guidelines for mobile money operators, enhancing innovation and increasing access to digital financial services. In addition, the *Guidelines on Open Banking (2021)* are designed to promote data sharing between banks and licensed third-party providers, thereby improving transparency, consumer choice, and competition within the digital financial ecosystem. Oyadeyi (2024) emphasizes that such regulatory reforms have contributed to expanding financial inclusion by lowering access barriers and improving service availability across socioeconomic classes.

To protect consumers and ensure compliance with global standards, the CBN has also introduced simplified *Tiered KYC* requirements. These measures allow individuals, especially those in low-income brackets or with limited formal identification, to open accounts and access basic financial services. Ene, Abba, and Fatokun (2019) highlight the significance of this policy in reaching financially excluded populations, especially in rural areas where documentation and identity verification remain key challenges.

Despite these advancements, challenges such as limited awareness of regulatory provisions, insufficient digital literacy, and inconsistent policy enforcement continue to impede the full realization of financial inclusion objectives. As digital banking continues to evolve, the regulatory framework must adapt by fostering innovation while ensuring consumer protection, data privacy, and operational resilience. Continuous review and implementation of targeted regulatory reforms will remain crucial to achieving Nigeria's financial inclusion goals in the digital age.

Emerging Trends in Digital Banking

The digital banking landscape is rapidly evolving, shaped by cutting-edge innovations that enhance the delivery, security, and

accessibility of financial services. These emerging trends are not only improving customer experience but are also playing a pivotal role in advancing financial inclusion across both urban and rural populations. One notable advancement is the deployment of artificial intelligence (AI) and chatbots in banking operations. These technologies automate customer interactions, enabling real-time responses to queries, personalized financial advice, and fraud detection, thereby improving operational efficiency and user satisfaction (Ogbonna, Okaro, & Igwe, 2019; Nduka, Atueyi, Osakwe & Mbanefo, 2021).

Biometric authentication is another significant development that enhances the security and integrity of digital transactions. The use of facial recognition, fingerprint scanning, and other biometric identifiers helps ensure secure access to banking platforms, reducing identity theft and fraud. As Ananwude (2018) notes, such security enhancements are critical in building user confidence, especially among new adopters in digitally underserved regions.

Furthermore, the integration of blockchain and distributed ledger technology (DLT) is redefining the architecture of digital banking by offering secure, transparent, and immutable transaction records. These technologies can improve transaction integrity, facilitate smart contracts, and enhance digital identity management. In Nigeria, while still at an early stage, the potential of blockchain to reduce costs and improve trust in digital financial services is increasingly being explored by both banks and fintech firms (Oyadeyi, 2024).

Another transformative innovation is open banking, which allows third-party providers to securely access consumer banking data with consent. This initiative encourages greater competition, service diversity, and personalized banking products. In line with the Central Bank of Nigeria's digital financial strategy, open banking is expected to drive financial inclusion by offering tailored financial solutions to users who may otherwise be excluded from formal financial systems (CBN, 2023; Oyadeyi, 2024).

In addition, the rise of embedded finance—where financial services are integrated directly into non-banking platforms such as ride-hailing apps, e-commerce platforms, or social media—has begun to reshape how users access and experience financial products. This model allows individuals to perform banking transactions within the digital ecosystems they already use regularly, lowering access barriers and improving service convenience (Kumari, 2021).

These innovations collectively represent the next frontier of digital banking in Nigeria and globally. They highlight how the integration of advanced technologies is not only transforming service delivery but also enhancing financial inclusion by reaching users in geographically remote and traditionally excluded areas. As Kumari (2021) and Ananwude (2018) emphasize, leveraging such trends is critical to ensuring inclusive, secure, and sustainable financial systems in emerging economies like Nigeria.

Role of Fintech–Bank Collaboration

The synergy between fintech companies and traditional banks has become a powerful driver of digital banking innovation in Nigeria. Fintechs bring agility, technological expertise, and customer-centered innovation, while banks offer regulatory compliance, trust, capital, and operational infrastructure. This collaboration enables the development of hybrid products and services that combine the strengths of both entities.

Examples of fintech-bank collaboration include partnerships to deliver agency banking,

micro-lending, mobile wallets, and real-time payments. For instance, Flutterwave's integration with Access Bank and Paystack's partnerships with various banks have improved payment processing and customer onboarding. Such collaborations also enhance transaction transparency, increase competition, and diversify financial products for consumers.

According to Oyadeyi (2024), these partnerships are essential for achieving scale in digital banking and accelerating financial inclusion. However, successful collaboration depends on regulatory clarity, interoperability of systems, and mutual trust between parties. The Central Bank's Open Banking Framework (2021) further facilitates such partnerships by enabling secure data sharing between banks and third-party providers. Overall, fintech-bank collaboration represents a strategic pathway to delivering inclusive, efficient, and innovative financial solutions across Nigeria's diverse population.

Overview on Financial Inclusion

In recent decades, financial inclusion has gained global recognition as a catalyst for economic development, poverty alleviation, and inclusive growth. In Nigeria, the evolution of financial inclusion within the banking sector has been marked by deliberate efforts to bridge the gap between the formally banked population and the millions who remain excluded from formal financial systems.

Historically, banking institutions in Nigeria catered primarily to affluent and urban-based clients, leaving rural and low-income populations with limited or no access to formal banking services (Singh & Srivastava, 2020; Oyadeyi, 2024; Monogbe, Omotayo, Achugbu & Nduka, 2016). This urban bias in financial service provision not only widened economic disparities but also hindered broader economic participation.

Financial Inclusion is defined by the World Bank (2019) as the process whereby individuals, businesses and corporate bodies have access to useful and affordable financial products and services that is appropriate to their wish in terms of transactions, savings, payments, credit and insurance rendered in a responsible and sustainable way. According to this definition, financial inclusion and financial exclusion seem like they are exact opposites. Financial inclusion refers to people who have access to financial services while financial exclusion refers to people who don't have access to financial services. In spite of these, there is a basic distinction amidst the two terms. While financial exclusion is the problem and financial inclusion the solution. The vital factor that addresses the two terms is that, financial inclusion refers to a financial sector that renders financial services responsibly and viable to people of all socioeconomic class.

Historically, the concept of financial inclusion began to take a more central role in policy and development discourse in the mid-20th century, as both the Nigerian government and financial institutions recognized the need to expand access to banking for underserved groups (Semusu & Turyasingura, 2023). Early interventions involved the physical expansion of bank branches and the establishment of cooperative banks and microfinance institutions to serve rural and low-income communities (Kyabarongo et al., 2024). While these traditional approaches yielded some gains, they were often limited by high operating costs, geographical constraints, and infrastructural challenges.

The late 20th century marked a significant turning point, as advances in technology—especially the advent of online and mobile banking—offered new pathways to financial inclusion. These innovations lowered the cost of service delivery and extended financial access to previously unreachable populations

(Iwuchukwu et al., 2023). In the 21st century, the rise of digital finance, powered by mobile technologies, fintech innovations, and blockchain, has further accelerated financial inclusion efforts. Even during the COVID-19 pandemic, digital banking platforms served as vital tools for maintaining access to financial services amid widespread disruptions (Sekiwu & Ocan, 2022; Aniefor, Nduka, Ananwude & Ezeaku, 2021).

Despite these advances, significant challenges persist. Limited internet connectivity, regulatory bottlenecks, and widespread digital illiteracy continue to hinder the full realization of digital banking's potential, particularly in Nigeria's rural and remote areas (Freeman et al., 2020). Therefore, achieving comprehensive financial inclusion requires coordinated efforts to enhance digital infrastructure, promote financial literacy, and create enabling policies that support innovation and access.

Cybersecurity and Digital Trust

As digital banking channels expand, the importance of cybersecurity and digital trust has grown significantly. Cybersecurity involves protecting digital infrastructure, networks, and users from malicious attacks, fraud, and unauthorized access. In Nigeria, incidents such as phishing, identity theft, and online banking fraud have undermined public confidence in digital financial services. According to Oyadeyi (2024), user distrust is a major barrier to the adoption of digital banking, especially among older adults and first-time users. To build digital trust, financial institutions must prioritize the implementation of robust cybersecurity measures, including multi-factor authentication, biometric verification, end-to-end encryption, and real-time fraud monitoring systems. The Central Bank of Nigeria's Risk-Based Cybersecurity Framework (2021) provides comprehensive guidelines for strengthening the cybersecurity posture of banks and fintech operators. Moreover, transparent dispute resolution systems, prompt reversal of failed transactions, and proactive consumer education are essential for increasing users' trust in digital channels.

Number of Account Holders: Measure of Financial Inclusion

The number of account holders is widely recognized as a critical indicator of financial inclusion, particularly in developing countries like Nigeria (Oyadeyi, 2024; Nduka, Okolie, & Ngangah, 2025). An account holder refers to an individual who possesses a formal financial account, such as a bank or credit card account, enabling them to perform essential financial transactions, including deposits, withdrawals, transfers, and accessing credit (Ene, Abba, & Fatokun, 2019; Anusi & Nduka, 2022). This individual typically enters a contractual agreement with a financial institution and assumes ownership of the funds contained within the account, as well as responsibility for any associated financial liabilities. In the Nigerian context, the increase in the number of account holders is indicative of broader access to financial services, which is a fundamental goal of financial inclusion initiatives. This measure reflects how deeply banking services have penetrated both urban and rural areas, and it also serves as a proxy for gauging the participation of individuals in the formal financial sector (CBN report, 2023).

Digital Literacy and Consumer Capability for Financial Inclusion

Digital literacy refers to the ability of individuals to understand, use, and interact effectively with digital technologies. In the context of digital banking, it includes knowledge of how to use mobile apps, USSD codes, ATMs, internet banking platforms, and digital wallets. Low digital literacy is a significant barrier to financial inclusion in

Nigeria, especially among rural dwellers, the elderly, and populations with low educational attainment. According to the World Bank (2023), millions of Nigerians remain excluded from formal financial systems not because of lack of access, but because of limited knowledge and confidence in using digital platforms. Banks and fintechs can also play a role by designing intuitive platforms and offering real-time guidance or chatbots for user support. Increasing digital literacy is not only crucial for onboarding new users but also for promoting responsible, secure, and sustained use of digital financial services.

2.2. Theoretical Review

The Diffusion of Innovation (DOI) Theory formed the theoretical anchorage. This theory was developed by Everett M. Rogers in 1962. The theory explains how new ideas, practices, or technologies are adopted and spread within a society or social system over time. The theory categorizes adopters into five groups: innovators, early adopters, early majority, late majority, and laggards. It further posits that the rate of adoption of an innovation is influenced by five key factors: relative advantage, compatibility, complexity, trialability, and observability.

In relation to the study, the DOI theory is particularly relevant as it provides a framework for understanding how digital financial services—such as mobile banking, agency banking, and internet banking—are adopted by various segments of the population. It helps explain the differential uptake of digital banking across rural and urban populations and highlights the socio-economic, cultural, and infrastructural factors that either facilitate or hinder adoption. Moreover, the theory is instrumental in identifying the barriers to financial inclusion and provides a guide for policymakers and financial service providers to design inclusive strategies that encourage the adoption of digital banking tools, thereby promoting broader financial inclusion among Nigeria's unbanked and underbanked populations.

2.3. Empirical Review

Gakuru, Adyanga, and Ocan (2025) did an explorative study on the implications of online banking on financial inclusion in banking institutions: A literature review on challenges and opportunities. It presents the challenges and opportunities of online banking globally. This study utilized a literature review approach. A comprehensive search was conducted across various academic databases, including Web of Science, Scopus, Dimensions, Google Scholar, and JSTOR, yielding a total of 563 documents. The search was performed using keywords such as "online banking," "financial inclusion," "digital banking challenges," "financial inclusion opportunities," and "banking institutions." Boolean operators (e.g., "AND," "OR") were used to refine search results and retrieve relevant literature. After filtering, 31 documents were selected for in-depth review based on relevance to the study's objectives, as evidenced in the reference section. This was after the inclusion and exclusion criteria to ensure the selection of pertinent literature. It was revealed that online banking has transformative potential to advance financial inclusion by making financial services more accessible and affordable. However, it faces challenges that can hinder its impact, including limited digital literacy, high transaction fees, and inadequate infrastructure in certain regions.

Ozili (2025) did a synopsis of financial inclusion research in banking. Complementing the existing reviews of the financial inclusion literature, the author offer focused on the role of financial inclusion in banking and the role of banks in financial inclusion. Emphasis was placed on the effect of bank managerial

discretion and regulation on financial inclusion outcomes, as well as the effect of financial inclusion on the banking business.. In contrast, financial inclusion affects banks by increasing the deposit base of banks, improving bank profitability, improving banks' resilience to shocks, improving bank stability, and reducing bank risk.

Rahman (2024) examined nexus between technological advancements in banking institutions and their impact on financial inclusion. The research design and methodology involve an extensive literature review and analysis of relevant studies from various sources. Findings reveal that technological innovations, including mobile banking apps, digital payment platforms, artificial intelligence, and blockchain technology, have significantly contributed to enhancing financial inclusion by improving accessibility, reducing transaction costs, and empowering marginalized communities and small businesses. The discussion highlights the transformative effects of fintech on financial services, emphasizing the role of peer-to-peer lending, digital wallets, and blockchain-based solutions in democratizing access to finance and promoting financial literacy. The implications of these findings suggest the need for collaborative efforts between public and private sectors to leverage technology effectively, enhance digital literacy, address data privacy concerns, and develop inclusive regulatory frameworks.

Law (2024) evaluated digital financial inclusion, defined as the impact of technology on financial inclusion, from the users' perspective. In 2019, Hong Kong launched eight virtual bank licenses with an aim to promote financial inclusion. It offers a suitable environment to address this issue. Results from 20 focus groups show that the intended usage of the virtual-only banking platform is affected by four thematic factors: namely: users' sense of security; engagement of regulators; promotion of the social acceptance of technology; and transparency and history of bank operations. These factors should be embedded into the landscape of banking regulation through a digital financial inclusion index as a prompt indicator of the digital acceptance level. This will assist regulators to offer timely policies to adapt to the fast-changing bank digitisation process.

Mittal, Tayal, Singhal, and Gupta (2024) examined the current state of using financial technology in the banking sector. Fintech has rapidly transformed traditional banking services, presenting both challenges and opportunities for financial institutions. The paper investigates into the key aspects of the role of fintech in the banking sector, examining the challenges faced by traditional banks and the opportunities that arise from embracing technological advancements. By conducting a comprehensive literature review, the authors aim to explore the utilization of technology across diverse facets of banking transactions, identifying challenges in its implementation, facts about enhanced role of technology in financial inclusion and more related data. The study also delves into future trends and the regulatory landscape of fintech within India's banking industry along with its scope around financial inclusivity.

Boldar, Omanwa, and Baimwera (2022) evaluated the effect of digital platforms as a channel for providing financial literacy for financial inclusion of commercial banks. The study was guided by diffusion of innovation theory. Using descriptive research design, a sample of 384 respondents was randomly selected from a target population of 10,717 management staff of commercial banks in Kenya. The data collected were analyzed using descriptive, correlation, and regression analysis. Digital platforms channels were found to significantly affect financial inclusion in commercial banks in Kenya. The study concluded that commercial banks in

Kenya had leveraged on the reachable of digital platforms like websites and online portals, social media pages, and online games and courses as channels of promoting financial literacy that significantly contributed to inclusion

Kumari (2021) investigated the role of modern banking as a tool for financial inclusion in India, between 2010 and 2015. The Ordinary Least Square method was adopted in the study. The study substantiated an adverse connection on five banks which accounts for 92% assertive mobile banking trades as against 63 banks that accounts for 8% that are not facilitating I assertively. The result of the study assumed that modern payment has ceased to function as a tool for financial inclusion in India between 2010 and 2015.

Nwude, Donatus, and Udeh (2020) examined the effect of e-banking on banks' performance and financial inclusion in Nigeria 2007-2019. The study employs multiple regression analysis models. The study collected its data from World Bank economic indicators, National financial inclusion strategy bulletin, and Statistical bulletin of the Central Bank of Nigeria. The findings of the study disclosed that modern payment options have made a positive and significant contribution in promoting Financial Inclusion amongst rural dwellers in Nigeria.

Ene, Abba, and Fatokun (2020) studied the impact of Modern Banking on Financial Inclusion in Nigeria. The total number of point-of-sale devices and automated teller machines in Nigeria was used as proxies for modern payment option and the proportion of the banked adult population to the total bankable adult population in Nigeria as a proxy for financial inclusion. The correlational analysis was adopted in the study. The result of the study disclosed that automated teller machines do not significantly impact financial inclusion while point-of-sale devices significantly impact financial inclusion in Nigeria.

Godfrey Akileng, Gillian Mercy Lawino, Eric Nzibonera (2018) evaluated the financial Inclusion in Uganda. This study examines how financial literacy and financial innovation can improve financial inclusion among households in Uganda. Large sections of the population in rural and urban areas in Uganda still remain out of the coverage of formal financial systems. The study uses a cross sectional survey research design. The study population comprised of the adult population in both rural and urban settings in Uganda. Empirical data was analyzed using correlation and regression analyses. The study reported that financial literacy and financial innovation are better determinants of financial inclusion among households. Therefore, financially literate households have a higher potential to make informed decisions on new innovations of financial products and services.

Aine Olugombo (2018) investigated the economy of financial inclusion in Nigeria. The study found that though access to bank accounts is high, a majority of the respondents operate savings accounts. However, bank account ownership penetration ratio of 1.4 accounts to an adult including inactive accounts is very low. The use of bank accounts in receiving money from, and sending money to family members living far away helps to service and maintain good family bond typical of Africans where family ties are held in high esteem. Most adults use their accounts between one and five times in a month but 24.01% of the accounts are inactive in receiving deposits while 6.91% are inactive for withdrawal in a month. The most popular non-cash payment methods are ATM/Debit card and wire transfer/on-line payment. 59.58% of those who save used a bank account, 32.5% save with cooperative societies while 26.25% used daily contributors and rotational savings scheme.

Anand and Saxena (2017) carried out a study on technology-based initiatives by Indian commercial banks towards financial inclusion. Descriptive statistics were adopted in the study. The result of the study indicated that despite making considerable developments in financial profitability, competitiveness, and viability, there are questions that banks have not been able to include an enormous portion of the public especially the underprivileged domains of the society into the furrow of basic banking services.

METHODOLOGY

The study adopted the *ex-post facto* research design because the present study involves the collection of data which have already occurred. Secondary is utilized for this study. The data were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin, Nigeria Inter-Bank Settlement System Plc (NIBSS), and the World Bank Data Bank (2023).

Data Analysis Techniques and Model Specification

The data on the digital payments options (ATM, MOB, INTB & POS) and financial inclusion proxy (numbers of account holders per 1000 kilometer) were analyzed with the aid of a table on the basis of which a regression model were used to find relationship between the dependent and independent variables. The software applied was the Econometric views (E Views 9.0 version). In line with the studies of Oyadeyi (2024), equation one is stated below:

$$NAH= \beta_0+\beta_1ATM +\beta_2MOB+\beta_3INB+\beta_4POS+Uit \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where:

NAH	=	Number of Account Holders
ATM	=	Automated Teller Machine expressed in Naira (Value)
MOB	=	Mobile Banking expressed in Naira (Value)
INB	=	Internet Banking expressed in Naira (Value)
POS	=	Point of Sales expressed in Naira (Value)
ε	=	Error term of the model
β_0	=	Constant value or intercept
β_1-β_4	=	Regression model coefficients.

Note: ATM, MOB, INB & POS were logged to ensure that all the variables are in the same order.

Decision Rule

Reject the null hypothesis if the p-value is less than the significance level, of 5%.

Apriori Expectation

Following extant empirical studies and the various theories used to underpin this study, we expect a positive relationship between the dependent and independent variable. It is mathematically expressed as:

ATM, MOB, INTB, POS>0 ……..(2)

DATA PRESENTATION, RESULT AND ANALYSIS

4.1 Data Presentation

This section presents the raw data; test the four research hypotheses formulated in chapter one, analyzed the results of the models specified in earlier chapter (chapter three) and at the same time discussed the relevant findings from the analysis. Accordingly, the first sub-section covered data presentation. The sourced data is presented in table 4.1:

Table 4.1: Raw Data on Digital Banking Platforms and Financial Inclusion

Year	ATM (₦' Billion)	POS (₦' Billion)	INB (₦' Billion)	MOB (₦' Billion)	NAH
2009	548.60	11.03	84.15	1.27	11.46
2010	399.71	12.72	25.05	6.65	11.23
2011	1,561.74	31.02	59.61	18.98	11.94
2012	1,984.66	48.01	31.57	31.51	11.49
2013	2,828.94	161.02	47.32	142.80	13.31
2014	3,679.88	312.07	74.04	346.47	16.19
2015	3,970.25	448.51	91.58	442.35	11.32
2016	4,988.13	759.00	132.36	756.90	9.29
2017	6,437.59	1,409.81	184.60	1,102.00	7.88
2018	6,480.09	2,383.11	675.92	1,974.25	8.42
2019	6,512.61	3,204.75	478.14	5,080.96	9.68
2020	18,199.66	4,727.08	392,340.25	14,987.74	8.80
2021	21,230.93	24,455.42	545,039.69	53,208.27	19.30
2022	32,648.02	41,035.80	783,660.03	111,122.11	13.00
2023	28,212.59	110,347.10	1,097,133.04	219,800.08	15.60

Source: Central Bank of Nigerian Statistical Bulletin & World Bank Data Base (2023).

The banking landscape in Nigeria has evolved significantly from 2009 to 2023, with notable growth across various platforms. Consequently, the outcomes of the four digital banking platform proxies (in value) are discussed herein.

1. ATM (Automated Teller Machine)

ATM transactions in Nigeria showed a steady increase over the years. In 2009, the total transaction value stood at ₦548.60 billion. This grew consistently, reaching ₦4,988.13 billion by 2016 and ₦6,512.61 billion in 2019. A significant jump occurred in 2020 with a value of ₦18,199.66 billion, likely due to changes in banking behavior during the COVID-19 pandemic. The peak was recorded in 2022 at ₦32,648.02 billion, followed by a drop to ₦28,212.59 billion in 2023. This decline may reflect customers' growing preference for cashless alternatives such as mobile and POS payments (Figure 4.1)

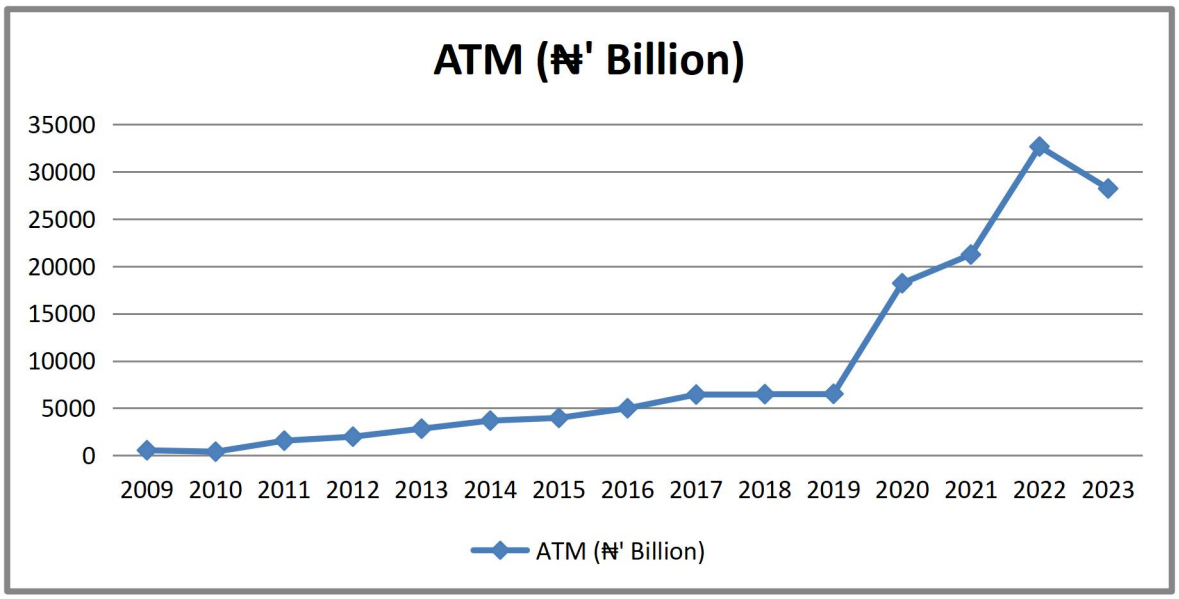


Figure 4.1: Value of ATM from 2009 to 2023

2. POS (Point of Sale)

POS transactions started with a low value of ₦11.03 billion in 2009 but increased rapidly in subsequent years. The growth was driven by financial inclusion efforts and expansion of agent banking. By 2016, the transaction value had risen to ₦759.00 billion and continued upward to ₦4,727.08 billion in 2020. A sharp increase occurred in the last three years, culminating in ₦110,347.10 billion in 2023. This pattern reflects rising acceptance of electronic payments among both consumers and businesses (Figure 4.2)

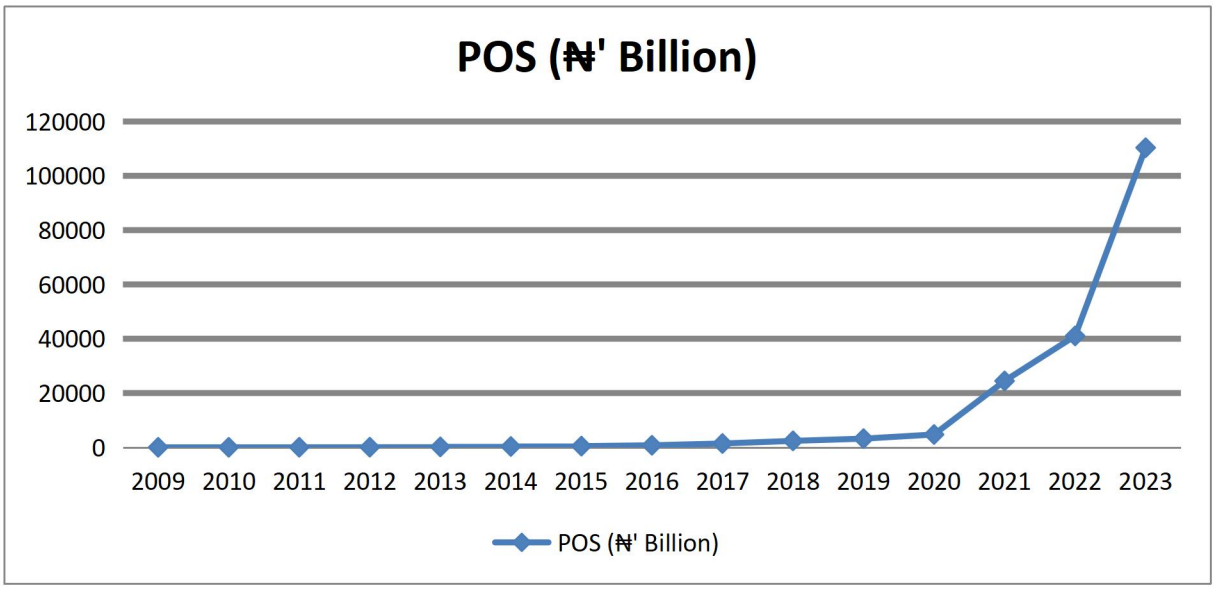


Figure 4.2: Value of POS from 2009 to 2023

3. Internet Banking (INB)

Internet banking usage fluctuated in the early years, starting at ₦84.15 billion in 2009 and declining to ₦25.05 billion in 2010. Growth resumed afterward, and by 2019 the value reached ₦478.14 billion. A major increase occurred in 2020 when transaction value hit ₦392,340.25 billion. The trend continued strongly, reaching ₦1,097,133.04 billion in 2023. This dramatic rise highlights the growing reliance on online platforms for large-value transactions, especially among corporate and urban users (Figure 4.3)

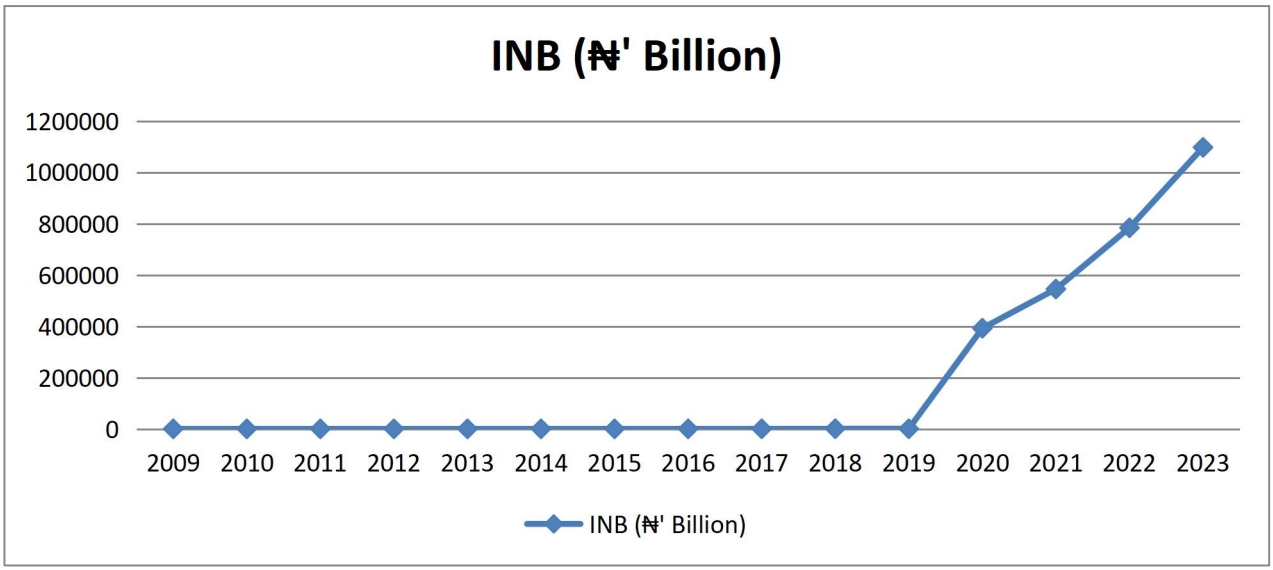


Figure 4.3: Value of INB from 2009 to 2023

4. Mobile Banking (MOB)

Mobile banking showed a consistent upward trend from ₦1.27 billion in 2009 to ₦442.35 billion in 2015. This growth was fueled by increased smartphone penetration and the adoption of USSD services. Transaction values continued to rise significantly, reaching ₦14,987.74 billion in 2020 and climbing to ₦219,800.08 billion in 2023. The data indicates strong adoption of mobile platforms for personal banking, especially among younger and tech-savvy populations.

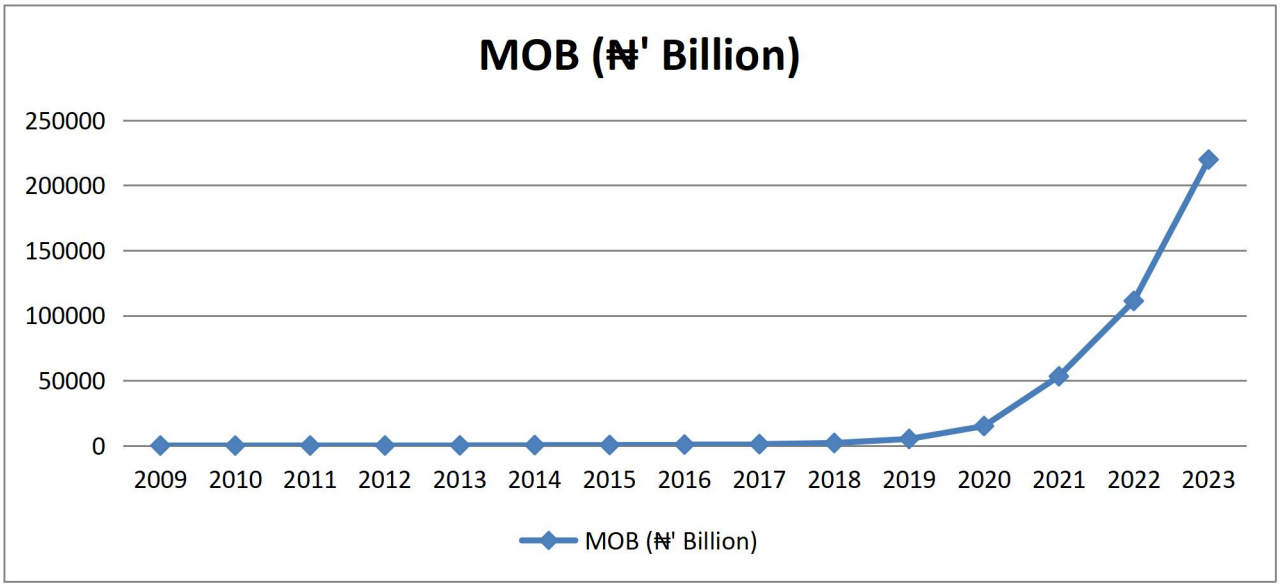


Figure 4.4: Value of MOB from 2009 to 2023

Table 4.2: Comparative Insights

Year	Leading Platform by Value
2009–2019	ATM dominated due to early adoption.
2020–2023	Internet Banking overtook other platforms in value, while Mobile Banking saw the fastest percentage growth.
2022–2023	Mobile and POS became more accessible, signaling retail shift; INB remained dominant for bulk transfers.

From 2009 to 2019, ATMs dominated the banking landscape, driven by early adoption and widespread availability, making them the primary platform for consumer transactions. However, between 2020 and 2023, internet banking emerged as the leading platform by value, as more users turned to online channels for their banking needs, particularly due to the convenience and ease of conducting transactions remotely. During this period, mobile banking experienced the fastest growth, highlighting the increasing reliance on smartphones and mobile apps for everyday banking activities. By 2022 and 2023, mobile banking and point-of-sale (POS) systems became more accessible, signaling a shift toward retail banking for smaller, everyday transactions, while internet banking remained dominant for larger, bulk transfers. This evolution in banking platforms reflects the broader trend of digital transformation in the financial sector, driven by technological advances and changing consumer behaviours.

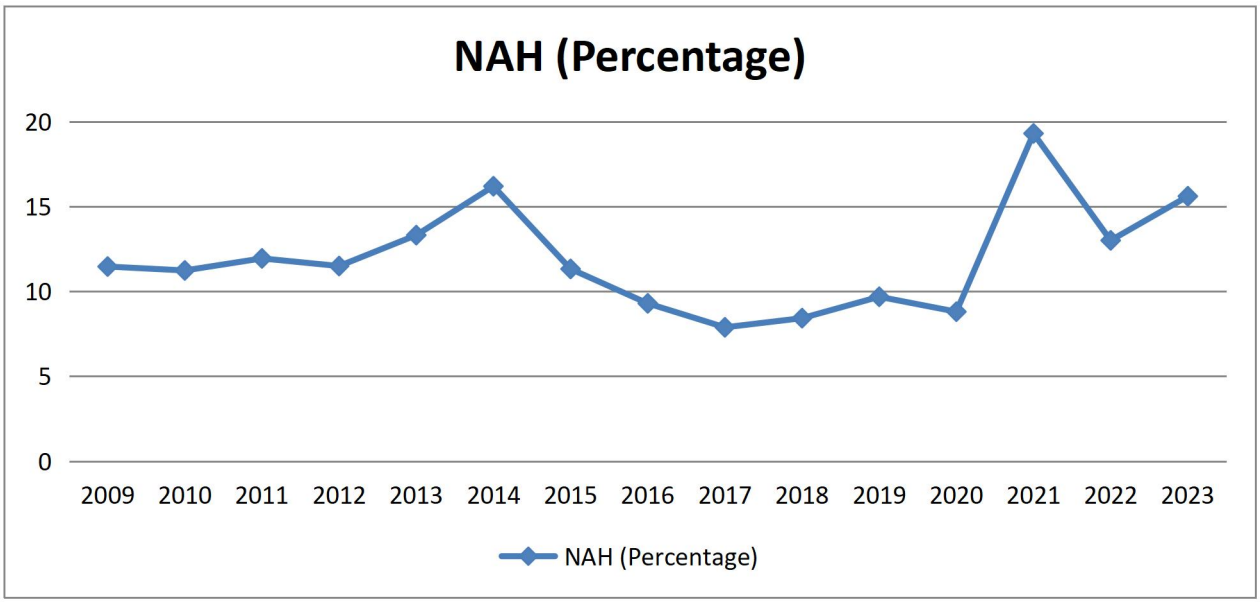


Figure 4.5: Value of NAH (%) from 2009 to 2023

From Figure 4.5, Nigeria has seen fluctuations in **NAH**, with an increase from 11.46% in 2009 to 15.60% in 2023. The rise in **NAH** reflects significant strides in expanding financial services, especially with the advent of mobile banking, agent banking, and government initiatives promoting financial inclusion. Notably, 2021 saw a substantial jump to 19.30%, possibly due to widespread adoption of digital banking platforms and efforts to open bank accounts in response to the COVID-19 pandemic. Despite fluctuations, the overall trend demonstrates gradual progress, indicating that more Nigerians are gaining access to financial systems, thereby contributing to economic development and greater participation in the formal economy.

Table 4.4: Summary Statistics (Descriptive Statistics)

	ATM	MOB	INB	POS	NAH
Mean	9312.227	27268.16	188003.8	12623.10	11.92733
Maximum	32648.02	219800.1	1097133.	110347.1	19.30000
Minimum	399.7100	1.270000	25.05000	11.03000	7.880000
Std. Dev.	10481.06	61292.33	352404.2	29410.32	3.171423
Observations	15	15	15	15	15

The data provides a summary of descriptive statistics and correlations for several banking transaction variables: ATM usage, mobile banking (MOB), internet banking (INB), point-of-sale (POS) transactions, and NAH (likely a dependent variable or related measure). The average values show that mobile banking (MOB) has the highest mean (27,268.16), followed by internet banking (INB) at 188,003.8, with ATM usage and POS transactions having lower averages. The highest values for the variables range significantly, with INB reaching over 1 million, indicating substantial variability. The standard deviation figures show notable dispersion, particularly for INB (352,404.2), suggesting that the values for internet banking transactions vary greatly from the mean.

Table 4.4: Normality Test

	ATM	MOB	INB	POS	NAH
Jarque-Bera	3.667524	28.75702	7.215058	44.38040	1.755111
Probability	0.159811	0.000001	0.027119	0.000000	0.415798
Observations	15	15	15	15	15

The results of the Jarque-Bera normality test indicate that the normality of the variables ATM, MOB, INB, POS, and NAH varies. ATM and NAH appear to follow a normal distribution, as their p-values (0.1598 and 0.4158, respectively) are greater than the 0.05 significance level, meaning we fail to reject the null hypothesis of normality. On the other hand, mobile banking (MOB), internet banking (INB), and point-of-sale transactions (POS) do not follow normal distributions, as their p-values (0.000001, 0.0271, and 0.0000, respectively) are significantly lower than 0.05, providing strong evidence against normality. This suggests that while ATM usage and NAH are approximately normally distributed, the other variables exhibit significant skewness or kurtosis, indicating that their distributions deviate from normal.

Table 4.5: Correlation Matrix

Variables	**NAH**	**ATM**	**MOB**	**INB**	**POS**	**VIF**	**TOV=1/VIF**
ATM	1.0000					1.2895	0.7769
MOB	0.8320	1.0000				1.4303	0.6998
INB	0.9476	0.0465	0.0465	1.0000		1.2496	0.8005
POS	0.7757	0.0925	0.0925	0.0153	1.0000	1.1713	0.8532
NAH	0.3814	0.4588	0.0894	0.1539	1.0000	1.3826	0.7249

The correlation matrix for the variables NAH, ATM, MOB, INB, and POS reveals several interesting relationships. ATM usage shows a strong positive correlation with mobile banking (MOB) at 0.8320, indicating that as ATM usage increases, mobile banking transactions also tend to rise. There is a very weak correlation between ATM and internet banking (INB) at 0.0465, suggesting that changes in ATM usage are not strongly related to internet banking activities. A moderate positive correlation of 0.7757 is observed between ATM and POS, which shows that higher ATM usage is somewhat linked to more POS transactions. The relationship between NAH and the other variables reveals a mixed pattern. NAH is moderately positively correlated with ATM (0.4588) and mobile banking (0.3814), suggesting a mild connection between these variables and the dependent measure (NAH). However, the correlation between NAH and INB (0.0894) and POS (0.1539) is weak, implying that NAH is less influenced by changes in internet banking and point-of-sale transactions. Overall, ATM and mobile banking have the strongest relationships with other variables, while internet banking and point-of-sale transactions show weaker associations with the rest of the variables.

By implication, the correlation values suggest moderate to strong relationships between some variables, such as ATM and mobile banking (MOB), while others, like ATM and internet banking (INB), show minimal correlation. Despite these correlations, the VIF values, ranging from 1.1713 for POS to

1.4303 for MOB, are all below the critical threshold of 10, indicating that multicollinearity is not problematic. Similarly, the TOV values, which range from 0.7249 for NAH to 0.8532 for POS, are well above the lower threshold of 0.1, reinforcing the absence of severe multicollinearity. These findings suggest that the model is well-specified, with each variable contributing distinctively to the explanation of financial inclusion in Nigeria, without significant overlap between the predictors. Therefore, the regression results are reliable, and the model can accurately capture the effects of modern payment systems on financial inclusion.

Table 4.6: Ramsey RESET Test

Omitted Variables: Squares of fitted values

	Value	Df	Probability
t-statistic	1.164389	9	0.2742
F-statistic	1.355801	(1, 9)	0.2742
Likelihood ratio	2.104834	1	0.1468

The results of the Ramsey RESET test and the Breusch-Pagan-Godfrey Heteroskedasticity test indicate that the model is well-specified and does not suffer from Heteroskedasticity. The Ramsey RESET test, with a t-statistic of 1.1644 and an F-statistic of 1.3558, both with p-values of 0.2742, suggests that the functional form of the model is appropriate and not significantly misspecified. The likelihood ratio test further supports this, with a p-value of 0.1468.

Table 4.7: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.866332	Prob. F(4,10)	0.5166
Obs*R-squared	3.860278	Prob. Chi-Square(4)	0.4252
Scaled explained SS	1.449713	Prob. Chi-Square(4)	0.8355

In terms of Heteroskedasticity, the Breusch-Pagan-Godfrey test yields an F-statistic of 0.8663 (p-value 0.5166), an Obs*R-squared of 3.8603 (p-value 0.4252), and a Scaled explained SS of 1.4497 (p-value 0.8355), all of which indicate that there is no significant

evidence of Heteroskedasticity in the model. Overall, these results suggest that the model is properly specified, and the error terms are Homoskedastic.

Table 4.8: Robust Least Square

Dependent Variable: NAH
Date: 01/14/25 Time: 08:09
Sample: 2009 2023
Included observations: 15
Method: M-estimation

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	2.5337	0.9445	2.6827	0.0073
ATM	0.2535	0.0909	2.7888	0.0053
MOB	0.0903	0.0658	1.3726	0.1699
INB	0.4879	0.1159	4.2081	0.0000
POS	-0.2195	0.0878	-2.5004	0.0124
	Robust Statistics			
R-squared	0.614910	Adjusted R-squared		0.599126
Rw-squared	0.779846	Adjust Rw-squared		0.779846
Akaike info criterion	32.54771	Schwarz criterion		39.59526
Deviance	62.47095	Scale		1.548437
Rn-squared statistic	30.67453	Prob(Rn-squared stat.)		0.000004

The regression result in Table 4.9 reveals that the coefficient of determination (R-squared) of the model is 0.614910. This means that over the studied period, the independent variables jointly accounted for at least 61.49% of the total variation in financial inclusion in Nigeria. Additionally, the indicator of the statistical significance of the entire model (Rn-squared statistic) signals that the model is statistically significant, with a p-value of 0.000004. This further indicates that the model is fit and the explanatory variables are properly selected, combined, and used. This implies that digital banking platforms have a highly significant effect on financial inclusion in Nigeria.

Table 4.9: Summary of Test of Hypotheses

Hypothesis Testing	p-value	Decision Rule	Conclusion
Hypothesis One	0.0053	Reject H01 if its P-value is <5%, otherwise accept H01 if its p-value is > 5%	Reject H01
Hypothesis Two	0.1699	Reject H02 if its P-value is <5%, otherwise accept H02 if its p-value is > 5%	Accept H02
Hypothesis Three	0.0000	Reject H03 if its P-value is <5%, otherwise accept H03 if its p-value is > 5%	Reject H03

Hypothesis Four	0.0124	Reject H04 if its P-value is <5%, otherwise accept H04 if its p-value is > 5%	Reject H04

Test of Null Hypothesis One

H01: Automated Teller Machine (ATM) has no significant effect on the number of account holders in Nigeria.

The regression result in Table 4.9 clearly reveals that Automated Teller Machine (ATM) has a positive effect on the number of account holders in Nigeria. This is because its coefficient value stands at 0.2535, and the p-value is 0.0053, which is less than the 5% significance level. Hence, we reject the null hypothesis, and conclude that ATM has a significant positive effect on the number of account holders in Nigeria.

Hypothesis Two

H02: Mobile Banking (MOB) has no significant effect on the number of account holders in Nigeria.

The regression result shows that mobile banking (MOB) has a positive but statistically insignificant effect on the number of account holders in Nigeria. The coefficient value is 0.0903, with a p-value of 0.1699, which is greater than the 5% significance level. Hence, we fail to reject the null hypothesis and conclude that mobile banking does not have a significant effect on the number of account holders in Nigeria.

Hypothesis Three

H03: Internet Banking (INB) has no significant effect on the number of account holders in Nigeria.

The regression result indicates that internet banking (INB) has a positive significant effect on the number of account holders in Nigeria. The coefficient value stands at 0.4879, and the p-value is 0.0000, which is less than the 5% significance level. Thus, we reject the null hypothesis, and conclude that internet banking has a significant positive effect on the number of account holders in Nigeria.

Hypothesis Four

H04: Point of Sale (POS) has no significant effect on the number of account holders in Nigeria.

The regression result shows that Point of Sale (POS) has a negative significant effect on the number of account holders in Nigeria. The coefficient value is -0.2195, with a p-value of 0.0124, which is less than the 5% significance level. Hence, we reject the null hypothesis, and conclude that Point of Sale (POS) has a significant negative effect on the number of account holders in Nigeria.

Discussion of Results

This study examined the effects of digital banking platforms on financial inclusion within the Nigerian banking industry from 2009 to 2023. Specifically, it investigated the effect of automated teller machines (ATM), mobile banking (MOB), internet banking (INB), and point of sale (POS) on the number of account holders in Nigeria. The study raised four research questions and formulated four null hypotheses. The results are discussed below:

Automated Teller Machine (ATM) and Numbers of Account Holders (NAH) in Nigeria

The regression results revealed that the coefficient of Automated Teller Machines (ATM) is 0.2535 with a p-value of 0.0053, which is less than the 5% significance level.

This indicates that ATM has a significant positive effect on the number of account holders in Nigeria. Specifically, the positive coefficient means that an increase in ATM usage is associated with an increase in the number of account holders.

This finding contradicts the previous conclusion in the study, which suggested a negative effect due to fraud-related concerns. Instead, the results point to a significant role of ATMs in encouraging financial inclusion. The explanation for this positive effect could be the increased accessibility and convenience that ATMs provide, which could lead to more people opening accounts. The findings are in line with the works of Muoghalu, Okonkwo, and Ananwude (2018), but deviate from Kumari (2017), who reported a negative relationship.

Mobile Banking (MOB) and Numbers of Account Holders (NAH) in Nigeria

The regression results revealed that mobile banking (MOB) has a positive, though not significant, effect on the number of account holders in Nigeria, with a coefficient of 0.0903 and a p-value of 0.1699. Since the p-value is greater than 5%, we fail to reject the null hypothesis for this variable, suggesting that mobile banking does not significantly affect the number of account holders.

Despite its positive coefficient, this result indicates that mobile banking, while a potential contributor to financial inclusion, does not have a statistically significant impact on the number of account holders. The positive coefficient suggests that mobile banking may still be encouraging some increase in account holders, but not strongly enough to show statistical significance. This is contrary to the findings of previous studies like Ene, Abba, and Fatokun (2019), Muoghalu, Okonkwo, and Ananwude (2018), and Marathe (2017), who found a positive effect. However, it aligns with findings from Obiaks (2017) and Kumari (2017), who did not find mobile banking to have a strong impact.

Internet Banking (INB) and Numbers of Account Holders (NAH) in Nigeria

The regression results indicate that internet banking (INB) has a positive significant effect on the number of account holders in Nigeria, with a coefficient of 0.4879 and a p-value of 0.0000. This result suggests that an increase in internet banking usage leads to an increase in the number of account holders, which contrasts with earlier statements in the study that suggested internet banking was associated with a reduction in the number of account holders.

The result shows that internet banking facilitates greater financial inclusion in Nigeria, possibly due to its convenience, accessibility, and the ability to reach remote areas. This finding supports the views of Nwude, Donatus, and Udeh (2020) and Ene, Abba, and Fatokun (2019), but contradicts the results of Obiaks (2017) and Kumari (2017), who found that internet banking deters financial inclusion.

Point of Sale (POS) and Numbers of Account Holders (NAH) in Nigeria

The regression results show that Point of Sale (POS) systems have a negative significant effect on the number of account holders in Nigeria, with a coefficient of -0.2195 and a p-value of 0.0124, which is less than the 5% significance level. This implies that as the use of POS systems increases, the number of account holders in Deposit Money Banks decreases.

This finding is somewhat surprising, given the widespread use of POS systems in facilitating easy transactions. One possible explanation is

that POS systems might be substituting for some traditional banking methods, causing users to bypass the need for having a formal bank account. Alternatively, POS systems might be limited in their geographic reach, preventing broader financial inclusion. The result aligns with the findings of Nwude, Donatus, and Udeh (2020), Ene, Abba, and Fatokun (2019), and Muoghalu, Okonkwo, and Ananwude (2018), but contradicts the findings of Obiaks (2017) and Kumari (2017), who reported a positive relationship between POS usage and financial inclusion.

CONCLUSION

Digital banking platforms are central to Nigeria's financial inclusion drive, but their impact varies. ATMs and internet banking platforms effectively promote account ownership and financial inclusion, while mobile banking, despite its potential is yet to demonstrate a strong statistical effect on financial inclusion. Bank regulators and policymakers must rethink the strategic role of POS in inclusion policies, ensuring they reinforce rather than weaken account ownership. Banks and financial institutions should invest more in user-centered internet and mobile banking platforms with robust security and easy onboarding processes. Fintech and technology developers need to design digital financial tools that align with account ownership goals, particularly in underserved areas. Development agencies and non-governmental organizations **s**hould tailor financial literacy campaigns to reflect platform-specific insights uncovered in this study.

Contributions to Knowledge

This study contributes uniquely to the existing literature and practice in several ways:

1. It provides one of the most up-to-date longitudinal analyses (2009–2023) of digital banking's effect on financial inclusion in Nigeria, a developing country context where such analysis remains sparse.
2. This research contributes to the growing body of knowledge on financial technology by highlighting the role of specific modern payment systems in expanding access to formal banking in Nigeria.
3. The study uncovers the unexpected negative effect of POS usage on formal banking adoption, which challenges current assumptions in policy circles and fintech literature.
4. The study bridges academic research with practical insights for financial institutions, regulators, and digital service providers seeking to enhance financial inclusion outcomes in Nigeria.

Suggestions for Future Studies

The areas suggested for future studies are as follows:

1. **Qualitative Investigations:** Future studies could adopt qualitative methods (e.g., focus groups or interviews) to better understand user behavior and perceptions surrounding digital platforms—especially POS and mobile banking.
2. **Cross-Country Comparative Analysis:** A comparative study across West African or Sub-Saharan African countries could reveal regional patterns and highlight best practices or shared challenges in digital financial inclusion.
3. **Moderating and Mediating Variables:** Future researchers could explore the role of trust, digital literacy, cyber-security concerns, and regulatory environment as moderators

or mediators between digital platforms and financial inclusion.

4. **Inclusion Beyond Account Ownership:** Researchers should consider broader indicators of financial inclusion—such as access to credit, usage frequency, savings, and insurance services—to provide a more holistic picture.
5. **Gender and Demographic Dimensions:** Disaggregating the effects of digital banking on financial inclusion by gender, age, income level, and geographic location (urban vs rural) will yield more targeted insights.

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