

**DIGITAL BANKING
AND FINANCIAL INCLUSION IN NIGERIA**

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FINANCIAL INCLUSION IN NIGERIA**

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NOVEMBER, 2025

DECLARATION

I Declare That:

This project work is based on a study undertaken by me in the Department of Finance, Faculty of Management Sciences, University of Benin, under the supervision of Prof. (Mrs.) Esther I. Evbayiro Osagie. This work has not been previously submitted for award of a degree elsewhere. All ideas and views are product of my personal research efforts and all references to work of others have been duly acknowledged.

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CERIFICATION

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DEDICATION

This work is dedicated to the Almighty God for his grace and mercy throughout my study in the University of Benin. I also want to dedicate this project to my parents Mr and Mrs Samuel Aidelojie, to my big bro, Bright Aidelojie and also to my younger siblings. God bless you all, Amen.

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ABSTRACT

This study investigates the impact of digital banking channels specifically Point of Sale (POS), Mobile Banking, Automated Teller Machines (ATM), and Internet Banking on financial inclusion in Nigeria over the period 2009 to 2024. Employing the Robust Least Squares (RLS) estimation technique, the analysis addresses issues of serial correlation and model misspecification to provide reliable estimates of the relationship between digital banking tools and the level of financial inclusion. The findings reveal that POS transactions significantly promote financial inclusion, while mobile banking exhibits a positive but statistically weak influence. In contrast, ATM usage has a significant negative effect, and internet banking shows no meaningful contribution to inclusion outcomes. These results suggest that while digital banking is a potent enabler of financial inclusion, its impact is not uniform across platforms. It is therefore recommended that policymakers prioritize investment in scalable, low-cost digital banking channels like POS and mobile banking, while simultaneously addressing infrastructural, trust, and literacy barriers that hinder the effectiveness of internet and ATM-based financial services in reaching underserved populations

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Affordable financial products and services—such as transactions, payments, savings, credit and insurance—help people manage risks, build wealth and invest in businesses. Financial inclusion means that individuals and businesses have access to and use affordable financial products and services that meet their needs, which are delivered in a responsible and sustainable way. Financial inclusion is a catalyst for achieving seven of the 17 Sustainable Development Goals (SDGs). It fosters economic growth and employment, promotes economic empowerment of women, and contributes to eliminating poverty.

The principle of financial inclusion has assumed greater level of importance in recent times due to its perceived importance as a driver of economic growth. Giving access to the hundreds of millions of men and women (all over the world) who are presently excluded from financial services would provide the possibilities for the creation of a large depository of savings, investable funds, investment and therefore global wealth generation. In other words, access to financial services, that are well suited for low-income earners promote enormous capital accumulation, credit creation and investment boom. Usually the low-income earners constitute the largest proportion of the population and so control enormous chunk of the economy's idle fund albeit held in small amounts in the hands of each of the several million members of this group. Harnessing and accumulating these resources provides a huge source of cheap long-term investable capital.

Financial inclusion refers to the ability of individuals and businesses to access a broad range of affordable and appropriate financial services, including savings, credit, insurance, and payments, delivered responsibly and sustainably (World Bank, 2022). It is recognized as a key enabler for poverty reduction, economic growth, and inclusive development, particularly in developing economies like Nigeria. In Nigeria, financial inclusion has remained a developmental priority for over a decade. The Central Bank of Nigeria (CBN) introduced the National Financial Inclusion Strategy (NFIS) in 2012 with a revised target to achieve 95% financial inclusion by 2024. However, challenges persist, and the country is yet to meet its inclusion goals.

In recent years, there has been a significant shift in how financial services are accessed in Nigeria which are :

1. The use of digital channels such as mobile banking, USSD, and mobile wallets has increased.
2. The fintech sector in Nigeria has grown rapidly, raising over \$1 billion in investments in 2021 alone (McKinsey, 2022).
3. COVID-19 accelerated the adoption of digital payments and mobile-based financial services due to lockdowns and cash-handling risks (World Bank, 2022).

According to EFInA's 2021 report, 64% of Nigerian adults were financially included, a modest rise from 58.4% in 2016, but still far from the national target. Moreover, financial exclusion remains high among women, youth, and rural dwellers, signaling performance gaps despite technological advances. There are variables that drive the dependent variable, which are primarily technological innovations and financial delivery mechanisms. One of the most prominent among them is digital banking.

The evolution of digital technology has revolutionized various sectors globally, and the financial sector is no exception. Digital banking has emerged as a transformative force, particularly in emerging markets, by enhancing financial access and efficiency. At the same time, financial inclusion—the drive to ensure all individuals and businesses have access to affordable financial services—has gained prominence in development agendas worldwide.

According to the World Bank (2022), around 1.4 billion adults globally remain unbanked, with most residing in developing economies. However, digital banking provides an opportunity to bridge this gap by leveraging mobile phones, internet platforms, and fintech innovations. Digital banking refers to the digitization of all traditional banking activities and programs that were historically available only at a bank branch. It encompasses internet banking, mobile banking apps, automated teller machines (ATMs), USSD services, and online customer service platforms. It relies on Information and Communication Technology (ICT) infrastructure and is driven by innovation in financial technology (fintech). [Basel Committee on Banking Supervision (2018). Sound Practices: Implications of fintech developments for banks and bank supervisors]. Financial inclusion supports entrepreneurship and business growth. Access to credit and capital, secure savings, and efficient payment services enable small businesses to expand, create jobs, and drive economic development. Access to insurance enhances resilience by offering protection against unforeseen risks and financial shocks providing individuals with peace of mind and allowing entrepreneurs to undertake ventures with greater confidence. By bringing more people and enterprises into the formal economy, financial inclusion strengthens economic activity, boosts productivity, and lays the foundation for inclusive and sustainable economic growth.

Digital banking refers to the delivery of banking services through electronic means such as mobile phones, internet banking, automated teller machines (ATMs), and digital apps (Basel

Committee on Banking Supervision, 2018). It includes services like account management, fund transfers, bill payments, mobile savings, credit access, and digital wallets.

Digital banking is directly linked to financial inclusion because it:

1. eliminates geographic barriers by allowing people in remote areas to access services via mobile phones.
2. reduces transaction costs, making financial services more affordable for the poor (GSMA, 2021).
3. provides convenient, 24/7 access, increasing usage and retention of financial services.
4. encourages savings and borrowing behavior through simplified platforms.

In Nigeria, digital banking has been instrumental in expanding access to financial services. Institutions such as Kuda Bank, OPay, PalmPay, and MoMo PSB (MTN) have transformed access to savings, payments, and micro-credit for millions of unbanked Nigerians. The CBN's licensing of Payment Service Banks (PSBs) is another initiative aimed at using digital tools to reach underserved populations (CBN, 2019). Thus, the performance of financial inclusion (dependent variable) is increasingly shaped by the growth, accessibility, and adoption of digital banking services (independent variable). As digital banking expands, it serves as a catalyst in bringing excluded individuals into the formal financial system.

1.2 Statement of the Research Problem

Despite the increase in digital banking infrastructure, many Nigerians, particularly in rural and low-income areas, remain financially excluded. This study seeks to explore how various forms of digital banking have affected financial inclusion in Nigeria. Despite ongoing efforts by financial institutions and regulatory bodies to improve access to financial services in Nigeria, a significant portion of the population—particularly in rural areas, among women, and in the informal

sector—remains financially excluded. This is a critical concern, especially in a country with a growing population and increasing mobile phone penetration.

Although digital banking has emerged as a promising solution to bridge the financial gap by offering convenient, low-cost, and accessible services, the impact of these digital innovations on actual financial inclusion remains inconsistent and uneven. There is limited empirical evidence on whether the expansion of digital banking platforms such as mobile money, online banking, USSD codes, and fintech applications has translated into meaningful financial inclusion for the most vulnerable populations.

Furthermore, challenges such as poor digital literacy, infrastructural deficits, cybersecurity concerns, and regulatory limitations continue to hinder the full utilization of digital banking services in driving inclusive finance. This raises a critical research question: To what extent has digital banking contributed to improving financial inclusion in Nigeria?

Therefore, this study seeks to examine the relationship between digital banking and financial inclusion in Nigeria, with the aim of identifying key barriers, evaluating progress, and exploring ways digital banking can be better leveraged to achieve inclusive financial growth.

Several scholars have extensively examined the relationship between digital banking and financial inclusion in Nigeria, employing a range of quantitative, qualitative, and mixed methodologies to understand how technological innovation influences access to financial services. For instance, Onaolapo (2015) employed descriptive statistics to investigate the impact of electronic banking on financial inclusion and found that mobile banking significantly increased accessibility, especially among youths and the educated class. Similarly, Adesina and Ayo (2010) conducted a survey-based study on internet banking adoption and concluded that

perceived ease of use and usefulness influenced the adoption rate, which in turn improved financial inclusion among urban dwellers. In another empirical study, Olayemi and Adedayo (2019) utilized regression analysis to assess the effect of mobile money operations on financial inclusion in Nigeria and discovered a strong positive relationship, particularly in rural outreach. These studies support the idea that digital banking mechanisms—such as mobile apps, internet banking, and point-of-sale terminals—enhance users' access to financial services, yet they also highlighted limitations in network infrastructure and digital literacy.

Furthermore, researchers have explored the nuanced dimensions of this nexus by analyzing demographic, institutional, and policy variables. For example, Ojo, Oduh, and Abiola (2021) used a mixed-methods approach to explore how fintech innovations contribute to bridging financial gaps among women and low-income earners, noting that gender-sensitive digital products were still underdeveloped. Ede, Udofia, and Asongu (2022) employed time-series econometric models to measure the long-term effect of digital banking on national financial inclusion indices and found that although digital banking tools have expanded rapidly, financial inclusion levels remained suboptimal due to regulatory inconsistencies and trust deficits in digital platforms. Adebayo and Ogunleye (2020) further argued that agency banking—an integral part of digital banking—has transformed financial access in peri-urban communities, but its impact is limited by challenges like erratic power supply and low financial awareness. Collectively, these studies suggest that while digital banking is a critical enabler of financial inclusion in Nigeria, its success largely depends on policy harmonization, digital infrastructure, and user-centric innovation.

Despite the increasing adoption of digital banking services — such as mobile apps, USSD codes, and agency banking — a large percentage of Nigerian adults remain financially excluded.

According to EFINA (2021), about 36% of adults are still outside the formal financial system. This suggests a mismatch between the rapid growth of digital banking and its effectiveness in reaching the financially excluded, especially in rural areas and among women.

Addressing these gaps through a comprehensive and integrative research approach will contribute to a more nuanced understanding of the macroeconomic factors influencing economic growth in Nigeria, thereby informing more effective policy interventions and strategies for sustainable development.

1.3 Research Questions

The following research questions have been carefully curated to guide the analysis of this research work:

1. What is the relationship between POS volume and financial inclusion in Nigeria?
2. Does mobile banking volume significantly affect financial inclusion in Nigeria?
3. How does ATMs volume significantly affect financial inclusion in Nigeria?
4. What is the relationship between internet banking volume and financial inclusion in Nigeria?

1.4 Research Objectives

The general objective of this research work is to examine the influence of digital banking factors on financial inclusion in Nigeria. Other specific objectives are to:

1. determine the effect of POS volume on financial inclusion in Nigeria.
2. examine the effect of mobile banking volume on financial inclusion in Nigeria.
3. ascertain the effect of ATM volume on financial inclusion in Nigeria.

4. investigate the effect of internet banking volume on financial inclusion in Nigeria.

1.5 Research Hypothesis

The following research hypothesis are stated in their null form:

H01: There is no significant relationship between POS volume and financial inclusion in Nigeria

H02: Mobile banking volume does not significantly affect financial inclusion in Nigeria

H03: There is no significant relationship between broad ATMs volume and financial inclusion in Nigeria

H04: There is no significant relationship between internet banking volume and financial inclusion in Nigeria

1.6 Scope of the study

This research focuses on the impact of digital banking tools and their role on the level of financial inclusion in Nigeria, specifically focusing on digital banking tools such as: POS volume, mobile banking volume, ATMs volume and USSD volume. Geographically this research covers Nigeria at large.

The time scope of this study is for a period of 16 years (2009-2024) The choice of this period was as a result of the recent dynamic nature of these digital banking tools and the various financial technological reforms it has brought about in recent years. It was also considered adequate for the study as it allows for a relatively robust analysis using a more recent dataset.

1.7 Significance of the study

The primary significance of this study lies in the urgent need to bridge the financial divide in Nigeria through the leveraging of digital banking channels such as Point of Sale (POS), Mobile Banking, Automated Teller Machines (ATMs), and Internet Banking. In recent years, financial inclusion has become not only a social objective but an economic imperative, especially for developing economies like Nigeria where a significant portion of the population remains unbanked or underbanked.

Why is this study needed now?

According to the World Bank (2022), about 40% of Nigerian adults still do not have access to formal financial services, with the rural population being disproportionately excluded. The rapid adoption of digital financial services (DFS) post-COVID-19 pandemic has brought about a significant shift in how Nigerians interact with financial institutions, necessitating an urgent investigation into how these channels are driving inclusion.

The Central Bank of Nigeria (CBN) through its Financial Inclusion Strategy (2022 update), aims to achieve a 95% financial inclusion rate by 2024, but the persistent infrastructural and digital literacy challenges call for a critical review of progress made, particularly through digital banking tools. Therefore, evaluating transaction volumes across digital platforms is crucial in understanding their actual contribution to financial deepening in Nigeria.

Benefits of the Study

1. Contribution to Policy and Regulatory Frameworks:

This study will serve as a vital resource for regulatory bodies like the CBN, Nigerian Communications Commission (NCC), and National Information Technology Development Agency (NITDA). By providing evidence-based analysis of digital banking metrics (POS, mobile, ATM, and internet banking), the study can guide:

1. Policy reviews on agent banking and digital literacy.
2. Infrastructure investments in underserved regions.
3. Regulatory decisions to strengthen cybersecurity and interoperability across platforms.

For instance, CBN's 2021 Annual Report notes a 130% rise in USSD and mobile transactions, but also warns of an urban-rural usage gap, suggesting the need for policies that target equitable access.

2. Benefit to Future Researchers and Students:

The study will provide a comprehensive empirical base and theoretical insight for scholars in finance, development economics, ICT, and public policy. It bridges the gap between quantitative transaction data (POS, USSD volumes, etc.) and development outcomes like savings, credit access, and small business growth.

Researchers such as Ozili (2018) and Adewuyi & Olayemi (2020) have called for more disaggregated studies that look beyond broad financial inclusion rates to understand the effectiveness of specific digital channels—this research directly answers that call.

3. Benefit to Financial Institutions and Fintech Companies:

With the growing presence of fintech firms (e.g., Opay, PalmPay, Moniepoint), this study will help service providers identify which platforms (POS, USSD, etc.) have the greatest inclusion

potential, especially among low-income groups. The insights can help improve service offerings, reduce digital exclusion, and expand agent banking networks strategically.

4. Benefit to the General Public:

For everyday Nigerians—especially those in rural and underserved urban areas—the study can reveal the best and most reliable digital channels to access financial services, fostering greater financial literacy and trust in digital systems. It will also encourage the public to adopt safer, faster, and more affordable means of transacting without relying heavily on traditional bank branches.

Relevance of the Study Variables

1. POS (Point of Sale) Volume:

According to Nigeria Inter-Bank Settlement System (NIBSS, 2023), POS transactions surged to N10.7 trillion in 2022, with over 1.8 million POS terminals deployed nationwide. This channel has emerged as a lifeline for micro and small businesses, especially in areas with poor bank branch density. The study will examine how increased POS availability correlates with account ownership and savings culture.

2. Mobile Banking Volume:

CBN's 2023 data shows mobile banking transactions reached over N19 trillion, reflecting significant user adoption. Mobile banking allows real-time access to services like bill payment, fund transfers, and micro-loans, enabling low-income earners and informal workers to engage with the formal economy.

3. ATMs Volume:

While ATMs were traditionally a leading financial access tool, their relevance is declining in the digital age. Yet, they still serve as a bridge for the semi-literate and cash-reliant population. The study will assess how ATM density and usage relate to other digital channels in achieving goals.

4. Mobile Money Volume:

In recent years, mobile banking has emerged as one of the most transformative innovations in Nigeria's financial system. The concept simply refers to performing financial transactions—such as transfers, bill payments, deposits, and airtime purchases—through mobile phones or handheld devices. The term is often captured in the Central Bank of Nigeria (CBN) Statistical Bulletin under “Mobile Payments” or “Mobile Money Operations”, reflecting both inclusion bank-led and non-bank (fintech) channels. As of 2020, Nigeria witnessed a massive surge in mobile banking activity. According to data from the Nigeria Inter-Bank Settlement System (NIBSS), mobile and USSD transactions reached an unprecedented 1.69 billion, representing over 82% year-on-year growth from 2019. This remarkable increase was largely driven by the COVID-19 pandemic, which encouraged customers to adopt contactless and digital financial services. The impressive transaction volume reflects not only the deepening of digital finance but also the growing confidence of users in mobile platforms as secure, fast, and convenient alternatives to traditional banking.

The relevance of mobile banking volume extends beyond mere numbers. It is a vital indicator of how deeply digital technology has penetrated the financial landscape. High transaction volumes signify greater financial inclusion, especially for unbanked and underbanked populations in rural areas. Through mobile phones, individuals can now send and receive money, save, and even

access credit facilities without visiting a physical bank branch. This accessibility supports small businesses, enhances trade efficiency, and promotes economic resilience.

1.8 Limitations of the study

While this study presents an insightful exploration of digital banking and its impact on financial inclusion in Nigeria, it is important to acknowledge several limitations that may influence the scope, accuracy, and generalizability of its findings. These limitations pertain primarily to the method of analysis, the temporal coverage (2009–2024), data availability, and the inherent complexity of measuring financial inclusion through transaction volume alone.

Method of Analysis Limitation

This research predominantly employs a quantitative trend analysis approach, focusing on transaction volumes of POS, mobile banking, ATMs, and internet banking to interpret the progress of financial inclusion. While this method is statistically valid and supported by several studies (Ozili 332; Ibekwe et al. 68), it inherently limits the ability to capture qualitative dimensions such as user satisfaction, financial literacy, trust, and behavioral patterns among financially excluded populations.

For instance, trend data alone may not accurately reflect financial empowerment, nor can it distinguish whether increased usage is due to necessity, convenience, or lack of alternatives. Moreover, volume data do not directly account for repeat usage by already-included individuals, which could inflate perceived inclusion levels (Adewuyi and Olayemi 52). Hence, without qualitative or survey-based inputs, the study may over-rely on transactional indicators as proxies for genuine inclusion.

Temporal Limitation (2005–2024)

The study limits its analysis to the period from 2009 to 2024, which corresponds with the growth and institutionalization of fintech in Nigeria. This timeframe is chosen deliberately because prior to 2009, digital banking infrastructure was largely underdeveloped, and transaction volumes across POS, mobile, and internet banking channels were negligible or non-existent.

However, this temporal limitation excludes historical financial data and analog banking practices that could offer comparative insights into how the transition to digital has shifted financial behavior over a longer horizon. Additionally, due to the recency of internet and mobile banking adoption (which surged post-2012), early years in this dataset (2005–2011) may lack comprehensive volume records (EFInA 2022). Thus, there may be inconsistencies or data gaps in measuring year-to-year growth, especially across rural and agent-based networks.

Nonetheless, this limitation is justified by the accelerated fintech innovation period in Nigeria, notably following the introduction of the CBN cashless policy in 2012, the rise of mobile money operators, and the proliferation of POS and USSD platforms post-2015 (CBN, Annual Report 2023). These developments define the era where digital banking tools truly began impacting financial inclusion metrics, making the 2005–2024 window a strategic and meaningful scope.

Incomplete or Inaccessible Data

Another key limitation is incomplete access to disaggregated data on digital banking volumes, particularly for USSD and mobile transactions in rural areas. While institutions like the CBN, NIBSS, and EFInA release periodic datasets, much of the data is aggregated at national levels, which limits the ability to conduct granular regional analysis.

Furthermore, fintech firms often treat transaction and user data as proprietary information, making it difficult to assess how their platforms (e.g., Opay, Paga, PalmPay) specifically contribute to inclusion outside of mainstream banking channels (Adedokun et al. 47). This data opacity limits the precision of the study and reduces the possibility of comparing public and private-sector impacts.

Platform-Specific Limitations

Each digital channel studied—POS, mobile banking, ATMs, and internet banking —has inherent functional and demographic biases that the study may not fully capture:

POS volumes may rise due to cash scarcity, such as during the 2023 naira redesign policy, not necessarily from increased financial inclusion (CBN, Financial Stability Report 2023).

Mobile banking is often limited to smartphone users, potentially excluding the bottom-of-the-pyramid demographic.

ATM usage is typically urban-centered and does not always reflect financial innovation or inclusion progress (Ifeanyi and Chukwu 75).

Internet banking, despite its potential, suffers from network unreliability, session timeouts, and user distrust, all of which are not reflected in raw transaction volumes (EFInA 2022).

In summary, while this study offers valuable insights into the relationship between digital banking and financial inclusion in Nigeria, its findings should be interpreted in light of the methodological, temporal, and data-related limitations outlined above. The reliance on transaction volumes across four platforms—POS, mobile, ATM, and internet banking—provides a solid baseline, but future research could benefit from mixed methods, longitudinal studies, and

better access to proprietary fintech data. Despite these constraints, the study remains a timely and relevant contribution to the evolving discourse on digital finance in emerging economies like Nigeria.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive review of existing literature related to digital banking and financial inclusion, with a particular focus on the Nigerian context. The objective of this review is to establish a theoretical and empirical foundation for the study by exploring relevant concepts, frameworks, and prior research findings. As digital technology continues to redefine financial service delivery, understanding its implications for financial inclusion becomes increasingly important, especially in a developing economy like Nigeria where access to formal financial services remains a challenge for many.

2.2 Conceptual Review

2.2.1 Financial Inclusion

Financial inclusion ensures affordable and accessible financial products for underserved communities. Adegbola (2024) emphasizes tailored services like savings and credit, while Johnson (2023) focuses on low-income populations engaging with formal financial systems. Aliyu (2023) describes it as a strategy to promote economic growth and poverty reduction, and Okechukwu (2022) underscores affordability for vulnerable groups. Zhang (2023) highlights its role in managing risks and improving economic well-being. In Nigeria, initiatives like mobile money, agent banking, and digital wallets have significantly improved financial access. These efforts support small businesses, alleviate poverty, and promote financial stability by enabling better risk management and economic participation.

Financial inclusion becomes the outcome or result that is influenced or determined by the accessibility, usage, and efficiency of digital banking platforms such as mobile banking, USSD transactions, ATM usage, and Point-of-Sale (POS) systems. According to Ozili (2018), financial inclusion in Nigeria has been shaped significantly by technological innovations, particularly mobile and digital banking systems. These innovations offer banking services beyond traditional brick-and-mortar branches, allowing the financially excluded population—especially in rural areas—access to basic financial services. Similarly, Adesanya and Oyetayo argue that the volume of digital banking transactions has a direct impact on the depth of financial inclusion in any economy, making digital banking an independent variable that shapes the expansion of inclusive financial access (Adesanya and Oyetayo 205).

Financial inclusion is the process of ensuring access to appropriate financial products and services needed by individuals and businesses, delivered in a sustainable and responsible manner. It emphasizes affordability, accessibility, and usage.

The World Bank (2022) defines financial inclusion as "the access that individuals and businesses have to useful and affordable financial products and services that meet their needs—transactions, payments, savings, credit, and insurance—delivered in a responsible and sustainable way." Similarly, the CBN (2018) explains financial inclusion as efforts to make formal financial services available, accessible, and affordable to all segments of the population, especially the disadvantaged. The Central Bank of Nigeria (CBN) notes that digital financial services, including mobile money and agency banking, have led to a substantial increase in account ownership and formal financial participation, especially with the advent of USSD services and mobile wallets (Central Bank of Nigeria 2020). This indicates that financial inclusion, measured

by indicators such as account ownership, frequency of usage, and access to credit, is dependent on the development and adoption of digital banking tools.

In essence, the degree of financial inclusion (dependent variable) varies based on the availability and adoption of digital banking services (independent variable). For example, increased usage of POS terminals and mobile banking correlates with higher financial access levels among the unbanked and underbanked populations in Nigeria (World Bank 2021). This relationship positions digital banking as a catalyst for financial inclusion outcomes. In Nigeria, financial inclusion plays a pivotal role in poverty reduction, economic development, and empowerment, particularly among women, rural dwellers, and informal sector participants. However, challenges such as digital illiteracy, poor infrastructure, gender disparity, and financial distrust continue to hinder full inclusion. Thus, digital banking has become central in addressing these gaps through innovative solutions that bypass traditional barriers.

2.2.2 Digital Banking

Digital banking refers to the use of electronic and online platforms to provide financial services without the need for physical bank branches. It encompasses various channels such as mobile banking, internet banking, automated teller machines (ATMs), point of sale (POS) terminals, and Internet Banking. According to Oladejo and Adereti, digital banking enhances customer convenience and reduces transaction costs while broadening access to formal financial services (Oladejo and Adereti 45). The Central Bank of Nigeria (CBN) defines digital banking as the application of technologies that enable customers to access banking services through digital devices and self-service channels, aiming to improve financial access, especially in remote areas (CBN, “Digital Financial Services Framework”). Digital banking has revolutionized financial services by leveraging advanced technologies to improve accessibility, efficiency, and

convenience. Olusanya (2024) highlights its ability to facilitate transactions without physical interactions, while Johnson (2023) emphasizes the digitization of banking operations, transforming customer engagement. Scholars such as Bishop (2023) and Nguyen (2023) note the convenience of online platforms for tasks like fund transfers, and Ahmed (2024) underscores the focus on security, scalability, and modern consumer needs. Digital banking in Nigeria emerged from the need to improve banking efficiency, financial access, and customer experience. The evolution began with basic e-banking services and has grown to encompass mobile apps, USSD codes, and agency banking. Today, digital banking is considered a key enabler of financial inclusion and economic empowerment in Nigeria.

Furthermore, digital banking is seen as a catalyst for financial system modernization and deepening in Nigeria. Eze et al. argue that the growth of digital financial platforms in Nigeria has transformed traditional banking, enabling low-cost, high-reach alternatives to conventional service delivery (Eze et al. 112). It allows individuals to make payments, transfer funds, open bank accounts, and access credit services through mobile phones and other digital interfaces, thereby bridging the financial access gap.

2.2.2.1 Dimensions of Digital Banking

Digital banking can be examined through several dimensions:

1. Accessibility – This refers to the ease with which individuals can access banking services via digital means. Mobile phones, USSD codes, and internet-enabled devices have made banking more accessible, especially in remote and underserved areas (Ozili 331).

2. Usability – The design and functionality of digital banking platforms determine how easily users can perform transactions. User-friendly interfaces and multilingual options enhance financial inclusivity (Akinwumi and Salami 412).
3. Security and Trust – Cybersecurity is a critical dimension, as digital banking must protect users from fraud and cyber threats. Enhanced authentication protocols, such as biometric logins and OTPs, are crucial to building trust (CBN 2020).
4. Innovation – Digital banking is also measured by the degree of innovation, such as the integration of AI for chatbots, blockchain for secure transactions, and APIs for open banking (KPMG 2021).
5. Cost Efficiency – Compared to traditional banking, digital platforms offer cost-effective services, reducing the operational expenses for banks and service costs for consumers (PwC 2020).

2.2.2.2 Types and Forms of Digital Banking

Digital banking manifests in several types and forms, often overlapping in application:

1. Mobile Banking (m-banking)

This is the use of mobile phones to carry out banking operations such as funds transfer, bill payment, airtime recharge, and account monitoring. It is especially popular in Africa due to the penetration of mobile phones. According to the World Bank (2021), mobile banking has been pivotal in extending services to unbanked populations in Nigeria.

Mobile banking significantly impacts financial inclusion by increasing access to financial services for previously excluded populations. Its volume, measured by transaction frequency and

user adoption, directly influences the extent to which mobile banking can bridge the financial inclusion gap. Increased mobile banking volume translates to greater financial participation, particularly in underserved areas, enabling individuals to save, borrow, make payments, and manage their finances more effectively. Mobile banking volume affects financial inclusion in several ways, some of which are:

1. Increased Accessibility:

Mobile banking overcomes geographical barriers and limited infrastructure that often restrict traditional banking services. Higher transaction volumes mean more people are using mobile platforms, indicating broader reach and improved access to financial services.

2. Reduced Costs:

Mobile banking can be more cost-effective than traditional banking, both for financial institutions and users. Increased transaction volume can lead to economies of scale, further reducing costs and making financial services more affordable for low-income individuals.

3. Enhanced Convenience:

Mobile banking offers convenient access to financial services anytime, anywhere. Higher transaction volumes suggest greater user satisfaction and demonstrate that mobile banking is meeting the needs of a wider population.

4. Greater Financial Inclusion:

By providing access to previously excluded populations, mobile banking contributes to greater financial inclusion. Increased volume indicates that more individuals are participating in the formal financial system, leading to greater economic empowerment and participation.

5. Economic Growth:

Mobile banking can drive economic growth by facilitating business transactions, remittances, and access to credit. Increased transaction volumes can stimulate economic activity and contribute to overall economic development.

Mobile banking's volume is a key indicator of its success in promoting financial inclusion. Higher transaction volumes, driven by increased adoption and usage, demonstrate the potential of mobile banking to bridge the financial inclusion gap and empower individuals with access to essential financial services. Addressing the challenges related to digital literacy, security, infrastructure, and regulation is crucial to further enhance the impact of mobile banking on financial inclusion.

2. Internet Banking (Online Banking)

In a general sense, the new type of service provided by the banks with the help of the internet technology is called "Internet Banking". It is also known as Internet banking allows customers to conduct financial transactions via the bank's website. It requires internet access and is commonly used for services like fund transfers, account management, and investment tracking (Adesanya and Oyetayo 207). Internet Banking can also be seen as the process of providing banking services through technology, without the physical presence of bank staff or resources (Alsajjan and Dennis, 2009). Internet banking is a financial service that is less expensive, time efficient and considerate which provides flexibility of space and have brilliant customers service.

According to Chavan (2013), internet banking is defined as "a system that allows individuals to perform banking activities at home, via the internet". It allows customers to check account balances, transfer funds, pay bills, and apply for services from their computers or mobile devices.

Chavan emphasizes that this technological advancement has revolutionized the banking sector by enhancing convenience and reducing operational costs.

Auta (2010) states that internet banking is a platform where banking transactions are conducted electronically through internet-enabled devices. He argues that internet banking has increased the speed and reliability of services, contributing significantly to customer satisfaction and competitiveness in the banking sector. Auta highlights that in developing countries, though internet penetration poses a challenge, the adoption of e-banking continues to rise steadily. In the words of Ovia (2001), "Internet banking is not just a product or service, but a revolution that is shaping the future of banking." Ovia, a pioneer in Nigerian digital banking, points out that internet banking is central to the strategy of banks aiming to maintain relevance in the 21st century. He believes the implementation of internet banking has transformed the nature of financial intermediation and customer engagement in Nigeria and other developing economies.

Agboola (2006) explains that internet banking involves a system where a customer can access his or her account through a secure website operated by the bank. He notes that this access provides various services such as viewing account history, downloading transaction data, and initiating transactions. Agboola stresses that security, user education, and infrastructure are key determinants of its adoption rate in Africa. Furthermore, Daniel (1999) describes internet banking as a "means of delivering banking services via the internet to enable customers to access accounts and general information on bank products and services through a personal computer or other intelligent devices." He underscores the growing trend among banks to innovate digital services as a response to changing customer expectations and technological advancements. According to Okiro and Ndungu (2013), internet banking is critical for expanding financial inclusion, especially in regions with limited physical banking infrastructure. Their study on

Kenya's banking sector finds that online platforms not only improve service delivery but also enhance transparency and reduce human error in financial operations.

From the views of these various scholars, it is evident that internet banking plays a transformative role in modern banking systems. While it offers increased convenience, accessibility, and efficiency, it also poses challenges such as cybersecurity threats, low digital literacy, and infrastructural limitations, especially in developing countries. Nonetheless, internet banking remains a powerful tool for financial inclusion and economic growth in today's digital economy.

Also, like mobile banking's volumes, internet banking volume significantly affects financial inclusion by bringing financial services to the unbanked populations in Nigeria. Its volume is the measure of the total number of financial transactions carried out through the use of the internet on the websites of different banking institutions. Internet banking significantly enhances financial inclusion in Nigeria by expanding access to financial services, particularly for those previously excluded due to geographical or logistical limitations. It provides a convenient and efficient way for individuals and businesses to manage their finances remotely, promoting greater participation in the formal financial system. As earlier stated, internet banking is making use of banks website to access their services online. These website are created in line with the banks image and speculations which makes it easily identifiable to already existing and new customers, for instance Zenith Bank has a banking app which is red and white colored theme displaying their brand for recognition.

Although online banking was already inculcated in Nigeria, a more indigenous introduction was recorded to be created by WEMA Bank which brought the 'ALAT BY WEMA'. ALAT was the

first to offer digital banking experience to its customers with having them visiting the bank physical offices and branches. This caused a stir in the improvement of financial technology in Nigeria and acted as an encouragement to other banks which followed suit in the creation of their own banking apps.

3. USSD Banking

USSD (Unstructured Supplementary Service Data) banking operates without internet and is used mainly through short codes on feature phones. It is a communication protocol used by GSM(Global System for Mobiles) phones to communicate with service providers without the use of internet. It is a key driver of financial inclusion in Nigeria, enabling millions to access banking services without smartphones (CBN 2020). It allows for two-way exchange of data in real-time, offering a platform for menu-based interaction through short numeric codes starting with * and ending with #. It makes use of short codes such as *955# for Opay Digital Services, *894# for First Bank, *966# for Zenith Bank, *919# for UBA, *901# for Access Bank, and many others. These codes allow customers to carry out a wide range of banking transactions directly from their mobile devices.

USSD banking is not constrained to a selected few but it can be easily accessible by anyone with a phone, does not necessarily need to be a smart phone with internet. It is cost-effective, fast and simple for customers to use especially the underbanked and unbanked populations mostly in the rural areas. USSD Banking technology has already been in existence but primarily for basic mobile phone functionalities, it is officially recorded that in the year 2012, Guarantee Trust Bank popularly known as "GT Bank" introduced USSD code of *737#, which coincided with the launch of Nigeria's cashless policy by the Central Bank of Nigeria. Other banks followed suit,

leading to the widespread adoption of USSD for various banking activities like balance checks, transfers, and bill payments. There are key features of USSD banking which makes it different from others, they include:

1. No internet required
2. Secured by a pin
3. Always available
4. Fast and interactive
5. Wide coverage
6. User-friendly interface

Some of the services offered by USSD codes are:

1. Balance enquiry
2. Airtime and data top-up
3. Money transfer
4. Blocking stolen ATM cards
5. Mini statement generation
6. Bills payment
7. Account opening
8. Loan applications, among others.

Its significance lies in its ability to bridge the digital divide — serving populations with low internet penetration and limited smartphone access. USSD banking usage has grown and developed overtime because of the continuous usage by both adults and youths even teenagers

mist especially in the rural area. The figure below shows the general growth on the usage of USSD volume in Nigeria within the years of 2018-2023.

YEAR	USSD VOLUME (in millions)	Value (in trillions)
2018	184M	#1.2T
2019	274M	#2.5T
2020	388M	#5.2T
2021	561M	#8.4T
2022	850M	#12.4T
2023	1.2B	#18.1T

Table 2.1: General Growth Trends (2018–2023)

Source: Nigeria Inter-Bank Settlement System (NIBSS); Central Bank of Nigeria Annual Reports

4. Agency Banking

This form allows banks to reach customers through third-party agents who provide banking services using digital platforms and POS devices. Agency banking bridges the gap between financial institutions and rural dwellers (Adewoye 92).

Agency banking is a branchless banking model that allows traditional banks to extend their services to underserved or unbanked populations by partnering with third-party agents who operate on their behalf. These agents—often local shop owners, business operators, or individuals—conduct financial transactions using mobile devices, POS terminals, and biometric systems. According to the Central Bank of Nigeria (CBN, 2013), agency banking involves "the provision of financial services to customers by a third party (agent) on behalf of a licensed

deposit-taking financial institution and/or mobile money operator." These agents are authorized to carry out services such as deposits, withdrawals, fund transfers, bill payments, account opening, loan disbursement, and even KYC (Know Your Customer) updates.

Agency banking was introduced in Nigeria as part of the broader drive to enhance financial inclusion. The CBN Guidelines for the Regulation of Agent Banking and Agent Banking Relationships in Nigeria (2013) laid the foundation for banks and mobile money operators to engage agents in delivering financial services. Since then, its adoption has surged, especially in underserved rural areas where formal bank branches are scarce or nonexistent.

Key Features of Agency Banking

1. Operates through third-party agents, not bank staff.
2. Uses digital platforms such as POS terminals and mobile apps.
3. Primarily found in rural or semi-urban areas.
4. Reduces the cost of banking infrastructure (no need for bank branches).
5. Offers extended hours of operation, including weekends and holidays.
6. Ensures quick access to financial services within local communities.

Contribution to Financial Inclusion

1. Rural Penetration:

Agency banking allows financial services to reach remote areas where opening a physical bank branch would be economically unviable. This promotes inclusion in hard-to-reach communities (Oluwafemi & Okikiola, 2016).

2. Reduced Transaction Costs:

Customers save money and time that would otherwise be spent traveling to urban banks. Agents charge minimal fees, and many operate within walking distance for locals.

3. Increased Account Ownership:

Agents often assist customers in opening new bank accounts using digital KYC and biometric systems, thus boosting formal financial participation.

4. Support for Government Initiatives:

Through agents, banks help disburse social benefits like TraderMoni, COVID-19 relief funds, and other conditional cash transfers—ensuring transparency and efficiency.

5. Financial Literacy:

Agents serve as the first line of contact with the banking system for many users, educating them on savings, transfers, and mobile platforms.

Agency banking has become one of the most transformative innovations in Nigeria’s financial ecosystem. By combining digital tools with human presence, it bridges the gap between formal financial institutions and the informal, excluded population. While challenges remain, its continued growth—driven by policy support, innovation, and increasing public trust—suggests that it will play a pivotal role in achieving the financial inclusion goals of the Nigerian government.

5. ATM and POS Banking

Digital banking in Nigeria has evolved through several channels, among which Automated Teller Machines (ATMs) and Point of Sale (POS) terminals have played pivotal roles. Both channels

are crucial to enhancing financial inclusion, especially for individuals in areas underserved by traditional bank branches. ATMs are self-service electronic banking terminals that allow customers to perform basic financial transactions without the need for a teller. These include cash withdrawals, account balance inquiries, fund transfers, and mini-statement generation.

According to Salehi and Alipour (2010), ATMs are critical to modern banking as they facilitate 24/7 service delivery and reduce human traffic at banking halls. The CBN classifies ATMs as part of the e-banking infrastructure necessary for nationwide financial access.

While ATMs provide automated teller services, POS (Point of Sale) systems enable merchants to accept card-based payments. Both are vital to digital transaction ecosystems, contributing to reduced cash dependency (Akinwumi and Salami 413). Though older, they remain a vital part of digital banking for cash dispensing. POS banking refers to the use of electronic terminals that process card-based payments or transactions. These terminals are operated by agents, merchants, or service providers who act on behalf of banks and fintech companies. POS banking has become one of the most impactful channels for deepening financial inclusion in Nigeria. According to the CBN (2022), POS terminals are now widely used in informal sectors, rural markets, and by small businesses.

Both ATM and POS banking channels play critical roles in extending financial services to underserved segments in Nigeria. While ATMs primarily serve the formally banked population in urban areas, POS terminals have become the go-to tool for inclusive banking, especially in remote and low-income communities. To fully leverage their potential, the Nigerian financial ecosystem must address infrastructure challenges, ensure customer protection, and enhance agent liquidity and training.

6. Neo-banking (Challenger Banks)

These are fully digital banks that operate without physical branches. They offer customer-centric services using apps and online platforms. Examples include Kuda Bank in Nigeria and Chime in the US (Finextra 2022).

7. Digital Wallets and Fintech Platforms

Wallets like OPay, Paga, and Flutterwave enable users to perform transactions, save money, and pay bills digitally. These platforms are often integrated with banking APIs to facilitate seamless operations (Ozili 333).

Digital banking is not just a technological transformation but a financial strategy that reshapes access and inclusion. It significantly reduces the cost of banking services, enhances convenience, and bridges the gap between the formally banked and the financially excluded (Adewoye, 2013).

2.2.3 Conceptual Framework

The conceptual framework below outlines how digital banking facilitates financial inclusion for underserved populations, particularly in rural Nigeria, through components like accessibility, affordability, trust, and technological advancement.

(i) Digital Banking Infrastructure: Technological tools and platforms, such as mobile banking, agent banking, and mobile money services, enable financial transactions without physical branches, bridging geographical gaps. For example, mobile money allows users to save, transfer funds, and access credit via phones in remote areas. 297 Gusau International Journal of Management and Social Sciences, Vol.7, No.3, October, 2024, ISSN(p): 2735-9026, ISSN(e): 2787-0383The Impact of Digital Banking on Financial Inclusion in Nigeria (2000-2022)

(ii) Access to Financial Products: Digital banking provides rural residents access to tailored financial products like microloans, savings accounts, and insurance. For instance, microloan platforms empower low-income individuals to finance businesses or personal needs without relying on traditional banks.

(iii) Digital Literacy and Financial Education: Digital literacy is crucial for effectively utilizing digital banking. Financial education delivered via mobile platforms empowers users to manage finances and leverage digital services. For example, text-based programs teach rural populations the safe use of digital tools for saving and borrowing.

(iv) Trust in Digital Platforms: Trust is vital for adoption, built through secure and reliable services. Strong encryption and authentication foster confidence in mobile banking platforms, especially in fraud-prone areas.

Regulatory and Policy Support: Supportive regulations promote infrastructure growth and consumer protection. For example, policies encouraging agent banking networks and affordable mobile services help extend inclusion to rural communities.

(vi) Socioeconomic and Cultural Acceptance: Adoption depends on alignment with local practices and conditions, such as informal savings groups and low-income needs. For example, digital alternatives that reflect traditional savings groups ensure cultural relevance.

2.3 Theoretical Framework

2.3.1 Theories of Digital Banking

These theories examine digital banking adoption in Nigeria and also to comprehensively understand why individuals adopt digital banking—and how these choices impact financial

inclusion—it is essential to anchor the study in established theories of technology adoption. In this research, four primary frameworks are employed: Diffusion of Innovation (DOI), Theory of Reasoned Action (TRA) including the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT/UTAUT2), and Prospect Theory.

2.3.1.1 Diffusion of Innovation (DOI):

Everett Rogers's DOI theory (1962) outlines how innovations spread within social systems. It asserts that the rate and extent of adoption depend on five attributes: relative advantage, compatibility, complexity, trialability, and observability. These dimensions have repeatedly been shown to influence digital banking uptake (Salehi & Alipour; Tan & Teo). Users in Nigeria, for instance, are more likely to adopt mobile or internet banking when they perceive clear advantages over traditional methods and when the innovation aligns with their lifestyle and capabilities. In Nigeria, DOI helps explain varying adoption levels based on users' socio-economic backgrounds. Urban youths, often early adopters, are more likely to embrace mobile banking due to its convenience and accessibility (Oluwatayo and Adebayo 45). In contrast, rural populations, often laggards, face adoption barriers like low digital literacy and cultural preferences for cash (Adeniran and Owioye 112). Fintech firms like OPay enhance trialability and observability through accessible, user-friendly platforms and peer influence (Okonkwo et al. 23).

2.3.1.2 Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM):

TAM, developed by Davis in 1989 and grounded in TRA, posits that Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) shape users' attitudes and intentions toward technology. In Nigeria, studies applying TAM have shown that PU and PEOU strongly predict digital banking

adoption across mobile and internet platforms. Extensions of TAM have also incorporated factors like perceived security, regulatory influence, social norms, and trust—all significant in Nigeria’s socio-cultural and regulatory context. TAM is relevant in Nigeria where mobile phone penetration is high (GSMA 14). Studies show urban users adopt digital banking for its time-saving benefits (Ogunleye and Adeyemo 67). However, PEOU remains a challenge for older and rural users unfamiliar with digital interfaces or with limited access to stable internet (Adebayo and Iweala 89). Additionally, concerns over trust and cyberfraud influence adoption behavior (Okeke and Eze 134), indicating that ease of use alone is insufficient without perceived security.

Application in Nigeria:

Ease of Use: User-friendly, intuitive platforms are essential for areas with low digital literacy to encourage adoption.

Usefulness: Digital banking must address specific needs, like money transfers, microloans, and payments, to demonstrate value and increase uptake.

Regulatory Support: Clear regulations, like those by the Central Bank of Nigeria, enhance trust through secure and reliable digital services.

2.3.1.3 Unified Theory of Acceptance and Use of Technology (UTAUT/UTAUT2)

UTAUT synthesizes eight earlier models, including TAM and DOI, consolidating core drivers: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions, later extended by UTAUT2 to include Hedonic Motivation, Price Value, and Habit. Research in Nigeria (e.g., Etuk et al. involving Calabar users) confirms that all four original constructs

significantly influence mobile FinTech usage. Given its integrated nature and proven predictive power, UTAUT helps explain the multi-dimensional drivers behind digital banking adoption.

Application in Nigeria

1. Performance Expectancy: Digital banking must prove its ability to improve access to savings, loans, and payments, especially in underserved areas.
2. Effort Expectancy: Simplified interfaces and training programs are necessary for populations with limited digital literacy.
3. Facilitating Conditions: Reliable internet and mobile networks are crucial for effective digital banking adoption, particularly in rural regions.

In this research, the integrated theoretical model draws from all three frameworks. DOI and UTAUT/UTAUT2 outline broad societal and behavioral predictors; TAM provides deeper insight into perceptions. This multi-theory approach allows a nuanced analysis of digital banking uptake and its effect on financial inclusion in Nigeria.

2.4 Empirical Review

In the early work of Oluwagbemi, Abah & Achimugu (2011) on IT impact in Nigeria's banking, Oluwagbemi et al. (2011) used descriptive means and trend analysis to conclude that e-banking technologies improved operational efficiency and service quality in Nigerian banks. Lawal, Sulaiman & Migiro (2018), covering 1981–2014, applied OLS regression to link financial inclusion—proxied by number of branches—with GDP. They found a significant positive effect of branch penetration on economic performance. Obiora & Ozili(2024) used index-based regression on FinScope data up to 2023, showing account ownership, formal/informal borrowing, and card ownership are positive determinants of inclusion . Through survey regression (not OLS),

Ajao, Oludamilare & Sadeeq (2023) found network externalities, along with perceived usefulness, significantly drive mobile payment adoption in Nigeria. Alabi & Olaoye(2022) ran cross-country Pooled OLS (China–Nigeria panel) (2005–2020), indicating ATMs, internet usage, and mobile subscription had weak positive effects on inclusion in Nigeria. Using OLS (2009–2021), Akpotor & Amughoro examined FinTech effects via ATM, POS, web, and mobile payments on:

1. SME credit (significant via ATM, Web),
2. Rural deposits (significant via POS),
3. But no effect on rural loans and private credit deepening.

Ubah, Adigwe, Okaro & Okoye (2023) applied OLS regression (2010–2021) to test the impact of agency (POS proxy), web, and USSD banking on inclusion. They found:

1. POS and USSD significantly promote inclusion
2. Web banking had no significant impact.

Ubah et al. (2023) used CBN data (2010–2021) and found that POS and USSD banking significantly contribute to financial inclusion, while web-based banking showed no significant impact to financial inclusion. Ozili also did a personal study and his forthcoming 2SLS regression (2007–2021) study found that:

1. Higher CBN rate reduces inclusion
2. Higher savings rate increases it
3. Loan-to-deposit ratio and inflation also significant.

An Arellano–Bond GMM (2015–2022) on women’s digital inclusion by Emerald’s researchers showed increased digital payments, debit and credit card ownership among women positively impact Nigeria’s GDP. Frank Eleanya (2020) described POS and USSD expansion with EFINA data—POS terminals grew to ~70,000, USSD reach increasing inclusion from 21.6% (2010) to 63.2% by 2020. Abu et al. in Niger State used Logistic regression and Probit model (cross-sectional) and found financial inclusion (bank/mobile account) significantly reduces poverty. Regulatory conflict analysis showed USSD fee disputes (2019–2021) suppressed mobile banking uptake until flat-fee resolution in March 2021, thus temporarily impeding inclusion.

Fiberesima (2023) used qualitative survey and noted that POS cybersecurity threats limit user trust and slow adoption. Onuegbu et al. (2025) in Southeast and South-South Nigeria discovered that awareness and communication were key drivers of digital banking adoption, with usage increasing from 36% to 37% shortly after the cash crunch.

POS Transaction Trends

Over 26.5 million POS terminals were registered as of August 2024, with ₦6.23 trillion in transactions over the first seven months—underscoring their expansive reach. The Shared Agent Network Expansion Framework (SANEF) helped raise POS volumes from 706.8 million in 2021 to 878.4 million in 2022, with transaction value rising to ₦4.6 trillion.

POS terminals accounted for ₦1.01 trillion in transactions in July 2024, highlighting their role in facilitating informal-sector inclusion.

USSD Adoption Rates

USSD is the preferred method among Nigerian women, with about 90% of mobile transactions via USSD rather than apps. Yet usability challenges and cost disputes between banks and telecoms delayed USSD accessibility until flat fees (≈~~₦~~6.98/session) were introduced in March 2021. Comparative studies point to both POS and USSD as the cheapest and most effective channels for including approximately 40 million unbanked Nigerians.

Mobile Money Growth

Mobile money has seen dramatic expansion: 204.7 million electronic payments via mobile apps in Q4 2021, growing to monthly mobile gateway transactions of about 108 million, valued at ₦2.37 trillion by January 2023.

However, persistent issues—unreliable internet connectivity, high data costs, fraud, and app instability—continue to limit app-based adoption.

Agency Banking Models

Initial POS-based agency banking struggled with delayed settlements and low agent trust. Yet recent innovations—like Moniepoint’s real-time settlement—dramatically improved agent confidence and network expansion.

Payment Service Banks (PSBs) and SANEF networks, particularly those led by telcos, have boosted agent networks to an estimated 1.4 million across the country.

2.5 Empirical Gaps

Based on all the empirical works reviewed above (from 2009-2024), including their methods, findings, and thematic focus, here are the major gaps:

1. Methodological Limitations:

- i. Over-reliance on OLS and Descriptive Statistics: Most Nigerian studies (e.g., Ubah et al., Akpotor & Amughor) use simple OLS regression, which assumes linearity, normal distribution, and no endogeneity. There's a lack of panel data models, instrumental variable (IV) techniques, or causal inference models that can better control for unobserved variables and establish cause-effect relationships.
- ii. Limited Use of Longitudinal or Dynamic Models: Only a few (e.g., Ozili with 2SLS; Ologbenla with ARDL) used dynamic models. Very few studies track long-term impact of digital banking on inclusion over time or account for feedback effects.

2. Narrow Coverage of Digital Banking Dimensions

- i. POS and USSD Dominance: Most studies focus on POS terminals and USSD (e.g., Ubah et al., Daily Trust, BusinessDay). There are limited empirical work on all of which are recent and increasingly relevant such as mobile apps, QR codes, virtual cards, and payment service banks (PSBs).
- ii. Web and ATM Usage Under-Used: While some works include them, the analysis of web banking and ATM use is often weak or inconclusive, with limited investigation into why they perform poorly in inclusion metrics. There is need for deeper behavioral or access-based studies (e.g., geography, digital literacy, trust).

3. Weak Disaggregation by Demographics or Regions:

- i. Gender: Only Emerald (2024) and SBM briefly touch on women's digital participation. No large-scale regression-based studies specifically measuring gender-based digital inclusion outcomes.
- ii. Geographic/Rural Focus: Studies mention rural users but few provide state-level, zone-level, or rural-urban disaggregated analysis of financial inclusion. Need for more spatial analysis of inclusion.

4. Inclusion Metrics Are Too General or Proxied

- i. Financial Inclusion is Often Poorly Measured: Many studies use broad proxies (e.g., number of POS terminals, number of ATMs, value of USSD transactions). Inclusion should be measured using EFINA indicators like: Percentage of adults with formal bank accounts, Usage of credit/saving, Insurance or investment access and Frequency of digital use (active vs dormant users).
- ii. Informal Inclusion Often Ignored: Few studies capture how mobile money agents, cooperatives, or non-bank channels contribute to inclusion. There's a blind spot around non-formal but impactful channels.

Inconsistent or Limited Time Scope: Many studies cover short windows (e.g., 2010–2021, 2009–2021), despite inclusion being a slow-moving structural outcome. Studies often ignore pre-2010 digital reforms or 2022–2024 post-cashless push, missing real-time evolution.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter outlines the methodology adopted in the study. The methodology provides a clear path through which the study investigates the effect of digital banking on financial inclusion in Nigeria from 2009 to 2024. This section looked at the research design, population and sample of the study, sources of data, theoretical framework, model specification, measurement and operationalization of variables as well as the method of data analysis.

3.2 Research Design

The study adopts an ex-post facto research design, specifically geared towards examining phenomena in their natural settings and describing characteristics without influencing them. The choice of this design is appropriate for analyzing the historical impact of digital banking innovations on financial inclusion. Given the nature of the study, quantitative and data-driven, the ex-post facto design allows for the examination of relationships among variables using empirical data. The design is in conjunction with the study's objective of analyzing trends and the effects of digital banking technologies.

3.3 Population and Sample of the study

The population of the study is Nigeria, serving as the macro unit of analysis. This study uses aggregate data; hence the total population of Nigeria is the sample size. The population of this study includes all financial data from regulatory and financial institutions in Nigeria, including the Central Bank of Nigeria (CBN), Nigeria Inter-Bank Settlement System (NIBSS), National

Bureau of Statistics (NBS), and other reliable financial access sources, covering the years 2005 to 2024. The sample consists of annual time-series data collected over a 16-year period. The sampling frame comprises yearly datasets of macroeconomic factors (Real GDP, Exchange rate, Government spending, Broad money supply, Lending rate) spanning a determined period, 16 years (2009 – 2024), to guarantee a full comprehensive representation.

3.4 Sources of Data

The study used secondary time series data covering the period 2009 to 2024. Secondary data was used as the main method of data collection. The relevant data for this study have been obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin and World Development indicators. These sources provide annual reports and datasets on mobile banking, ATM deployment, internet banking usage, POS transaction volumes, and digital banking products.

3.5 Theoretical Framework and Model Specification

Based on the theoretical framework, equation (1) specifies the financial inclusion equation in log linear form/ functional form as:

$$FI = f (MoB, POS, ATM, IntB) \quad (1)$$

Where:

FI = FINANCIAL INCLUSION

MoB = MOBILE BANKING

POS= POINT OF SALE

ATM = AUTOMATED TELLER MACHINES

IntB = INTERNET BANKING

Thus, we can specify our empirical models in econometric form as follows:

$$FI_t = \alpha_0 + \alpha_1[MoB]_t + \alpha_2[POS]_t + \alpha_3[ATM]_t + \alpha_4[IntB]_t + \varepsilon_t \quad (2)$$

Where:

t = time in years

ε_t = error term

FI = FINANCIAL INCLUSION

MoB = MOBILE BANKING

POS= POINT OF SALE

ATM = AUTOMATED TELLER MACHINES

IntB = INTERNET BANKING

3.6 Measurement and Operationalization of Variables

Table 3.6 Measurement and Operationalization of Variables

VARIABLES	VARIABLE T Y P E S	MEASUREMENTS OF VARIABLES	SOURCES O F VARIABLES	A P R I O R I CONSIDERATION
Financial Inclusion	Dependent	% of adult population with bank accounts in Nigeria	World Bank, CBN, EFInA, NIBSS	_____
Mobile Banking	Independent	Volume of mobile banking transactions	CBN, NIBSS	Positive
Point of Sales	Independent	Volume of POS transactions	CBN, NIBSS	Positive
Automated teller machines	Independent	Volume of ATM transactions	CBN, NIBSS	Positive
Internet banking	Independent	Volume of internet banking transactions	CBN, NIBSS, Commercial Banks	Positive

3.7 Method of Data Analysis

This study used descriptive statistics, correlational and regression analysis to analyze the data. The descriptive statistics are used to describe the data set using the mean, maximum and minimum values, standard deviation. The correlation analysis is used to determine the linear relationship between the variables pair wisely. The Ordinary Least Squares (OLS) technique is used to determine the effect of the explanatory variables on the outcome variable. The OLS method is often used for estimation since it provides the best linear unbiased parameter estimates of the explanatory. The OLS estimator possesses desirable properties of unbiasedness, efficiency and consistency. Hence, the parameter estimates of the OLS technique are valid and reliable for inferential analysis.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSES

4.1 Introduction

This chapter presents and analyses time series data from 2009 to 2023, sourced from CBN annual reports and the National Bureau of Statistics. Using EViews 12 for analysis, results are displayed in tables with accompanying explanations for clarity. Key sections include data presentation, hypothesis testing, and findings discussion.

4.2 Data Presentation and Interpretation

This section evaluates the study's variables through descriptive statistics, unit root tests for stationarity, and correlation analysis. Diagnostic tests, including the Breusch-Godfrey test for serial correlation, the Breusch-Pagan test for heteroscedasticity, and the Ramsey RESET test for model specification, ensure the regression model's robustness.

Table 4.1 Descriptive statistics

	FI	ATM	MOB	POS	INTB
Mean	60.64000	8.723500	7.777032	7.830873	7.735632
Maximum	87.30000	9.281992	10.03241	9.993315	10.33754
Minimum	43.20000	7.779117	6.063158	5.962964	6.204415
Std. Dev.	12.59069	0.418756	1.197517	1.326322	1.556679
	-				
Skewness	0.678665	0.771706	0.236972	0.064372	0.728050
Kurtosis	2.654962	3.052914	2.085220	1.786842	1.900418
Jarque-Bera	1.225871	1.490574	0.663403	0.930204	2.080816
Probability	0.541758	0.474598	0.717702	0.628071	0.353311
<i>FI= Financial Inclusion; POS = Point of Sale (Logged); ATM = Automated Teller Machine (Logged); INTB = Internet Banking (Logged); MOB= Mobile Banking (Logged)</i>					

Source: Researcher's compilation (2025)

Table 4.1 provides the descriptive statistics for five key variables related to financial inclusion (FI) and digital banking services, namely Automated Teller Machines (ATM), Mobile Banking (MOB), Point of Sale (POS), and Internet Banking (INTB), all of which are log-transformed except for FI.

The mean value for Financial Inclusion (FI) is 60.64, significantly higher than the digital banking indicators, which are all logged. Among the digital service variables, ATM usage has the highest mean (8.72), followed by POS (7.83), INTB (7.74), and MOB (7.78). These figures suggest that, on average, ATM usage remains the most prevalent digital financial service compared to mobile and online platforms.

The maximum value for FI is 87.30, and the minimum is 43.20, indicating a wide range (44.1 points), suggesting variation in access to or usage of financial services across the sampled periods or regions. In contrast, the digital variables show tighter ranges, with MOB having a minimum of 6.06 and a maximum of 10.03, indicating moderate adoption rates. POS and INTB exhibit similarly narrow ranges, showing that while digital financial inclusion is increasing, it is doing so with less variability than traditional FI measures.

In terms of standard deviation, FI exhibits the highest dispersion (12.59), highlighting considerable variability in financial inclusion levels. This dispersion likely reflects disparities in infrastructure, regulation, or population characteristics. The lowest standard deviation is observed in ATM usage (0.42), suggesting more uniform distribution or consistent access across regions or periods. MOB, POS, and INTB have standard deviations of 1.20, 1.33, and 1.56 respectively, indicating a moderate degree of variability in digital service adoption.

Regarding skewness, most variables exhibit slight positive skewness, indicating a long right tail—meaning that while most observations are clustered on the lower end, a few high outliers

exist. FI and INTB show relatively stronger positive skewness (0.68 and 0.73, respectively), suggesting that while many individuals or regions may experience low to moderate inclusion, some achieve significantly higher levels. Interestingly, ATM usage shows negative skewness (-0.77), indicating a left-tail distribution where higher usage rates are more common, and fewer areas have significantly low usage, possibly due to infrastructural diffusion of ATM networks.

Kurtosis values for all variables fall below 3, with POS (1.78) and INTB (1.90) displaying the lowest peakedness, indicating platykurtic distributions with lighter tails than the normal distribution. The ATM variable approaches a mesokurtic shape (3.05), suggesting a more normally distributed dataset. These kurtosis patterns reinforce the notion that ATM usage is more consistent across observations than newer digital financial platforms like MOB or INTB, which are still undergoing expansion.

The Jarque-Bera test statistics for all variables are relatively low, and their corresponding p-values exceed the standard significance thresholds ($p > 0.05$), indicating that the null hypothesis of normality cannot be rejected for any of the variables. Specifically, FI's JB statistic is 1.23 ($p = 0.54$), and the closest to a non-normal distribution is INTB with a JB value of 2.08 ($p = 0.35$). Therefore, it can be inferred that all variables approximate a normal distribution, facilitating the use of parametric statistical techniques in subsequent analyses.

Figure 4.1 illustrates the overall normality assessment for all variables, with an aggregate p-value of 0.48. This result suggests that, collectively, the variables in the study conform to the assumptions of normal distribution.

Figure 4.1: Aggregate Normality Graph

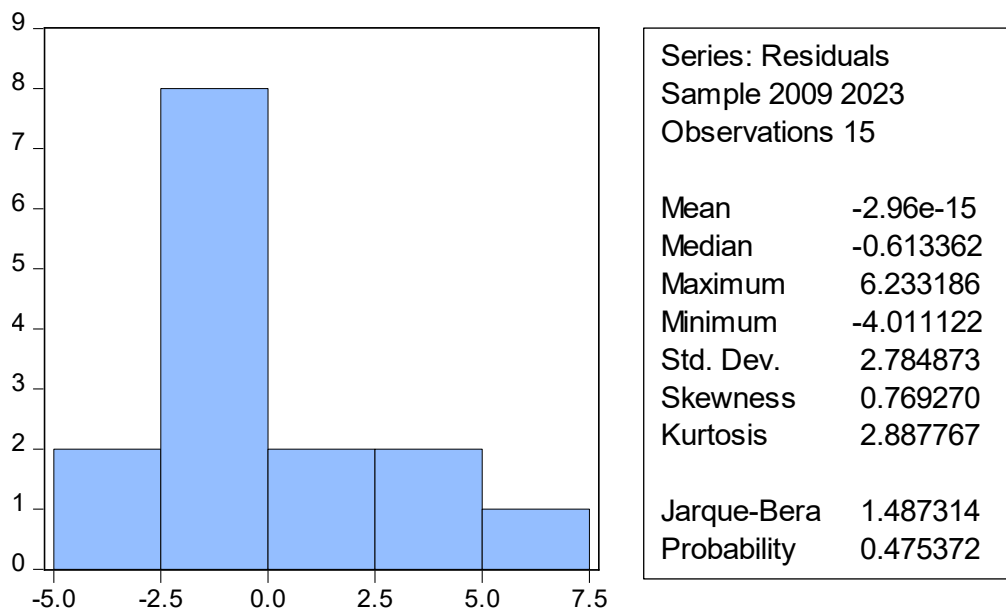


Table 4.2 Correlation Matrix and Multicollinearity Analysis (VIF)

	FI	ATM	MOB	POS	INTB	VIF
FI	1.000000					
ATM	0.820758*	1.000000				4.628598
MOB	0.967505*	0.857314*	1.000000			3.617623
POS	0.963209*	0.883119*	0.983516*	1.000000		3.784153
INTB	0.943464*	0.808670*	0.940419*	0.930675*	1.000000	8.733642

* Sig @ 1%; ** Sig @ 5%

Source: Researcher's compilation (2025)

Table 4.2 reveals that none of the financial inclusion variables exceed this critical value, indicating that multicollinearity is not severe enough to distort regression estimates significantly. The highest VIF is recorded for Internet Banking (INTB) at 8.73, which, although high, remains below the threshold of concern. This suggests that while INTB shares substantial variance with other digital banking variables—particularly Mobile Banking (MOB, VIF = 3.62) and Point of

Sale (POS, VIF = 3.78)—it does not yet compromise the model’s stability. Moreover, all variables exhibit strong and statistically significant correlations at the 1% level. FI is most strongly correlated with MOB ($r = 0.97$), POS ($r = 0.96$), and INTB ($r = 0.94$), indicating that digital channels are pivotal in advancing financial inclusion. Similarly, the high intercorrelations among MOB, POS, and INTB (all $r > 0.93$) underscore the integrated nature of digital financial platforms. Although high correlations could suggest overlapping functionalities, the VIF results confirm that no variable individually poses a multicollinearity threat under the conservative threshold of 10 (Gujarati & Porter, 2009). Thus, all variables may be retained in the model, albeit with awareness of their conceptual proximity.

Table 4.3 Diagnostics Test: Serial, Heteroskedasticity, and Specification Tests

<i>Breusch-Godfrey Serial Correlation LM Test:</i>			
F-statistic	3.330544	Prob. F(2,8)	0.0887
Obs*R-squared	6.815068	Prob. Chi-Square(2)	0.0331
<i>Heteroskedasticity Test: Breusch-Pagan-Godfrey</i>			
F-statistic	0.971397	Prob. F(4,10)	0.4648
Obs*R-squared	4.197432	Prob. Chi-Square(4)	0.3799
<i>Ramsey RESET Test: Specification: FI ATM MOB POS INTB C</i>			
t-statistic	5.855214	9	0.0002
F-statistic	34.28353	(1, 9)	0.0002
Likelihood ratio	23.55821	1	0.0000

Source: Researcher’s compilation (2025)

Table 4.3 presents diagnostic tests for serial correlation, heteroskedasticity, and model specification to evaluate the robustness and reliability of the regression model involving financial inclusion and its determinants. The Breusch-Godfrey Serial Correlation LM Test yields an F-statistic of 3.33 with a p-value of 0.0887, and an ObsR-squared statistic of 6.82 with a p-value of 0.0331. While the F-statistic suggests marginal evidence of serial correlation at the 10% level,

the ObsR-squared result is significant at the 5% level. This indicates the presence of second-order serial correlation in the residuals, which can bias standard errors and invalidate classical inference if not corrected.

In contrast, the Breusch-Pagan-Godfrey Heteroskedasticity Test results show no significant evidence of heteroskedasticity. The F-statistic is 0.97 with a p-value of 0.4648, and the Obs*R-squared statistic is 4.20 with a p-value of 0.3799—both well above conventional significance thresholds. This implies that the variance of the error terms is constant across observations, satisfying the homoskedasticity assumption of classical linear regression models. Consequently, there is no need for variance correction based on this test alone, and the residuals appear to be well-behaved in terms of spread.

However, the Ramsey RESET Test reveals serious model misspecification. The t-statistic of 5.86, F-statistic of 34.28, and likelihood ratio of 23.56, all with p-values of 0.0002 or lower, strongly reject the null hypothesis of correct model specification. This indicates that the model suffers from omitted variable bias or incorrect functional form, thereby compromising the reliability of coefficient estimates. Given the presence of serial correlation and model misspecification—but no heteroskedasticity—a robust least squares estimation technique is justified to correct for the identified violations of classical linear regression assumptions and to ensure more consistent and efficient parameter estimates.

4.2.3 Multivariate Analysis

Table 4.4: Multivariate Analysis

Dependent Variable: FI				
Robust Least Squares (RLS)				
Variable	Coefficient	Std. Error	Z-Statistic	Prob.
ATM	-11.34003	3.351331	-3.383740	0.0007
MOB	6.085619	3.276299	1.857467	0.0632
POS	7.353769	3.025442	2.430642	0.0151
INTB	0.465251	1.238375	0.375694	0.7071
C	49.64358	22.75774	2.181393	0.0292
R-squared: 0.843746		Adjusted R-squared: 0.781245		
Rn-squared statistic: 440.6506		Prob(Rn-squared stat.): 0.000000		
Source: Researcher's compilation (2025)				

Table 4.4 presents the results of a Robust Least Squares (RLS) regression analysis, examining the impact of digital banking channels—ATM, Mobile Banking (MOB), Point of Sale (POS), and Internet Banking (INTB)—on Financial Inclusion (FI). The model demonstrates a strong overall fit, with an R-squared of 0.8437 and an adjusted R-squared of 0.7812, indicating that approximately 78% of the variation in financial inclusion is explained by the included predictors. Among the variables, ATM usage has a significant negative effect on financial inclusion (coefficient = -11.34 , $p = 0.0007$), suggesting that greater reliance on ATM infrastructure may reflect traditional banking access rather than promoting broader inclusion. In contrast, POS usage exerts a significant positive effect (coefficient = 7.35 , $p = 0.0151$), implying that wider deployment and use of POS terminals can effectively enhance access to financial services by supporting real-time, decentralized transactions.

Although Mobile Banking (MOB) shows a positive coefficient (6.09), its effect is only marginally significant ($p = 0.0632$), indicating a potentially meaningful but statistically weaker influence on financial inclusion—possibly due to adoption lags or digital literacy barriers. Internet Banking (INTB), however, has a negligible and statistically insignificant effect

(coefficient = 0.47, $p = 0.7071$), which may reflect limited penetration or user capacity, especially in regions with poor internet infrastructure. The constant term is significant ($p = 0.0292$), supporting the presence of other structural factors influencing FI not captured by the digital variables. The Rn-squared statistic (440.65, $p = 0.000$) confirms the overall significance of the model. These findings substantiate the relevance of digital channels—especially POS and mobile banking—in driving financial inclusion, justifying the use of robust least squares estimation to mitigate the effects of model misspecification and serial correlation identified in prior diagnostic tests.

4.3 Hypotheses Testing

In this research, the hypotheses were assessed using a 5% significance threshold, meaning that a null hypothesis is rejected if the p-value is less than or equal to 0.05, while it is accepted if the p-value exceeds 0.05. The findings summarized in Table 4.4 provide the basis for evaluating each hypothesis. Presented below is a comprehensive discussion of the hypotheses, the corresponding tests conducted, and the decisions derived from the results:

H01: There is no significant relationship between POS volume and financial inclusion in Nigeria.

The coefficient for POS is 7.354 with a p-value of 0.0151, which is less than 0.05. This indicates a statistically significant positive relationship between POS usage and financial inclusion in Nigeria. Therefore, the null hypothesis is rejected, and it is concluded that POS volume significantly affects financial inclusion in Nigeria.

H02: Mobile banking volume does not significantly affect financial inclusion in Nigeria.

The coefficient for Mobile Banking (MOB) is 6.086 with a p-value of 0.0632, which is greater than 0.05. This implies that mobile banking has a positive but not statistically significant effect

on financial inclusion at the 5% level. Hence, the null hypothesis is accepted, and it is concluded that mobile banking volume does not significantly affect financial inclusion in Nigeria.

H03: There is no significant relationship between broad ATMs volume and financial inclusion in Nigeria.

The ATM coefficient is -11.340 with a p-value of 0.0007 , which is well below 0.05 . This reveals a statistically significant negative relationship between ATM volume and financial inclusion. As such, the null hypothesis is rejected, and it is concluded that ATM volume significantly affects financial inclusion, though the effect is inverse.

H04: There is no significant relationship between internet banking volume and financial inclusion in Nigeria.

The coefficient for Internet Banking (INTB) is 0.465 with a p-value of 0.7071 , which exceeds the 0.05 threshold. This indicates no statistically significant relationship between internet banking and financial inclusion. Therefore, the null hypothesis is accepted, confirming that internet banking volume does not significantly affect financial inclusion in Nigeria.

4.4 Discussion of Findings

4.4.1. POS Volume and Financial Inclusion

The empirical finding that Point-of-Sale (POS) volume significantly enhances financial inclusion in Nigeria aligns with a growing body of literature emphasizing POS as one of the most impactful digital banking tools. The result, which shows a statistically significant positive relationship between POS usage and financial inclusion, reflects POS terminals' increasing penetration in rural and informal markets. As highlighted by Adebayo and Ogunleye (2020), POS-enabled agency banking has expanded the reach of financial services by allowing small-

scale merchants and local businesses to act as financial intermediaries. Similarly, Ubah et al. (2023) observed that POS terminals significantly contribute to financial inclusion, particularly in regions with poor banking infrastructure. This finding reinforces the assertion by Ozili (2018) that inclusive financial growth in Nigeria is increasingly shaped by alternative banking touchpoints that circumvent the need for formal bank branches. However, POS banking is not without limitations; Fiberesima (2023) cautions that cybersecurity concerns may deter trust and sustained usage. Nevertheless, the evidence strongly supports POS systems as a robust channel for improving financial inclusion in Nigeria, affirming the relevance of policies such as the Shared Agent Network Expansion Facility (SANEF), which promotes agent-based POS deployments in underserved communities.

4.4.2. Mobile Banking Volume and Financial Inclusion

Although mobile banking shows a positive relationship with financial inclusion, its impact is not statistically significant at the 5% level, suggesting a nuanced or uneven effect. This partially aligns with existing studies which emphasize mobile banking's potential, but also acknowledge systemic constraints limiting its full realization. For instance, while Olayemi and Adedayo (2019) found mobile money to be effective in enhancing inclusion in select Nigerian states, Ede, Udofia, and Asongu (2022) pointed out that infrastructural challenges, digital illiteracy, and trust deficits reduce the effectiveness of mobile platforms across the broader national landscape. The findings here may be reflecting these limitations—despite the dramatic growth in mobile banking transaction volumes, its benefits may be concentrated among urban and semi-urban populations with access to smartphones and stable networks (Adesina & Ayo, 2010). Furthermore, as Ajao et al. (2023) argue, adoption is often driven more by network externalities and perceived usefulness than actual access among the financially excluded. Thus, while mobile banking holds

transformative promise, as noted by Ozili (2018), its impact on inclusion remains conditional upon infrastructure, trust, and tailored policy interventions—especially targeting the rural poor and digitally illiterate populations.

4.4.3. ATM Volume and Financial Inclusion

The finding that ATM volume negatively and significantly impacts financial inclusion challenges earlier assumptions that automated teller machines contribute meaningfully to banking outreach. Rather than promoting inclusion, ATMs may now reflect legacy infrastructure with limited reach in the digital era. This finding contrasts with older perspectives, such as those of Salehi and Alipour (2010), who emphasized the critical role of ATMs in improving financial access through 24/7 cash availability. However, recent empirical works, such as by Alabi and Olaoye (2022), support the current result by showing that ATM density in Nigeria has a weak or even adverse association with financial inclusion, particularly because ATMs are mostly clustered in urban, already-banked regions. Ifeanyi (2021) similarly observes that ATMs primarily serve cash-dependent users and have not evolved in tandem with mobile-based innovations, thereby limiting their reach to excluded populations. The regression result thus reflects a structural limitation in ATM-based financial service delivery—suggesting that while they remain functional for withdrawals, they do little to onboard the unbanked or promote financial empowerment. This underscores the need for a strategic shift from ATM expansion to more accessible and interactive digital platforms.

4.4.4. Internet Banking Volume and Financial Inclusion

The insignificance of internet banking volume in determining financial inclusion in Nigeria reflects a widely acknowledged digital divide that renders internet-based banking inaccessible

for a substantial segment of the population. This finding aligns with the work of Auta (2010) and Chavan (2013), who both acknowledged that while internet banking offers sophisticated functionalities, it is limited by low internet penetration, poor digital literacy, and user mistrust—particularly in developing economies like Nigeria. Adesina and Ayo (2010) similarly argued that perceived complexity and unreliable connectivity hinder the widespread adoption of internet banking, especially outside urban centres. Supporting this view, Ede et al. (2022) emphasized that web-based platforms disproportionately serve middle to upper-class users, thus reinforcing inclusion gaps rather than closing them. The negligible impact in the current study confirms that despite technological advancements, internet banking in Nigeria remains an elite service, underutilized by the financially excluded majority. As rightly noted, effective communication, user education, and simplified interfaces are important to improve uptake. Therefore, to reposition internet banking as an inclusive tool, stakeholders must address infrastructural and educational barriers that currently limit its reach and relevance.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

As the study draws to a close, this chapter provides a comprehensive summary of the major empirical findings, the conclusion drawn from the statistical analysis, and actionable recommendations. The study explored the impact of digital banking tools specifically POS transactions, mobile banking, ATMs, and internet banking on financial inclusion in Nigeria, a country where digital access is emerging as a primary driver of inclusive financial systems. Using a robust econometric approach (Robust Least Squares), the study tested four hypotheses and evaluated the strength and significance of the relationship between these digital banking channels and the level of financial inclusion between 2009 and 2023.

5.2 Summary of Findings

This research examined the relationship between digital banking channels and financial inclusion in Nigeria, covering four key technological indicators. Based on the econometric results from the Robust Least Squares estimation, the following findings were established:

- i. POS volume showed a statistically significant and positive relationship with financial inclusion, confirming its crucial role in expanding access to formal financial services, especially among informal and underserved populations.
- ii. Mobile banking volume had a positive but statistically insignificant effect on financial inclusion, suggesting that while adoption is increasing, its impact remains uneven due to digital literacy, smartphone penetration, and network limitations.

- iii. ATM volume had a statistically significant but negative relationship with financial inclusion, indicating that ATM infrastructure may now reflect legacy systems primarily serving already-banked, urban populations, and failing to extend outreach to the excluded.
- iv. Internet banking volume exhibited no statistically significant relationship with financial inclusion, pointing to usage barriers such as poor internet access, user distrust, and the platform's bias toward more financially literate or urban-based users.

5.3 Conclusion

This study focused on assessing the effect of digital banking channels on financial inclusion in Nigeria over the period 2009 to 2023, with particular attention to transaction volumes across POS, mobile banking, ATMs, and internet banking. The study employed the Robust Least Squares (RLS) technique to account for serial correlation and specification issues previously diagnosed in the regression model. The findings revealed that POS services play a substantial role in promoting financial inclusion, while mobile banking shows promise but lacks consistent reach. Conversely, ATM services have a declining influence, and internet banking remains largely ineffective in broadening access due to infrastructural and socio-economic limitations. In conclusion, the study affirms that not all digital banking tools contribute equally to financial inclusion, and that policymakers must adopt a differentiated strategy—prioritizing low-cost, mobile-accessible platforms like POS and mobile banking while reforming underperforming channels—to realize Nigeria's financial inclusion targets.

5.4 Recommendations

Based on the findings, the following policy and operational recommendations are proposed:

- i. Strengthen and scale POS infrastructure in underserved regions, particularly rural and peri-urban areas, through incentives to agent networks and merchant partnerships, as POS terminals have proven to be the most effective channel for promoting financial inclusion.
- ii. Enhance mobile banking accessibility and trust by investing in digital literacy programs, simplifying user interfaces, and resolving network and cybersecurity concerns, to transform mobile banking into a fully inclusive tool.
- iii. Rethink ATM deployment strategies, shifting away from expanding physical ATM networks to integrating cashless alternatives and mobile-enabled services that better serve financially excluded populations.
- iv. Reform internet banking platforms through mobile-optimized solutions, lower data consumption, and user-centric innovations, ensuring broader access for digitally excluded segments, particularly in rural and low-income settings.

5.5 Suggestions for Further Studies

Future studies could extend the current research by incorporating additional digital financial innovations such as USSD banking, agency banking, fintech-based digital wallets, and blockchain-enabled payment systems. These newer channels have shown growing influence on financial behavior in Nigeria and could provide a more comprehensive picture of digital inclusion dynamics. Comparative regional analysis across geopolitical zones—especially rural versus urban contexts—would also help capture spatial disparities in access and usage. Additionally, scholars may adopt mixed methods, integrating qualitative approaches like focus groups and user interviews, to uncover the behavioral and institutional barriers behind digital banking adoption. Including mediating variables such as digital literacy, regulatory environment, or internet penetration could further enrich the analysis. Methodologically, future studies should

consider using dynamic panel models (e.g., GMM or VECM) and Structural Equation Modeling (SEM) to explore both causality and latent constructs influencing the digital banking–financial inclusion relationship. Such multidimensional approaches will better inform policy and industry decisions aimed at optimizing the transformative potential of digital banking for inclusive finance in Nigeria.

APPENDICES

Appendix One: Data for Analysis

Years	Automated Teller Machines	Mobile Banking	Point of sale	Internet Banking	Financial Inclusion	LogATM	LogMOB	LogPOS	LogINTB
2009	109,161,646	1,809,251	918,256	2,703,516	43.2	8.03807	6.257499	5.962964	6.431929
2010	60,133,610	1,156,533	1,072,426	1,601,086	45.4	7.779117	6.063158	6.030367	6.204415
2011	347,569,999	3,649,374	2,100,673	1,932,355	49.1	8.541042	6.562218	6.322358	6.286087
2012	375,487,756	2,297,688	2,555,045	2,276,464	52.9	8.574596	6.361291	6.407399	6.357261
2013	295,292,940	15,812,435	9,402,255	2,900,473	53.7	8.470253	7.198999	6.973232	6.462469
2014	400,102,507	29,156,406	20,817,423	5,587,081	55.3	8.602171	7.464734	7.318427	6.747185
2015	433,587,623	43,933,362	33,720,933	7,981,361	55.9	8.637077	7.642794	7.5279	6.902077
2016	590,238,934	47,053,252	63,715,203	14,088,247	56.3	8.771028	7.67259	7.804243	7.148857
2017	800,549,099	47,804,561	146,267,156	28,991,097	59.6	8.903388	7.679469	8.165147	7.462265
2018	875,519,307	87,086,260	295,890,167	50,815,901	62.9	8.942266	7.93995	8.471131	7.706
2019	839,819,922	338,720,999	438,614,182	103,497,007	65.4	8.924186	8.529842	8.642083	8.014928
2020	1,914,220,419	769,238,689	655,748,348	6,480,548,630	67.9	9.281992	8.886061	8.816737	9.811612
2021	1,599,187,337	1,201,541,158	2,743,555,841	10,321,579,925	74.1	9.203899	9.079739	9.438314	10.01375
2022	1,506,991,903	1,926,293,135	3,885,782,065	14,063,927,436	80.6	9.178111	9.284722	9.589478	10.14811
2023	1,012,277,981	10,774,795,048	9,847,258,500	21,753,925,242	87.3	9.0053	10.03241	9.993315	10.33754

Appendix Two: Output From Analysis

	FI	ATM	MOB	POS	INTB
Mean	60.64000	8.723500	7.777032	7.830873	7.735632
Median	56.30000	8.771028	7.672590	7.804243	7.148857
Maximum	87.30000	9.281992	10.03241	9.993315	10.33754
Minimum	43.20000	7.779117	6.063158	5.962964	6.204415
Std. Dev.	12.59069	0.418756	1.197517	1.326322	1.556679
Skewness	0.678665	-0.771706	0.236972	0.064372	0.728050
Kurtosis	2.654962	3.052914	2.085220	1.786842	1.900418
Jarque-Bera	1.225871	1.490574	0.663403	0.930204	2.080816
Probability	0.541758	0.474598	0.717702	0.628071	0.353311
Sum	909.6000	130.8525	116.6555	117.4631	116.0345
Sum Sq. Dev.	2219.356	2.454991	20.07665	24.62783	33.92550
Observations	15	15	15	15	15

Covariance Analysis: Ordinary

Date: 10/10/25 Time: 06:31

Sample: 2009 2023

Included observations: 15

Balanced sample (listwise missing value deletion)

Covariance

Correlation

t-Statistic

Probability

	FI	ATM	MOB	POS	INTB
FI	147.9571 1.000000 ----- -----				
ATM	4.038894 0.820758 5.180138 0.0002	0.163666 1.000000 ----- -----			
MOB	13.61510 0.967505 13.79610 0.0000	0.401254 0.857314 6.004532 0.0000	1.338443 1.000000 ----- -----		
POS	15.01259 0.963209 12.92218 0.0000	0.457789 0.883119 6.787020 0.0000	1.457971 0.983516 19.61146 0.0000	1.641855 1.000000 ----- -----	
INTB	17.25880 0.943464	0.492003 0.808670	1.636210 0.940419	1.793424 0.930675	2.261700 1.000000

	10.26231	4.956457	9.972255	9.172127	----
	0.0000	0.0003	0.0000	0.0000	----

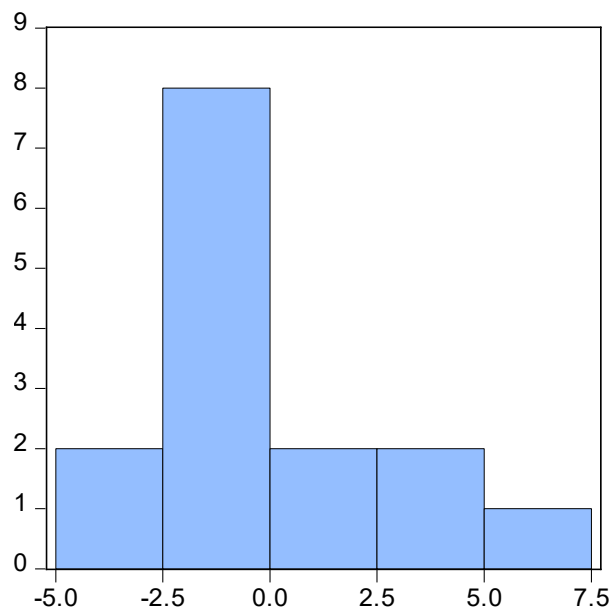
Variance Inflation Factors

Date: 10/10/25 Time: 06:31

Sample: 2009 2024

Included observations: 15

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
ATM	20.47097	2156.778	4.628598
MOB	19.56460	1670.925	3.617623
POS	16.68328	1451.206	3.784153
INTB	2.795169	239.8081	8.733642
C	943.9784	1304.111	NA



Series: Residuals
Sample 2009 2023
Observations 15

Mean -2.96e-15
Median -0.613362
Maximum 6.233186
Minimum -4.011122
Std. Dev. 2.784873
Skewness 0.769270
Kurtosis 2.887767

Jarque-Bera 1.487314
Probability 0.475372

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.330544	Prob. F(2,8)	0.0887
Obs*R-squared	6.815068	Prob. Chi-Square(2)	0.0331

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 10/10/25 Time: 06:32

Sample: 2009 2023

Included observations: 15

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATM	-0.570366	3.743357	-0.152367	0.8827
MOB	-4.860304	5.271374	-0.922018	0.3835
POS	3.346935	4.189572	0.798873	0.4474
INTB	1.072596	1.758274	0.610028	0.5588
C	8.318495	25.60744	0.324847	0.7536
RESID(-1)	0.893550	0.388203	2.301764	0.0503
RESID(-2)	-0.412343	0.391413	-1.053475	0.3229
R-squared	0.454338	Mean dependent var	-2.96E-15	
Adjusted R-squared	0.045091	S.D. dependent var	2.784873	
S.E. of regression	2.721362	Akaike info criterion	5.144867	
Sum squared resid	59.24651	Schwarz criterion	5.475290	
Log likelihood	-31.58650	Hannan-Quinn criter.	5.141347	
F-statistic	1.110181	Durbin-Watson stat	1.807686	
Prob(F-statistic)	0.432769			

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.971397	Prob. F(4,10)	0.4648
Obs*R-squared	4.197432	Prob. Chi-Square(4)	0.3799
Scaled explained SS	1.760838	Prob. Chi-Square(4)	0.7796

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 10/10/25 Time: 06:33

Sample: 2009 2023

Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-96.75854	96.38222	-1.003904	0.3391
ATM	17.18588	14.19336	1.210840	0.2538
MOB	0.278214	13.87559	0.020051	0.9844
POS	-13.95821	12.81317	-1.089364	0.3015
INTB	7.913673	5.244691	1.508892	0.1623
R-squared	0.279829	Mean dependent var	7.238485	
Adjusted R-squared	-0.008240	S.D. dependent var	10.29446	
S.E. of regression	10.33678	Akaike info criterion	7.770496	
Sum squared resid	1068.491	Schwarz criterion	8.006513	
Log likelihood	-53.27872	Hannan-Quinn criter.	7.767982	
F-statistic	0.971397	Durbin-Watson stat	2.314293	
Prob(F-statistic)	0.464767			

Ramsey RESET Test
Equation: UNTITLED
Specification: FI ATM MOB POS INTB C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	5.855214	9	0.0002
F-statistic	34.28353	(1, 9)	0.0002
Likelihood ratio	23.55821	1	0.0000

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	86.00066	1	86.00066
Restricted SSR	108.5773	10	10.85773
Unrestricted SSR	22.57661	9	2.508513

LR test summary:

	Value
Restricted LogL	-36.12967
Unrestricted LogL	-24.35056

Unrestricted Test Equation:

Dependent Variable: FI

Method: Least Squares

Date: 10/10/25 Time: 06:33

Sample: 2009 2023

Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ATM	16.45804	3.973672	4.141770	0.0025
MOB	-13.07475	3.600056	-3.631817	0.0055
POS	-7.324984	2.767061	-2.647207	0.0266
INTB	-10.62862	2.332793	-4.556175	0.0014
C	40.72124	15.83203	2.572079	0.0301
FITTED^2	0.030805	0.005261	5.855214	0.0002
R-squared	0.989827	Mean dependent var		60.64000
Adjusted R-squared	0.984176	S.D. dependent var		12.59069
S.E. of regression	1.583828	Akaike info criterion		4.046741
Sum squared resid	22.57661	Schwarz criterion		4.329962
Log likelihood	-24.35056	Hannan-Quinn criter.		4.043725
F-statistic	175.1460	Durbin-Watson stat		2.272975
Prob(F-statistic)	0.000000			

Dependent Variable: FI

Method: Robust Least Squares

Date: 10/10/25 Time: 06:34

Sample (adjusted): 2009 2023

Included observations: 15 after adjustments

Method: S-estimation

S settings: tuning=1.547645, breakdown=0.5, trials=200, subsmpl=5,
refine=2, compare=5

Random number generator: rng=kn, seed=371461880

Huber Type I Standard Errors & Covariance

Variable	Coefficient	Std. Error	z-Statistic	Prob.
ATM	-11.34003	3.351331	-3.383740	0.0007
MOB	6.085619	3.276299	1.857467	0.0632
POS	7.353769	3.025442	2.430642	0.0151
INTB	0.465251	1.238375	0.375694	0.7071
C	49.64358	22.75774	2.181393	0.0292

Robust Statistics

R-squared	0.843746	Adjusted R-squared	0.781245
Scale	2.567992	Deviance	6.594584
Rn-squared statistic	440.6506	Prob(Rn-squared stat.)	0.000000

Non-robust Statistics

Mean dependent var	60.64000	S.D. dependent var	12.59069
S.E. of regression	4.577820	Sum squared resid	209.5644

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